UNITED NATIONS EDUCATIONAL,
SCIENTIFIC AND CULTURAL
ORGANISATION

EDUCATION AND INFORMATICS

PROCEEDINGS OF THE SECOND INTERNATIONAL CONGRESS

UNESCO INSTITUTE
FOR INFORMATION TECHNOLOGIES
IN EDUCATION

"THE ORGANISATION OF THE CONGRESS WAS CONDITIONED BY THE NECESSITY TO PROMOTE WIDE INTERNATIONAL CO-OPERATION IN ORDER TO REFLECT OBJECTIVES AND TO DEFINE VARIOUS NEEDS OF THE MEMBER STATES IN THIS FIELD, WHICH BECOMES MORE AND MORE SIGNIFICANT."

FEDERICO MAYOR
DIRECTOR - GENERAL OF UNESCO

R. MOREL
22.7.00

UNITED NATIONS EDUCATIONAL,
SCIENTIFIC AND CULTURAL ORGANIZATION

EDUCATION and INFORMATICS

EDUCATIONAL POLICIES and NEW TECHNOLOGIES

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OF THE SECOND INTERNATIONAL
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UNESCO INSTITUTE
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PREFACE

TO THE SERIES OF THE PROCEEDINGS OF THE 2nd UNESCO INTERNATIONAL CONGRESS

EDUCATION AND INFORMATICS

EDUCATIONAL POLICIES and NEW TECHNOLOGIES

Information and scientific knowledge are the most important strategic resources of mankind progress on the eve of the third millenium. Informatization of education is a key condition for increasing the role and the influence of intellectual activities in transition of the world society from industrial to information era. This explains attention that is being given in the last years by governments, national and international organizations to the use of new information and communication technologies (NITs) in education.

In accordance with resolution 1.18 of the 27th Session of the General Conference (October-November 1993), the 2nd International Congress on Education and Informatics was organized and held by the UNESCO in cooperation with the Government of the Russian Federation. The key topic in the work of this Congress was *policy in the educational area and new technologies.*

The 1st UNESCO Congress "Education and Informatics", held in Paris in 1989 and focused on *Strengthening of international cooperation* in this field, underlined the need for *"using collective experience and joint exploitation of limited resources in the sphere of new information tecnologies in education".* As a consequence, expansion of international cooperation was recommended in this area.

In the letter about the 2nd Congress, disseminated by the UNESCO head-quarter in January 1996, the UNESCO General Director F. Mayor pointed out that considerable progress achieved in the last few years in information and communication technologies resulted in a quick change of computer hardware and software generations and their merging, in an innovatory manner, with other technologies. As a result, unprecedented combinations of information facilities have emerged, which have led to the formation of "information community". The appearance of "information supermains" calls for the critical revision of the state of the art and perspectives of development of education systems, which is particularly needed due to the leading development of technologies as compared to the possibilities of their application in education of all levels.

No country, even that with the most advanced education system, is able alone to cope effectively with problems involved in education at the threshold of the 21st century. The UNESCO Congress contributed to the development of international contacts in the education sphere, as well as correction and coordination of national education systems. The main topic of the Congress was *the problem of national and international policy in the field of education based on new information technologies and the choice of organizational and technological forms of implementation of this policy.*

The modern strategy in education is being built with regard for new educational technologies and legal and legislative principles which form the basis for particular decisions and results. As a consequence, the word "education" in the Congress name was put at the first place.

Since the organizers of the Congress proceeded from the priority of education, it is not by accident that Russia, with its internationally recognized achievements in education, was chosen as a country to hold the Congress. At the Moscow Congress Russia represented not only the country-organizer of this global meeting, but also one of the most advanced countries in the field of education and application of new technologies for education development.

The Moscow Congress was preceded by great organizational work related, in particular, to the determination of the team of participants and observers, invited lecturers to appear at plenary sessions and commission meetings, and preparation of reports and abstracts.

The Congress became an extraordinary event in the life of the world society, an international forum for discussing and solving the problems of education and informatics, which will determine in many respects the pathways of mankind in the 21st century. At the same time, it became a marked event in the life of Russia and the Russian education system and an important step on the road to integration of the world education systems.

More than 1200 representatives of governments, science and business from many countries, specialized UN institutions, government and non-government international organizations took part in the Congress. Researchers, professors and lecturers from educational institutions, representatives of industry, experts on informatics and communications engaged in using NITs in education were among the participants of the Congress.

The plenary sessions, commission meetings, and seminars of practical education were devoted to analysis of national, regional, and international achievements and experience in introducing and using NITs in education systems. New developments in the sphere of NITs and their use in education systems were examined; international, regional and national policies in the use of NITs in the education sphere were discussed, and recommendations

for international cooperation were given. Success of the Moscow Congress helped to reach the agreement between the UNESCO and Russia on joint work in organization and development of two important institutions - the World Technological University and the UNESCO Institute for Information Technologies in Education.

The work of the Congress was conducted under the program and along the lines suggested by the International Program Committee (IPC) and the Russian Organizing Committee (ROC).

Each day of the Congress work started with a plenary session at which the invited lecturer made the main report on the predetermined theme. This main report was followed by other reports in three Commissions where the following basic themes were discussed:

- *Commission I:* Trends and experiences in the introduction and application of ICTs in education systems;
- *Commission II:* Latest developments in ICTs in education;
- *Commission III:* Cooperation for the use ICTs in education.

Outstanding scientists - experts in education and informatics - were chosen by the UNESCO as the Chiefs of Commissions: Director of Higher School of Foreign Languages Katerina Martcheva (Bulgaria); President of the French National Commission on Intergovernment Programs on Informatics Pierre Mathelot (France); Coordinator of the UNDP/UNESCO project, representative of the Computerized Information Systems Co., Dr. Mohamed Noor Burhan (Syria). Prominent scientists and specialists from many countries were invited to participate in discussions.

The following topics were discussed at the Commission meetings:

- *Policy:* Development of national plans, strategies for changes on the level of educational institutions, strategies for developing perspective plans and programs;
- *Technologies:* Informatics, computerized education, and "traditional" education technologies, multimedia and telematics;
- *Teachers:* Modern practice in using new technologies, training and improvement of professional skill of teachers, their new role in education;
- *Students:* Educational facilities, new role of students, new education methods in educational institutions;
- *Social, economic, and cultural aspects* of using new information technologies;
- *Through themes:* Permanent, open, and distant education; estimation of the influence of NITs; the UNESCO and international cooperation.

It should be noted that the priorities of the above-listed topics have been changed in the course of discussion of these topics: the problems of using NITs by students and teachers were put at the first positions; the second place was given to the development and application of education technologies; social, economical, and cultural aspects of the problem moved to the third place; and the fourth position was given to strategy in the sphere of education and new technologies. Of all through themes only those relating to international cooperation were left because the remaining questions could be effectively treated as part of other themes. As a result, in the Congress Recommendations the themes were arranged in the following order:

- *Theme 1:* Students;
- *Theme 2:* Teachers;
- *Theme 3:* Technologies;
- *Theme 4:* Social, economic, and cultural issues;
- *Theme 5*: Educational Policies;
- *Theme 6:* International Cooperation.

This order was also followed in preparation of the Congress Proceedings for publication.

Along with plenary sessions and commission meetings, 12 seminars of practical education were held at the Congress. Their participants discussed the following topics:

- Information super high way and education (*Part I:* Perspectives and issues of development of worldwide and regional unified information systems for education; *Part II:* From information literacy toward information culture);
- Psychological and pedagogical effects and medical implications of using modern information and communication technologies;
- Program environment: perspectives of active use;
- Knowledge and experience transfer with the use of information and telecommunication technologies;
- National policies in the sphere of technological transfer;
- Individual distant education;
- Analysis of UNESCO/IFIP (International Federation for Information Processing) documents published in 1994-1995 (*Part I:* Informatics for secondary education; *Part II:* Module educational program on informatics);
- Logic, informatics, and education;
- Information technologies and humanitarian education;
- Development of primary and secondary education with the use of modern information technologies and distant education methods;
- Medicine: new approach to gaining and improving knowledge;
- Formation of integrated worldwide database systems and knowledge on planets of the Solar system and their use in research works and education.

The chiefs of seminars were well-known scientists, teachers, and organizers of education. Among them were: David Walker (Great Britain), adviser; Peter Waker (South Africa), adviser in the Interware Co.; Alain Meyer (France), Director of the Teleeducation Center of the National Conservatorium of Arts and Skill; Tom van Weert (the Netherlands), Director of the School of Informatics at the Mathematics and Informatics Department of the University of Nijmegen; Harald Schütz (Germany), researcher in the Deutsche Welle Internet Co.; K.K. Kolin (Russia), First Vice-Director on Science in the Institute of Informatics, RAS; Yu.N. Afanasiev (Russia), Rector of the Russian State University of Humanities; A.L. Semenov (Russia), Vice-Chairman of the Moscow Education Department, Head of the Moscow Institute

for Improvement of Professional Skill of Education Specialists; N.N. Evtikhiev (Russia), Rector of the Moscow Staten Institute of Radio Engineering, Electronics and Automation; Yu.I. Ivlev (Russia), Head of the Logic Department of the Philosophical Faculty of the Moscow State University.

The directions of work of the Moscow Congress and topics listed above show how extensive and diverse was the spectrum of problems examined at the Congress, while the names of the Commission and Seminar Chiefs and participants of discussions indicate its high scientific, political and organizational level.

In parallel to the Congress, the International Exhibition - Fair was organized where the most recent exhibits in the area of new information technologies were shown: training systems, education and methodical complexes, multimedia technologies, programs and courses for distant education, telecommunication facilities and technologies of global computer networks, information filling of servers, etc. 80 educational organizations and 24 firms, including leading computer companies such as IBM, Apple, Novell, Oracle, Informix, took part in the exhibition. It demonstrated the efficiency of using NITs in education and high rate of NIT development in Russian institutes of higher education.

The 2nd International Conference on Distant Education (under the title "Open and Distant Education - Strategy of Development" was confined to the Moscow UNESCO Congress. It was organized by the International Education Association and the International Council on Distant Education and supported by the Higher Education State Committee and the Russian Ministry of Science and Technoly Policy. The main objective was to discuss the role of distant education in modern society and the main trends in its development.

The time of the Congress work coincided with the 50-year anniversary of manufacturing the first computer. The international symposium "50 years of information era" held simultaneously with the Moscow Congress was devoted to this remarkable event. This symposium was organized by the Pennsylvania university (the USA), The International Trustee Foundation of the Tsiolkovskii State University of Aviation Technology, the Russian Academy of Sciences, the State Committee for Higher Education, and the Information Policy Committee with the President of the Russian Federation. Participants of this symposium discussed a 50-year history of informatization and the use of information systems in education, industry, aerospace technology, and in the life of various countries.

All above-listed undertakings allowed participants of the Congress, in spite of rather dense schedule, to become acquainted with latest achievements of various countries, including Russia, in the fields to which the Congress was devoted - education and informatics in their interplay.

A great many documents, reports, communications, abstracts, and other materials worked out and obtained as a result of the Congress work are of prime importance for the world community. It was recognized necessary to issue these materials as a series of the Congress Proceedings.

The Russian Organizing Committee, in accord with the UNESCO Secretariat, entrusted analysis, selection, and preparation of the Congress materials for publication to the International Center of Systems Analysis of Higher Education and Science Problems (the UNESCO associated center), the head organization on the Russian side, which provided preparation and work of the Moscow Congress. The result of the Congress work will be the volumes of the Congress proceedings prepared in the three official Congress languages of the Congress- English, French, and Russian. These volumes will include the following materials:

- Volume I. *GENERAL DOCUMENTS OF THE CONGRESS;*
- Volume II. *NATIONAL REPORTS*;
- Volume III. *REPORTS AND SPEECHES*;
- Volume IV. *REPORTS' THESES* .

The arrangement of materials in these volumes will comply with the above basic topics of the Congress.

Because materials of these volumes had initially a different degree of readiness for publication, each volume will be issued as the work on particular volume is completed.

I express my conviction that the materials published will be of great interest for all persons engaged in the education sphere and in the use of information and communication technologies.

I would like to underline the importance of the publication of these materials in view of the fact that the Moscow Congress is by no means the last one and all the materials will therefore provide a good basis for organizing the next UNESCO congresses.

PRESIDENT OF THE RUSSIAN ORGANIZING COMMITTEE
FOR THE 2nd INTERNATIONAL CONGRESS
"EDUCATION AND INFORMATICS",

MINISTER OF GENERAL AND PROFESSIONAL EDUCATION
OF THE RUSSIAN FEDERATION,

V. G. KINELEV

UNITED NATIONS EDUCATIONAL,
SCIENTIFIC AND CULTURAL ORGANIZATION

EDUCATION and INFORMATICS

EDUCATIONAL POLICIES and NEW TECHNOLOGIES

PROCEEDINGS
OF THE SECOND INTERNATIONAL
CONGRESS

VOLUME I

GENERAL DOCUMENTS OF THE CONGRESS

UNESCO INSTITUTE
FOR INFORMATION TECHNOLOGIES
IN EDUCATION

PREFACE

TO THE 1st VOLUME OF THE PROCEEDINGS OF THE 2nd UNESCO INTERNATIONAL CONGRESS

EDUCATION AND INFORMATICS

EDUCATIONAL POLICIES and NEW TECHNOLOGIES

We bring to the notice of specialists and all interested persons the 1st volume of the Proceedings of the 2nd UNESCO International Congress "Education and Informatics", held in Moscow, on July 1-5, 1996.

This volume includes, first, the main documents prepared by the Congress organizers before the onset of the Congress, which served as a basis for its organization. These documents were then distributed among the Congress participants and formed the basis for discussion and decision making. Second, the volume incorporates two main documents: Declaration and Recommendations worked out by the Congress *as a result* of its work. And third, the volume contains the UNESCO Final Report in which *the content and main results* of the Congress work are presented in the concentrated form.

The Final Report on the Congress work, prepared in the complete form by the UNESCO Secretariat and published as an independent document, consists of two parts: (1) the main part (preface, introduction, brief account of the content and results of the work of Commisions and seminars, appearances at the Opening and Closing Ceremonies and at the first and final plenary sessions); (2) 12 Appendices including the aforementioned materials prepared before the Congress onset and adopted as a result of its work, as well as the lists of participants and observers.

The editors considered it necessary to include in the 1st volume only the main part, without Appendices, because the latter entered the volume as independent documents.

The lists of participants are given in this volume in the same form as in the Final Report: separately presented is the list of participants from all countries except Russia and separately the list of Russian participants and observers.

When forming these lists, we met with certain problems in translating names and surnames of participants and titles of organizations from one language to another. To simplify the edition, the lists of participants in the French version of the volume are given in the English language.

The significance of the Moscow Congress as a representative international forum called to outline the pathways for education development and to find the possibilities of using new information technologies in this area was underlined in the greetings to the Congress participants received from the UNESCO General Director F. Mayor and the President of the Russian Federation B.N. Yeltsin.

Two basic documents - the Main Working Document and the Congress Program - constituted the system-forming basis for preparation and work of the Moscow Congress. Both documents were prepared by the International Program Committee which included outstanding experts in the field of education and informatics from various countries and continents (The list of the members of this Committee is given in this volume.) These documents have been discussed at four regional meetings of experts: at Austin (Texas, USA) for countries of North and South America and Caribbean region; for European countries at St. Petersburg and for Asian and Pacific Ocean countries at Vladivostok (Russia), and at Dakar (Senegal) for African countries. Also, six subregional meetings were held from 1991 to 1996: at Harare (Zimbabwe, 1993); Yalta (Ukraine, 1994); Enschede (the Netherlands, 1994); Sofia (Bulgaria, 1994); Moscow and Novosibirsk (Russia, 1991 and 1996).

Participants of these forums put forward their suggestions concerning the organization and work of the Congress and the content of the Main Working Document and the Congress Program. These documents represent, therefore, the result of cooperative effort of many researchers, professors and lecturers, teachers and specialists in information and communication, and representatives from industry.

In the opinion of compilers of this volume, the Report on Basic Lines in the UNESCO activity in the field of education and information in the time elapsed from the First International Congress on Informatics and Education held in Paris in 1989 is of special interest. This report summarizes the work performed by the UNESCO in collaboration with relevant national and international organizations, agencies and professional associations along the following lines:

- Introduction of information technologies in schools, universities, and institutes of informal education;

• Information technologies and the role of teachers;

• Progress of informatics in education;

• Information technologies as a means of education control;

• Information technologies for developing distant and open education.

This Report is of interest, first of all, because its content is in full agreement with some lines in the work of the Moscow Congress and because it enables one to estimate progress achieved by the world society over the period between the two congresses.

The volume also incorporates the "Analytical Review of the Problem "Education and Informatics (Concepts, Current State, Perspectives)" prepared for organizers and participants of the Congress by the group of independent experts - specialists from Russia in this field. This review presents different views of the problems discussed at the Congress. It follows logic in constructing the theme of the Congress and examines the current state of the subject in Russia as compared to other countries in the directions corresponding to the theme of this international forum. Based on their own experience and taking into account the available native achievements, the authors of this review put forth their viewpoint on each line in the work of the Congress.

Proceeding from common principles in forming the volumes of the Congress Proceedings, the compilers and editors attempted to preserve, where possible, original texts and avoided, as a rule, editorial corrections and, moreover, corrections in the content. At the same time, some lingual nuances, which were difficult to circumvent, are possible in the issue of materials in the three official Congress of the languages - English, French, and Russian.

The editors will be grateful to authors and readers for amendments and suggestions. Your references will help to continue the discussion started at the Congress, to unify terminology and concepts, and to increase exchange of information in this area. The importance of publication of these materials is also determined by the fact that this Congress is by no means the last one and all materials will serve as a good basis for organizing future UNESCO congresses on education and informatics. They can be a great help in the build-up of the UNESCO Institute for Information Technologies organized in Moscow in accord with the Congress recommendations.

Analysis, selection, and preparation of this volume for publication were carried out by the UNESCO Institute for Information Technologies in Education and by the International Center of Systems Analysis of Higher Education and Science Problems (The UNESCO associated center). References, notices and suggestions from our readers will be accepted with thanks by the Editorial Board. They should be sent to the Center's address: 117918, Moscow, GSP-1, Mal. Kaluzhskaya ul. 1, The Center's General Director, Academician of the Russian Education Academy, Manushin Eduard Anatol'evich.

PRESIDENT OF THE RUSSIAN ORGANIZING COMMITTEE
FOR THE 2nd INTERNATIONAL CONGRESS
"EDUCATION AND INFORMATICS",

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V. G. KINELEV

ADDRESS

TO THE PARTICIPANTS OF UNESCO'S SECOND INTERNATIONAL CONGRESS ON EDUCATION AND INFORMATICS

BY **COLIN N. POWER**
ASSISTANT DIRECTOR-GENERAL
FOR EDUCATION, UNESCO

Mr. Kinelev,
Mr. Sadovnichy,
Professor Bauknecht.
Distinguished Participants,
Ladies and Gentlemen,

It is a great pleasure for me to welcome you to this Congress, the Second International Congress on "Education and Informatics", on behalf of the Director-General of UNESCO, Mr. Federico Mayor.

Very sadly he is unable to be here and so I am now filling in for him. Yesterday in Guatemala and El Salvador he became ill and, unfortunately, cannot be with you. He very much wanted to show his solidarity with the people of Russia at this historic point in their history and also his solidarity with the countries and the organizations represented here.

As you know, he has a deep interest in the theme of this Conference and is committed to ensure that all have access to knowledge and information, scientific, technological, for the benefit of all. UNESCO is devoted to the promotion of the sharing of expertise and knowledge.

It is indicative of the worldwide interest in the new information and communication technologies that we have approximately 1,000 participants and observers at this conference, representing 70 Member States of UNESCO, many UN organizations, intergovernmental and nongovernmental organizations and the private sector which produces the hardware and the educational software we need to make our dreams of an enriched learning environment for all a reality.

As you know, the first International Congress on 'Education and Informatics' was organized in 1989 at UNESCO's Headquarters, in Paris. It was one of my first duties as Assistant Director-General for Education to oversee the planning and development of that Congress. In the seven years that have passed, tremendous developments have taken place in the information and communication technologies. Indeed, it is a measure of the rapidity of these changes that terms such as the Internet and the World Wide Web were not even mentioned during the first Congress.

The function of this morning's session is to open this conference, so I will not give a long speech. But I do want to suggest that the new information technologies present us with a formidable challenge to our sense of equity, justice and of solidarity around the world. It is important to note that UNESCO's international congresses are truly international, that is, they include representation from the poorest countries in the world as well as the richest, those who do not have access to the technologies as well as those who are at their cutting edge. It provides us, then, with an unrealized opportunity for the sharing of knowledge and for promotion of understanding between peoples and of cultures.

It is appropriate that this Congress should be taking place in Russia with its long and distinguished tradition of scientific and technological development and of education. In this connection, I would wish to reiterate the tribute which the Director-General paid to the Government of the Russian Federation at the ceremony in Moscow, last April, on the centenary of the birth of the chemical physicist Nikolai Semenov, and assure the Russian Federation of UNESCO's continuing support for its efforts to preserve and to develop Russia's outstanding scientific, technological and intellectual heritage. The Director-General asked me to inform you that he is following with great admiration the process of democratization here in Russia, which is liberating the moral and intellectual potential necessary for the development of the country and of a culture of peace throughout this world. Education is essential to this democratization process, to development and to peace. The new information technologies, equitably shared and properly employed, can enhance the potential of education to shape a broader future for us all.

I wish to conclude by expressing once again our gratitude to the host country for its leadership and for the impeccable preparation of this conference, and to the Moscow State University for generously agreeing to host it. I should pay tribute as well to the International and the Russian Organizing Committees of the Congress, and especially to you, Mr. Kinelev, for the enormous efforts which you personally have put into the preparation of this very large and complex conference. It is now up to us, Ladies and Gentlemen, to ensure that the Congress does provide us with guidelines for the policies and the actions needed in order to ensure that the new information technologies serve the cause of lifelong education for all, which is the central platform of UNESCO's programme.

Thank you.

ADDRESS

TO THE PARTICIPANTS OF UNESCO'S SECOND INTERNATIONAL CONGRESS ON EDUCATION AND INFORMATICS

I warmly welcome the participants to UNESCO's Second International Congress on Education and Informatics, which is now opening in Moscow.

You represent the governments and scientific and business communities of many countries, United Nations Specialized Agencies and other international organizations. I am convinced that such a representative forum will be able to indicate how to develop education and identify opportunities for using new information technologies in this field.

The Congress has particular resonance because it is taking place on the cusp of two centuries and two millennia. The decisions taken today will influence the lot of humanity in the future.

It is significant that your intellectual forum is working under the auspices of UNESCO. This international organization has rightly earned respect for its substantial contribution to consolidating the efforts of education, science and culture professionals and creating the conditions for the sustained development of the world community.

I would like to wish the participants in the Congress good luck and success in their valuable work, and peace and prosperity to their countries and peoples!

BORIS YELTSIN

PRESIDENT
OF THE RUSSIAN FEDERATION

GENERAL INFORMATION

ON THE 2nd UNESCO INTERNATIONAL CONGRESS

EDUCATION AND INFORMATICS

EDUCATIONAL POLICIES and NEW TECHNOLOGIES

INTRODUCTION

In accordance with Resolution 1.18 of the twenty-seventh Session of the General Conference (October-November 1993), UNESCO, in co-operation with the Russian Federation, will organize its Second International Congress on ***Education and Informatics*** *- Educational Policies and New Technologies (EI'96) to be held in Moscow from 1 to 5 July 1996. The first Congress, which was held in 1989 at the UNESCO Headquarters, stressed the need 'to benefit from collective experience and the sharing of scarce resources in the field of new information technologies (NITs) in education' and, to this effect, recommended that international co-operation be strengthened.*

Today co-operation is even more needed than ever before. In recent years, remarkable development has taken place in information and communication technologies, whereby hardware and software 'generations' have rapidly succeeded each other and, in a most innovative manner, converged with other technologies. Unforeseen media combinations have emerged to shape the 'information society' and to challenge those living in it. In the midst of the 'information superhighways', education is challenged to re-examine its position critically, especially since technologies seem to develop faster than education has capacity to make use of them.

OBJECTIVES

The Congress, which offers an international forum to discuss the future of education and informatics, will *analyse* national, regional and international trends and experiences in the introduction and use of NITs in educational systems, *review* the latest developments in NITs and *examine* their application in education: *discuss* international, regional and national policies for the use of NITs in education; and *make recommendations* for international co-operation.

OUTPUTS

As results of its work, the Congress is expected to produce:

- a general declaration or manifesto;
- recommendations to Member States and to the Director-General of UNESCO;
- proposals for regional and international co-operation.

PROGRAMME AND THEMES

The Congress will pursue its objectives through the following programme and themes proposed by the International Programme Committee (I PC) in co-operation with the Russian Organizing Committee (ROC).

Each Congress day will begin with a *plenary session* in which a *keynote speaker* makes the main presentation on the chosen theme, followed by presentations and discussions in three commissions with the following general orientations:

- *Commission 1:* Trends and experiences in the introduction and use of NITs in educational systems:
- *Commission II-.* Latest developments in NITs and their application in education:
- *Commission III:* Policies and co-operation for the use of NITs in education.

The themes proposed to be discussed in the *commissions* include:

- *Policies* (Developing National Plans. Strategies for Change at Institutional Level, Strategies for a Future-Proofed Curriculum):
- *Technologies* (Computer Science, Computer Enhanced Instruction and "Traditional" Educational Technologies, Multimedia and Telematics);
- *Teachers* (Current Practices with New Technologies, Pre- and In-service Teacher Training, New Roles for Teachers):
- *Learners* (Learning Tools, New Roles for Learners, New Options for Learning inside and outside Educational Institutions):
- *Social, Economic and Cultural Issues*
- *Transverse Themes* (Lifelong, Open and Distance Learning, Measuring the Impact. UNESCO and International Co-operation).

The themes proposed for the *workshops* on 4th and 5th July 1996 include:

- Information Superhighways and Education;
- Medical and Psychological Consequences:
- The Software Environment - a Perspective for Effective involvement:

	1 July	2 July	3 July	4 July	5 July
9:00-10:30	**Opening**	**Theme 2** *Plenary*	**Theme 4** *Plenary*	**Theme 6** *Plenary*	**Workshops** | | | | |
10:30-12:30	*Plenary* Keynote speeches	*Commissions* I II III; Presentations Discussions	*Commissions* I II III; Presentations Discussions	*Commissions* I II III; Presentations Discussions	Demonstrations, exhibitions, visits
12:30-14:00	**L**	**U**	**N**	**C**	**H**
14:00-15:30	**Theme 1** *Plenary*	**Theme 3** *Plenary*	**Theme 5** *Plenary*	**Workshops** | | | | |	*Plenary* Closing speeches Declaration and Recommendations **Closure**
16:00-18:00	*Commissions* I II III; Presentations Discussions	*Commissions* I II III; Presentations Discussions	*Commissions* I II III; Presentations Discussions	Demonstrations, exhibitions, visits	

- Transfer of Knowledge and Skills through Information and Communication Technologies;
- National Policies - Transfer of Technologies:
- individual Distance Training (for the French-speaking countries):
- Analysis of UNESCO/IFIP documents, published by UNESCO in 1994-1995:
  - Informatics for Secondary Education *(A Curriculum for Schools);*
  - A Modular Curriculum in Computer Science.

PARTICIPANTS AND OBSERVERS

As is common for international congresses of Category IV, UNESCO will invite the participants and observers in their personal capacity, at the proposal of its Member States, representatives/observers of UN specialized agencies, other intergovernmental organizations, international non-governmental organizations, professional associations, as well as public and private institutions working in related fields. The participants and observers will include decision-makers, researchers, teacher trainers, industrial trainers, university professors, teachers and information and communication specialists interested in the application of NITs in education. In conformity with the regulations for international congresses, the participants and observers are expected to cover their travel and accommodation expenses. The Russian Organizing Committee will make arrangements through Aeroflot, the designated official carrier for the Congress, for reduced air fares. The participants will also benefit from reduced hotel room prices.

EXHIBITION

In conjunction with the Congress, a major exhibition will be organized, in which ministries educational institutions, research centres, publishers, as well as private companies involved in the development and application of NITs in education are welcome to participate. Those interested in presenting their projects or products at the exhibition are invited to contact the Secretariat of the Russian Organizing Committee (see address on p. 3).

LANGUAGES

Simultaneous interpretation in three languages (English, French, and Russian) will be available for the plenary and commission sessions.

PREPARATORY CONFERENCE AND EXPERT MEETINGS

In preparation for the Congress, the following conference and expert meetings are scheduled: a conference in Novosibirsk (19-22 March 1996, in the Russian language), and regional expert meetings, namely, in Austin (Texas, USA, 9-1101.1996) for North and Latin America as well as for the Caribbean countries: in St. Petersburg (25-26.02.1996) for the Europe Region: in Vladivostok (10-1405.1996) for Asia and Pacific countries, and in Dakar (March 1996) for Africa.

SIR/MADAM,

UNESCO is pleased to invite you to participate in the preparation of the above Congress by:

- *Commenting on the proposed programme of the Congress:*
- *Proposing candidates for keynote speakers so as to allow the International Programme Committee to select from a wide geographical representation.*

The comments and proposals should reach the UNESCO Secretariat by 15 February 1996.

- *Preparing a National Report (maximum 20 pages on a floppy disk) which should give an overview of the state-of-the-art of NITs in your educational system, including priorities in your national plan concerning the introduction of NITs in various forms and at various levels of education (primary school, secondary school, higher education, teacher/instructor training, industrial training and retraining etc.): the level of computer hardware and software provision, including in educational administration: any policy towards standardisation; the use made of broadcast technologies in education; the factors limiting progress in the adoption of new technologies in education, including insufficient numbers of trained staff, any inadequacy in the infrastructure of service utilities (electricity supply, broadcasting, telephone services, telematics etc.): participation in international programmes concerning the use of NITs and the benefit you may derive from it.*

Your National Report should reach the UNESCO Secretariat by 15 March 1996.

- *Preparing a paper which might be selected to be presented as a contribution to the discussions in the commissions. The paper should be prepared on a floppy disk and should not exceed five pages.*

The paper should reach the UNESCO Secretariat by 31 March 1996.

SPONSORSHIP

The Member States and potential sponsors are kindly asked to look at the possibility of helping specialists from developing countries financially (by sponsoring travel grants, fellowships etc.) so that they can participate in the Congress. Kindly inform the UNESCO Secretariat if you are willing to do so.

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EDUCATION AND INFORMATICS

EDUCATIONAL POLICIES and NEW TECHNOLOGIES

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PROGRAMME

OF THE 2nd UNESCO INTERNATIONAL CONGRESS

EDUCATION AND INFORMATICS

EDUCATIONAL POLICIES and NEW TECHNOLOGIES

TIMETABLE

	1 July	2 July	3 July	4 July	5 July
9:00-10:30	**Opening**	**Theme 2** *Plenary*	**Theme 4** *Plenary*	**Theme 6** *Plenary*	**Workshops** I I I I I
10:30-12:30	*Plenary* Keynote speeches	*Commissions* I II III Presentations Discussions	*Commissions* I II III Presentations Discussions	*Commissions* I II III Presentations Discussions	Demonstrations, exhibitions, visits
12:30-14:00	**L**	**U**	**N**	**C**	**H**
14:00-15:30	**Theme 1** *Plenary*	**Theme 3** *Plenary*	**Theme 5** *Plenary*	**Workshops** I I I I I	*Plenary* Closing speeches Declaration and Recommendations **Closure**
16:00-18:00	*Commissions* I II III Presentations Discussions	*Commissions* I II III Presentations Discussions	*Commissions* I II III Presentations Discussions	Demonstrations, exhibitions, visits	

MONDAY, 1 JULY 1996

9.00-10.25 hrs. - Opening Ceremony (Grand Hall)

Addresses by:

- Mr. Vladimir G. Kinelev, Deputy Chairman of the Government, Chairman of the State Committee for Higher Education of the Russian Federation
- Mr. Colin N. Power, Assistant Director-General for Education of UNESCO
- Mr. Kurt Bauknecht, President, International Federation for Information Processing
- Mr. Armando Rocha Trindade, President, International Council for Distance Education
- Mr. Viktor A. Sadovnichy, Rector, Moscow State University

10.25-10.30 hrs.- Break

10.30-12.30 hrs. - Plenary (Grand Hall)

- Election of the President
- Adoption of the Rules of Procedure
- Election of the other members of the Bureau and members of the Drafting Group
- Keynote speakers:
- Mr. Vladimir G. Kinelev, Deputy Chairman of the Government, Chairman of the State Committee for Higher Education (Russian Federation), *Education and Civilization*
- Mr. Colin N. Power, Assistant Director-General for Education (UNESCO), *New Perspectives for Learning in the Information Age*
- Dr. Norio Matsumae, President, Tokai University (Japan), *New Directions in Education*

12.30-14.00 hrs. - Lunch Break

14.00-15.30 hrs. - Plenary (Grand Hall)

Theme 1: Learners

Speakers:

• Acad. Blagovest Sendov, President of Parliament (Bulgaria), *Learners in a Global Knowledge Space: Towards Global Wisdom*

• Mr. Tahar Hafaied, Directeur, Institut National de Bureautique et Micro-Informatique (Tunisia), *Training in the Context of New Information and Communication Technologies*

15.30-16.00 hrs.- Break

16.00-18.00 hrs.- Commissions:

Commission I: Room 01 - Main Building of Moscow State University

Theme 1.1

Speakers:

• Prof. Sergei S. Goncharov, Deputy Director, Research Institute for the Mathematical and Informational Basis of Education (Russian Federation), *Peculiarities of Usage of New Information Technologies in Secondary and University Education*

• Mr. Francis Moret, Centre Suisse de Technologie de l'Information dans l'Enseignement (Switzerland), *Compulsory Education and the Secondary Level*

Discussion:

• Prof. Yasen N. Zasursky (Russian Federation)

• Dr. Mohamad Noor Burhan (Syria)

• Prof. Gia G. Gvaramia (Georgia)

Commission II: Room 02 - Main Building of Moscow State University

Theme 1.2

Speakers:

• Mr. Predrag Pale, Deputy Minister of Science, Ministry of Science and Technology (Croatia), *Can Education Save the World?*

• Mrs Yaffa Vigodsky, Head of Division, Ministry of Education, Culture and Sport (Israel), *Tomorrow '98: The Computerization of the Educational System*

Discussion:

• Prof. Yuri A. Pervin (Russian Federation)

• Mr. Alain Chaptal (France)

Commission III: Room 611- Main Building of Moscow State University

Theme 1.3

Speakers:

• Mrs. Anne Marrec, Directrice générale, Télé-université (Canada), *The "Neurone-Student" in a Reconfigured Education System*

• Mr Peter Baumgartner, Institute for Interdisciplinary Research and Further Education (Austria), *Evaluation of Technology-Based Learning. A Social Science Approach to Quality Assurance in Education*

Discussion:

• Prof. Viktor A. Bolotov (Russian Federation)

• Mr. Tamás Káldi (Hungary)

TUESDAY, 2 JULY 1996

9.00-10.30 hrs. - Plenary (Grand Hall)

Theme 2: Teachers

Speakers:

• Mr. Kunming Qian, Deputy Director, Distance Education Center of Central TV University (People's Republic of China), *New Information Technology and Teachers*

• Prof. Alexei L. Semenov, Vice-Chairman, Moscow Department of Education (Russian Federation), *The Teacher in a National and Regional Perspective of the Informatization of Education*

10.30-11.00 hrs. - Break

11.00-13.00 hrs. - Commissions

Commission I: Room 01 - Main Building of Moscow State University

Theme 2.1

Speakers:

• Dr. Betty Collis, Faculty of Educational Science and Technology, University of Twente (The Netherlands), *Teachers and Telematics: Lessons from Experience with Computer Implementation*

• Mr. Gérard Lisée, Président, Comité exécutif de STÉFI, Université de Montréal (Canada), *Development and Experimentation of Education Services Using Information Superhighway Infrastructures*

Discussion:

• Dr. Sergei A. Khristochevsky (Russian Federation)

• Prof. Bengt Bengtsson (Sweden)

Commission II: Room 02 - Main Building of Moscow State University

Theme 2.2

Speakers:

• Prof. Jenny Sendova, Institute of Mathematics and Informatics (Bulgaria), *Enhancing the Teacher's Creativity by Exploratory Computer Environments*

• Mr. David A. Thomas, Montana State University (USA), *Internet-based Inservice Teacher Training in Montana*

Discussion:

• Acad. Alexander A. Samarsky (Russian Federation)

Commission III: Room 611- Main Building of Moscow State University

Theme 2.3

• Mr. A.Y. Montgomery, Head of Department, Royal Melbourne Institute of Technology (Australia), *Development of "Multi Media" Teaching and Learning Environments*

• Prof. Paul Resta, Director, Learning Technology Centre, University of Texas at Austin (USA), *Building a Community of Learners: New Tools for Collaborative Learning*

Discussion:

• Mr. Yves Brunsvick (France)

• Prof. V. L. Matrosov (Russian Federation)

13.00-14.00 hrs. - Lunch Break

14.00-15.30 hrs. - Plenary (Grand Hall)

Theme 3: Technologies

Speakers:

• Prof. Jean-Pierre Arnaud, Conservatoire National des Arts et Métiers (France), *Which Technologies for Education? New Education Technologies at the Time of Deployment*

• Mr. Rockley L. Miller, President, Future Systems Incorporated (USA), *A Matter of Mathematics: The Impact of Moore's Law on the Future of Education, Training and Global Communication*

15.30-16.00 hrs.Break

16.00-18.00 hrs.Commissions

Commission I: Room 01 - Main Building of Moscow State University

Theme 3.1

Speakers:

• Prof. Sandra Wills, Director, Educational Media Services, University of Wollongong (Australia), *Interface to Interactivity: Technologies and Techniques*

• Dr. Hartmut Grebe, Consultant (Germany), *Is Technology the Answer for Our Changing Educational Means? Yes, but only If...*

Discussion:

• Acad. Oleg M. Belotserkovsky (Russian Federation)

• Dr. Gerhard Eisfeld (Germany)

Commission II: Room 02 - Main Building of Moscow State University

Theme 3.2

Speakers:

• Prof. Dines Bjørner, Director, International Institute for Software Technology, UN University, *Teaching the Laws of Informatics and Its Applications*

• Prof. Igor A. Mizin, Director of the Institute of Problems of Informatics, Academy of Sciences (Russian Federation), *Present and Future Trends in the Development of Telecommunication Technologies in the Field of Education and Science*

Discussion:

• Prof. Ivan N. Pustinsky (Russian Federation)

• Mr. Eric Garnier (France)

Commission III: Room 611- Main Building of Moscow State University

Theme 3.3

Speakers:

• Dr. Ella Kiesi, Head of the Unit of Educational Technology, National Board of Education (Finland), *Regional Co-operation in the Construction of Information Networks*

• Dr. Alexei M. Dovgyallo, Deputy Director, UNESCO/IIP Research and Training Centre, V.M. Glushkov Institute of Cybernetics of the Academy of Sciences (Ukraine), *Communication and Information Technologies Infrastructures in a Country in Transition*

Discussion:

• Dr. Valery A. Vasenin (Russian Federation)

• Prof. P. D. Kukharchik (Belarus)

WEDNESDAY, 3 JULY 1996

9.00-10.30 hrs. - Plenary (Grand Hall)

Theme 4: Social, Economic and Cultural Issues

Speakers:

• Dr. P.A. Motsoaledi, Minister of Education, Northern Province (South Africa), *The Penetration of New Information Technologies into Developing Countries: Cultural Hegemony or Mutual Exchange*

• Dr. Heinz-Werner Poelchau, Ministerial Counsellor (Germany), *New Information Technologies as a Challenge for General and Vocational Training: Chances for International Co-operation*

10.30-11.00 hrs. - Break

11.00-13.00 hrs.- Commissions

Commission I: Room 01 - Main Building of Moscow State University

Theme 4.1

Speakers:

•Prof. Yuri N. Afanasiev, Rector Russia State University of Humanities (Russian Federation), *New Information Technologies in Humanities Education*

• Dr. Siegfried Hermann, Bundesinstitut für den wissenschaftlichen Film (Austria), *Scientific Film in Education*

Discussion:

• Prof. Yuri M. Arsky, Viktor T. Trofimov (Russian Federation)

• Prof. Esengheldy U. Medeuov (Kazakhstan)

Commission II: Room 02 - Main Building of Moscow State University

Theme 4.2

Speakers:

• Mr. Régis Poubelle, Directeur de PDO MEDIA (France), *Electronic Publishing on Optical Support and Education*

• Dr. Nikolai I. Listopad, Director, Ministry of Education and Science, Prof. S.V. Kritsky (Belarus), *Use of Telecommunications in the Field of Education and Science*

Discussion:

• Prof. Alain Meyer (France)

• Prof. Konstantin K. Kolin (Russian Federation)

Commission III: Room 611 - Main Building of Moscow State University

Theme 4.3

Speakers:

• Mrs. Jeanne Girardot, Présidente, Internews Europe-France), *International Community of the Hearing Impaired: Education and New Technologies*

• Prof. V. A. Zhuravlyov, Rector, Udmurt State University (Russian Federation), *Introduction of New Information Technologies in Higher Education in the Context of Difficult Financial Conditions*

Discussion:

• Mr. Paulin Mbalanda Kisoka (Zaire)

• Prof. Viktor L. Mironov (Russian Federation)

13.00-14.00 hrs. - Lunch Break

14.00-15.30 hrs. - PlenaryGrand Hall

Theme 5: Educational Policies

Speakers:

• Prof. José A. Valente, Coordinator, Núcleo de Informática Aplicada à Educação, Universidade Estadual de Campinas (Brazil), *The Role of Computers in Education: Achievement and Comprehension*

• Prof. T. Plomp, University of Twente (The Netherlands), *Worldwide Information and Communication Technology in Education Study*

15.30-16.00 hrs.Break

16.00-18.00 hrs.Commissions

Commission I: Room 01 - Main Building of Moscow State University

Theme 5.1

• Mr. Gilles Braun, Ministère de l'Education Nationale (France), *New Technologies in the French Educational System*

• Mr. Jan Wibe, Centre for Continuing Education (Norway), *Distance Education in the Nordic Countries*

Discussion:

• Prof. Alexander G. Asmolov (Russian Federation)

• Prof. Roumen Nikolov (Bulgaria)

Commission II: Room 02 - Main Building of Moscow State University

Theme 5.2

Speakers:

• Mr. German Escorcia, IBM-CLIE (Mexico), *Preparing Children for a Knowledge-Based Society: Latin American Experiences Using Megatools to Develop Megabilities*

• Prof. Ludavit Molnár, Slovak Technical University (Slovakia), *Transforming Curricula in the Transforming Countries*

Discussion:

• Acad. Stanislav V. Yemelianov (Russian Federation)

• Mr. Gerald McConaghy (Canada)

Commission III: Room 611 - Main Building of Moscow State University

Theme 5.3

Speakers:

• Mr. Mohammad Larijani, Director, Institute for Studies in Theoretical Physics and Mathematics (Iran), *Modern Technologies in Education and Science*

• Mr. Mushobekwa Kalimba wa Katana, Ministre de l'Enseignement Supérieur, Universitaire et de la Recherche Scientifique (Zaire), *Policies in the Computerization of Education in African Countries*

Discussion:

• Prof. Vladimir E. Tretiakov (Russian Federation)

• Mr. Don Ferguson (New Zealand)

THURSDAY, 4 JULY 1996

9.00-10.30 hrs. - Plenary (Grand Hall)

Theme 6: International Co-operation

Speakers:

• Mr. H. Yushkiavitshus, Assistant Director-General for Communication, Information and Informatics (UNESCO), *UNESCO Intergovernmental Programmes in the Field of Communication, Information and Informatics*

• Prof. Armando Rocha Trindade, President, International Council for Distance Education, *International Co-operation in Open and Distance Learning*

• Mr. Wim Jansen, Task Force Educational Software and Multimedia (European Commission), *Multimedia for Education and Training*

10.30-11.00 hrs. - Break

11.00-13.00 hrs. - Commissions

Commission I: Room 01 - Main Building of Moscow State University

Theme 6.1

Speakers:

• Prof. Peter Bollerslev, Chairman of TC-3 (IFIP), *Information Technologies and Education in IFIP Activities*

• Mr. Mike Aston, Director, The Advisory Unit: Computers in Education (UK), *The Impact of New Technologies in the Schools of Europe and the G7 Nations*

Discussion

Commission II: Room 02 - Main Building of Moscow State University

Theme 6.2

Speakers:

• Prof. Jean A. Vergnes, Université d'Aix-Marseille (France), *On Education and Use of Information Technologies*

• Prof. Ivan Stanchev, IPC Scientific Secretary (The Netherlands), *Flexible and Distance Learning through Telematic Networks*

Discussion

Commission III: Room 611 - Main Building of Moscow State University

Theme 6.3

Speakers:

• Prof. Valery S. Meskov, Vice-Chairman, Russian State Committee for Higher Education (Russian Federation), *International Projects: Creation and Development of a Common Distance Education System*

• Mr. John Middleton, Economic Development Institute (World Bank), *Looking Sideways*

Discussion:

• Dr. Vitaly Boyko (Russian Federation)

• Prof. Gennady Ryabov (ILO)

13.00 -14.00 hrs - .Lunch Break

14.00-18.00 hrs. - Workshops, demonstrations, exhibitions, visits

FRIDAY, 5 JULY 1996

9.00-13.00 hrs. - Workshops, demonstrations, exhibitions, visits

14.00-15.30 hrs. - PlenaryGrand Hall

Speakers:

- Acad. Yury L. Ershov, Co-Chairman of the EI'96 International Programme Committee (Russian Federation)
- Prof. Jef Moonen, Co-Chairman of the EI'96 International Programme Committee (The Netherlands)
- Prof. Arkady Golubkov, Chairman of Presidential Committee for Informatization (Russian Federation)

15.30-16.00 hrs. - Break

16.00-17.30 hrs. - Summing up the Results of the Congress

- Oral Report on Workshops
- Oral Report on the Work of the Commissions
- Oral Report by the Rapporteur-General
- Adoption of the Declaration and Recommendations

17.30-18.00 hrs. - Closing Ceremony

- Mr. Colin N. Power, Assistant Director-General for Education (UNESCO)
- Mr. Viktor A. Sadovnichy, Rector, Moscow State University

	THEMES OF WORKSHOPS	CHAIRPERSONS	DATE	TIME	PLACE
1	Information Superhighways and Education: Part I: Perspectives and Problems Related to the Development of World and Regional Common Information Space for the Field of Education Part II: From Information Literacy to Information Culture	Prof. Konstantin K. Kolin, *Institute of Problems of Informatics (Russian Federation)* Mr. Harald Schütz, *Deutsche Welle (Germany)* Dr. Shota Sh. Chipashvili, *Institute of Problems of Informatics (Russian Federation)* Dr. Sergei A. Khristochevski, *Institute of Problems of Informatics (Russian Federation)*	4 July 5 July	14.00-16.30	Main Building, Room 01 Main Building, Room 01
2	The Psychological-Pedagogical Impact and the Medical Consequences of the Application of Modern Information and Communication Technologies	Prof. Irena V. Robert, *Institute of General Secondary Education of the Russian Academy of Sciences (Russian Federation)* Prof. Alexei M. Bolshakov, *Sechenov Moscow Medical Academy (Russian Federation)*	4 July	14.00-18.00	Grand Hall
3	The Software Environment - A Perspective for Effective Involvement	Mr. David Walker, *Consultant (UK)*	5 July	9.00-12.00	Main Building, Room 02
4	Transfer of Knowledge and Skills through Information and Communication Technologies	Prof. Alexei L. Semenov, *Vice-Chairman, Moscow Department of Education (Russian Federation);* Dr. Heinz-Werner Poelchau, *Ministerial Counselor;* Mr. Harald Schütz, *Deutsche Welle (Germany);* Dr. Elena I. Bulin-Sokolova, Dr. P.A. Yakushkin, *Institute of New Educational Technologies (Russian Federation)*	4 July	14.00-18.00	Main Building, Room 611
5	National Policies - Transfer of Technologies	Mr. Peter Waker, Consultant, Interware (South Africa)	4 July	14.00-18.00	Main Building, Room 02

	THEMES OF WORKSHOPS	CHAIRPERSONS	DATE	TIME	PLACE
6	Individual Distance Training	Mr. Alain Meyer, Directeur, *Conservatoire National des Arts et Métiers (France)*	5 July	9.00-12.00	Main Building, Room 611
7	Analysis of UNESCO/IFIP Documents Published by UNESCO in 1994-1995 Part I: Informatics for Secondary Education (A Curriculum for Schools) Part II: A Modular Curriculum in Computer Science	Prof. Tom van Weert, *University of Nijmegen (The Netherlands)*	 5 July 5 July	 9.00-10.30 11.00-12.30	 Grand Hall Grand Hall
8	Logics, Informatics, Education	Prof. Yury V. Ivlev, *Philosophical Faculty, Moscow State University (Russian Federation)*	4 July 5 July	14.30-18.00 9.00-12.30	First Building of the Humanities Faculties Room 1157
9	Information Technologies and Humanities Education	Prof. Yury N. Afanasiev, *Russian State University ofr the Humanities (Russian Federation)*	4 July	14.30-18.00	Russian State University for the Humanities
10	Development of Pre-University Education via Modern Information Technologies and Methods	Prof. N. N. Evtikhiev, *Moscow State Institute for Radioengineering, Electronics and Automation* Prof. N. I. Klyatova, *Moscow City Palace for Children and Youth Creativity* Prof. V. A. Mordvinov, *Moscow Institute for Radioengineering, Electronics and Automatics (Russian Federation)*	4 July	14.30-18.00	Moscow City Palace for Children and Youth Creativity
11	Medicine: New Approaches to Knowledge Acquisition and Improvement	Prof. Oleg S. Medvedev, *Faculty of Fundamental Medicine, Moscow State University* Dr. Mikhail Y. Natenzon, *Institute of Aerospace Research, Russian Academy of Sciences* Dr. Vladimir I. Tarnopolsky, *Institute of Aerospace Research, Russian Academy of Sciences (Russian Federation)*	4 July	14.00-16.00 16.30-18.00	Main Building, Room 1029 Medical Centre "GAZPROM"
12	Forming Integrated World Data Bases and Knowledge about the Planets of the Solar System and Their Use in Research and Education	Dr. Vladimir I. Tarnopolsky, *Institute of Aerospace Research, Russian Academy of Sciences (Russian Federation)* Dr. Mikhail Y. Natenzon, *Institute of Aerospace Research, Russian Academy of Sciences (Russian Federation)*	5 July	9.00-12.30	Main Building, Room 1806

MAIN WORKING DOCUMENT

INTRODUCTION

The rapid development of information and communication technologies and their application present the world community not only with opportunities but also with new challenges. The evolution towards the so-called "information highway" and their associated economic, social, cultural and educational effects could lead to considerable changes in forms of governance, creativity, co-operation, sharing of ideas and knowledge and daily life. It will also call for wider participation and action on the part of national, regional and international organizations and agencies. Under its Constitution, UNESCO is required "to collaborate in the work of advancing the mutual knowledge and understanding of peoples, through all means of mass communication and to that end recommend such international agreements as may be necessary to promote the free flow of ideas by word and image", "give fresh impulse to popular education and to the spread of culture " and "maintain, increase and diffuse knowledge". With regard to information and communication technologies, that mission today embodies three main functions:

(i)promoting the application of information and communication technologies for the free flow of information, innovation and effective management in education, science, culture and the media;

(ii)encouraging international co-operation on legal, ethical and educational issues raised through the social and cultural implications of information and communication technologies; and

(iii)assisting Member States, particularly developing countries, in building information and communication capacities, benefiting from new applications of information and communication technologies, and ensuring that those technologies do not lead to exclusion among and within societies.

The urgency of the national, regional and international action in this field has been greatly accentuated by the constantly accelerating rate of change in the technologies relating to information presentation, access and exchange. A growing flood of data is potentially available anywhere in the world. The digital technology revolution, integrating text, graphics, video, voice, and music in digital form, is providing powerful new tools for the representation and communication of knowledge and tools for learning. Their use has been greatly enhanced by the fact that devices cost less and are more powerful; more countries have plans and budgets for provision and for teacher training in some stage of execution; and the Internet allows technology and knowledge transfer to the benefit of all levels of education. More teachers at all levels of education have some opportunity to experience training, or even just computer use, and the cascade process of dissemination- both formal and informal - has led to an ever increasing understanding of the potential of computer related strategies as a cost beneficial solution to some learning problems. More software, courseware, research and case study material now exists and is being shared or purchased internationally.

The International Commission on Education for the Twenty-first Century stressed in its report (*Learning: The Treasure Within, 1996*) that "... these technologies are in the process of accomplishing nothing short of a revolution before our eyes, one that is affecting activities connected with production and work just as much as those connected with education and training." Technology has enabled students in isolated areas of the world to access information resources and expertise unavailable locally. It has provided new tools for cognitive learning, intellectual collaboration and problem solving. It has enabled children to work with other children across the globe through computer-mediated communications and develop new levels of cultural insight and understanding. It has opened new perspectives for the education of the handicapped. It has enabled adults to receive job retraining and professional development opportunities through new distance learning technologies. In addition, the new multimedia technologies have provided unique and powerful ways to convey difficult and abstract concepts. Research in cognitive learning is providing new insights and strategies for facilitating student learning and new and different ways in which technological tools and information resources may be integrated into the learning environment. In short, from pre-school to higher education, learning will never be the same.

Probably the most radical change that information and communication technologies bring to learning is the abolition of distance. By freeing learners from the constraints of time and place, it can potentially offer new and more flexible learning opportunities. Distance learning, which has rapidly

spread all over the world, is widely used at all levels of education, including higher education. UNESCO's "Policy Paper for Change and Development in Higher Education" urged higher education institutions to make greater use of the advantages offered by the advancement of communication technologies. As a result of such developments, not only have large-scale "mega-universities" emerged as alternative delivery systems, but also the distinction between traditional and distance universities has become blurred.

While the developments in information and communication technologies in many ways challenge the society in general and its educational provision in particular, they do not affect everyone in the same manner. The methodologies of the "information society" are not universally available. The "superhighways" that allow information access and exchange are not open to all. There has been a growing gap between developed and developing countries in their ability to access and use technology. This gap, which was viewed with concern at the 1989 Congress, has widened in the intervening years, and developing countries are perhaps even further disadvantaged in technology access and use than they were seven years ago. For a great number of developing countries, technologies generally available in developed countries, such as telephone, television and even electricity, are still beyond their reach. Therefore, full participation of developing countries in the "information society" and in the use of opportunities offered by information and communication technologies are crucial issues to be faced today. Undoubtedly, this inequity in access to information technologies exists not only among countries but also within countries. The International Commission on Education for the 21st Century felt that there is a real danger of societies with fast and slow tracks, depending on individuals' ability to access technology. It considered that the emergence of information societies is a challenge to both democracy and education, and that the two aspects are closely integrated. Therein lies also humankind's quest for peace. New perspectives, strategies, skills, and knowledge, as well as new levels of cultural understanding will be required in order to surmount the growing array of complex social, political, economic and ecological issues confronting all countries. The educational systems of the world, with the assistance of communication technologies, must play a key role in developing the human potential needed to address these challenges.

It was the rapid development of communication technologies, the increasing awareness of their great potential at the service of education and the concern about the inequity in access to technologies between developed and developing countries that encouraged the resolution at the 27th Session of UNESCO's General Conference to convene the Second UNESCO International Congress on Education and Informatics to provide decision-makers, educators and technology specialists with an opportunity to:

- *discuss the latest developments in New Information Technologies (NITs) and their implications for education and training;*
- *explore current trends and pedagogical issues in the application of technology in different educational and training systems;*
- *discuss effective strategies as well as pitfalls in the planning and implementation of NITs in education and training;*
- *examine important policy issues and opportunities for regional and global collaboration in the use of NITs to improve learning and teaching.*

The Congress is designed to help decision-makers and educators understand the ways technology may enhance the teaching-learning process and the ways in which students can acquire the knowledge and skills needed for the next century. A number of current efforts to restructure educational systems include technology as an important component of a national strategy. What the various strategies share is the need to modernise the systems of educational provision and expand the access of millions of adults and young people to education through communication technologies, including open and distance education. This accords with UNESCO's leading principle of "Lifelong Learning for All" and its "Learning Without Frontiers" programme. Here, it is particularly important for decision-makers to understand how technology can impact on learning in the context of the culture, the curriculum, educational system goals, and evaluation criteria, as well as to realise the costs and projected benefits of the technology implementation.

The Congress will focus on current needs and applications of NITs as well as emerging issues, directions and scenarios as we approach the 21st Century. Its programme will aim to reflect the needs and interests of its delegates:- decision makers, researchers, teacher trainers, industrial trainers, university professors, teachers, information and communication specialists, and technologists and system designers interested in the application of NITs in education and training. The programme at times is divided, for convenience, into three commissions, running in parallel. *Commission I* will reflect trends and experiences in the introduction and use of NITs in educational and training systems. *Commission II* will be concerned with the latest developments in NITs and their application in education and training. *Commission III* will be concerned with policies for and co-operation in the use of NITs in education and training. While it is envisaged that the first commission will be of particular interest to teaching/training practitioners, the second to technologists and developers, and the third to decision makers, participants will be free to choose which commissions they attend each day.

THEMES OF THE SECOND INTERNATIONAL CONGRESS

The Congress is organised around six major themes that will provide a framework for focusing the discussions of important issues related to the application of NITs in education and training. The outputs from the theme-related discussions will be used by the Congress to produce a general declaration, develop recommendations to UNESCO and its Member States, and formulate proposals for regional and international co-operation.

THEME 1: LEARNERS

The shift from the teacher as information dispenser towards the role of mentor, guide and manager of learning requires, in turn, more responsibility on the part learners in the learning process. Moves toward more constructivist and collaborative learning environments are resulting in changes in the role of students. These new environments require that the learners become more self-directed and take greater responsibility for their learning. Although this is more true in some cultures than in others, it is important to understand both the benefits as well as the stresses that result from the new learner roles. It is also important to understand better how technology may support or detract from these new roles.

Technology provides learners with an array of new tools and resources to facilitate cognitive activity. There are, however, wide variations in the type and level of access to technological tools by different groups of learners within educational systems. With limited resources, it is difficult for policy makers and educators to decide the level of technology access that should be provided to primary, secondary, vocational, and higher education, students. It is important to understand how change can be accomplished in educational institutions to allow learners to take advantage of the new options for learning (television, video, radio, the Internet, video-conferencing etc.) - from open classrooms to open universities and other forms of continuing education. In fact, lifelong learning is of increasing importance, also because of the significant changes taking place in the nature or work. While technology has reduced the need for certain jobs it has also created a number of jobs that require new knowledge and work skills. It has also changed the demands and skills needed for many existing occupations. To accommodate these changes individuals must continuously learn new skills and acquire new knowledge. NITs may help address this need in providing educational and training opportunities to adults through distance learning, open education and by providing learning opportunities in contexts other than schools and at times and places convenient to the learner.

Among the questions that may be addressed at the Congress are:

(a)*Learning Tools.* We all remember inspiring teachers who in some way influenced our lives. From the learners' viewpoint how can we be sure that new technologies do not impede this special process? In what ways can the curriculum become more than the old content delivered by new media? Can learning become too dependent on the computer? What would be the effects of this? How can the design of learning tools - the user interface, graphic presentation, readability - enhance equity of tool provision and use?

(b) *New Roles for the Learner.* What stresses do the new roles (having more responsibility for their own learning, the move towards a more constructivist learning and collaborative working) put onto learners? How do new technologies enhance or detract from these changes? Is it possible to maintain any equity between students who have access to technology on a regular basis and those who do not have this access? Is there any evidence indicating the learning roles which are most favoured by the learner and those which are most productive?

(c)*New Options for Learning.* How can change be accomplished in educational institutions to allow learners to take advantage of the new options for learning (television, video, radio, the Internet, video-conferencing etc.)? How can distance learning techniques best help the learner who cannot attend a traditional institution for learning? How does the learner make these choices, particularly at the post-secondary level? Is distance learning necessarily the second best option (compared with face-to-face learning)? What are the circumstances that make it the best option for the learner? How can we best make use of NITs for the education of the handicapped?

THEME 2: TEACHERS

13.The new information and communication technologies provide both new opportunities and challenges for teachers. The NITs can be used to serve as a catalyst to help change the role of teachers from information dispenser to that of guide, mentor, knowledge navigator, consultant and even co-learner with the student. They can also be used to support traditional teaching modes and practices. A critical variable in the effective use of the NITs is the knowledge and skill of the teacher in the application and integration of the technologies into instruction. Pre-service teacher education programmes are needed that not only prepare teachers to use the current generation of technologies but also to accommodate and even develop new technologies in the future. To accomplish this goal requires that the teacher preparation institutions provide adequate student and faculty access to the technologies. In order that they can model the use and integrate technologies

into the pre-service curriculum, the faculty must also be provided with training and support. A critical need also exists to enhance the technology skills of existing teachers. In-service professional development programmes are needed to provide technology training opportunities and technical support. Improved programme documentation, teacher-oriented computer-based programmes and the new distance learning technologies may assist in this effort. Without effective teacher training, investments in technology will bear little fruit.

Among the teacher-related issues and questions to be addressed in the Congress are:

(a)*Current Practice with New Technologies.* What makes for successful teaching using new technologies? How is this success gauged? What characterises a successful teacher's use of NITs? Does particular software use seem to promote success? Are the characteristics for successful teaching with new technologies the same in all sectors of education - primary, secondary, higher, vocational and informal adult teaching? Is the use of film, television and radio in teaching strategies less valued when computers are introduced? If it is, should it be? How do we best teach information skills to students? Information overload results from the unlimited access to information that new technologies can bring the learner. How do we teach selection, indexing, alternative presentations and evaluation of information? Since access to information is at the root of much of what is being discussed, how can efforts in this area be co-ordinated and how can standards be arrived at?

(b)*Teacher Training: Pre- and In-service.* How are teachers best being prepared (pre-service) and supported (in-service) to use new technologies in their teaching roles? How are they best supported technically? Can ongoing professional support, for example by Telematics, be incorporated into overall policy and funding for teacher education? How will a remote trainer, providing training through Telematics be able to match the policy, provision and support available locally?

(c)*New Roles for Teachers.* The role of the teacher is said to be shifting from that of an instructor to that of an organiser and guide. Do new technologies hinder or support this shift? Is this movement the same in all sectors of education and training? To what extent does culture shape this expectation of change in the teachers' roles? What are the stresses that the teacher must confront with regard to these new roles?

THEME 3: TECHNOLOGIES

The new information technologies are evolving very quickly. Since the First Congress of 1989 remarkable progress has been made in the development of informatics and communications technologies and their use in education and training. We have seen the development of several generations of increasingly more powerful educational hardware and software at lower cost. We have also seen the rapid and largely unforeseen development of global networking. For example, the Internet has grown so rapidly that there are thousands of databases and information resources available on a global basis, and an array of new navigation and search tools to help users find needed information. The rate of development of NITs has continued to accelerate each year. There is a general trend to use technology to accommodate better the individual needs of users. Translated into an educational perspective, this trend refers to the use of NITs in order to support further individualisation, differentiation and user (learner and teacher) control. This trend must, however, be embedded in a pedagogical approach which should focus on the improvement in the involvement of the main actors in the teaching-learning process (learners and teachers), and the integration of the enormous range of information gathering possibilities and communications with peers, through the use of Telematics, into the curriculum.

The expanding use of computer-related technologies in education has focused increased attention on the most appropriate ways of assessing the impact of NITs on learning. Although traditional assessment methods and criteria will continue to be used, new assessment models and methods are being developed to understand better the effects of the new technology-based tools and environments for cognitive activities.

In exploring both current and emerging trends, some of the questions that must be asked are:

(a)*Computer Science, Computer Enhanced Instruction and "Traditional" Educational Technologies.* What sort of students need to learn *about* the technologies (as opposed to *with* the technologies) at the various stages of education? How are software and hardware changing? Does the CD-ROM, for example, change how we teach? What is the place of educational television? How can we make television more interactive? To what extent is research on artificial intelligence and intelligent tutoring systems contributing to learning and instruction? Do the models of the learning process apply universally? Are there decision points for policy makers?

(b)*Multimedia.* We need to examine what is now possible in multimedia and gauge what contributions multimedia makes/could make to the educational process. The analysis of cost v. educational gain needs to be considered. Is this simply a technology enriching what would otherwise be delivered by traditional teaching methods, or does it add a new dimension and new possibilities to the educational process? Is there an equity issue? How can more expensive equipment be made available with best results? (The following strategies might be considered: centres visited by students; mobile equipment e.g. computer bus classrooms; or equipment only in experimental or "magnet", schools.)

(c)*Telematics.* Communications on, for example, the Internet can bring the work of an expert or a rare information resource to a widely dispersed set of students comparatively cheaply. Telematics has given rise to new international curriculum projects which have, incidentally, brought students from different countries together to work on projects. However, the telephone is still a rare and often a costly resource, even in the world's richest countries. Is there a primary focus for Telematics investment

(high school students? students in higher education? handicapped students? teachers in-service? adult learners?) ? How can technologies such as packet-radio and satellite transmission economically compensate for poor terrestrial networks? As all jobs change and the requirements for employment in them change, there is an ever increasing need for retraining. This life-long learning is becoming heavily reliant on new technologies and bringing with it new challenges to the traditional educational system. To what extent can mechanisms be put in place to share the expertise needed to produce this training, even between commercial rivals and different countries?

THEME 4: SOCIAL, ECONOMIC AND CULTURAL ISSUES

It seems evident that the current developments in NITs have and will continue to have a strong impact not only on education but on social, economic and cultural development in general. The concern which has already been expressed about the growing gap between developed and developing countries in their ability to access and use information technology is here accompanied by another concern, emanating from the fact that the new technologies are emerging primarily from the developed world. The content and form of the messages they carry typically reflect the cultural values, methodology and interests of that world. There is the danger that the technologies, for all their worth, may result in the homogenisation and loss of culture and language among many peoples of the world. For example, media such as television, radio and films have resulted in massive and continuous exposure of peoples to the language, cultural values and information of other cultures with few opportunities for reinforcement of their own heritage. The expansion of the Internet and other internationally accessible communication networks tend to stress generality at the expense of specificity, adding to the concern about the loss of native culture. Many of its essential aspects including language, folklore, oral histories, traditions, and food may be lost in the flood tide of Western and other dominant cultures.

In addition, there is a lack of culturally appropriate educational resources in schools serving some students. Western culture curriculum and instructional methods often fail to support or reinforce other cultural values, history and knowledge. Consequently, for many children, education has sometimes meant alienation from their cultural identity. There is a critical need for appropriate cultural materials to infuse and integrate into existing instructional programmes and to create new instructional programmes to better serve all peoples.

Technology now provides powerful and easy to use tools to enable communities to develop their own culturally appropriate curriculum resources. In addition, through multimedia databases, telecommunications networks, television and radio, it is possible to provide wide access to such materials and information. The proliferation of digital electronic libraries and the complex webs and links between nodes and layers of information is having an impact on society. Materials (for good or bad) in digital form that reside in any one place are now available globally and can be accessed 24 hours a day. This has an impact on economic, medical, social and educational structures.

The developments in NITs have dramatically reduced the size of the world. Local events have suddenly become global events in which it is possible to be psychologically and emotionally present while being physically far away. Technology has delivered a potential means for the promotion of peace and international understanding but also for disinformation and propaganda. It is at the cross-roads of these two possible options that education has to stand in its quest for peace.

Among the questions that may be addressed at the Congress are:

(a)*Economic Issues*. All national policies for the introduction and support of new technologies are tempered by the availability of funding. The amount of the available budget for education which is spent on new technologies is often more dependent on the advocacy of the enthusiast than on data. This is in part because of the paucity of data. This can be true at all levels of decision making from the national to the institutional. Practitioners at the institutional level complain of the lack of any long term planning for the financial support for new developments. New plans are adopted but have to be abandoned for want of continued financing. The time it takes to get results from a change of methods is not always appreciated by policy makers, and practitioners are often slow to produce evidence on which policy can be made. What ways are there to ensure that finance provided for change doesn't get wasted? How can technology support lifelong learning in different economic and socio-cultural scenarios?

(b)*Social and Cross Cultural Issues*. Are new technologies increasing or decreasing inequities among groups in society? Can the effects of national wealth, language, gender and culture be overcome through the use of technology in striving to provide some equality of educational opportunity worldwide? Are new technologies further advantaging the more elite educational institutions? To what extent should a global aspect of learning be limited by local political decisions? How can the development of appropriate resources be fostered in order to, at least, protect and, at best, reinforce native cultures.

(c)Peace and International Understanding. Are the new technologies *per se* contributing to peace and international understanding? What may be some of their positive and negative effects? What is the long-term effect of the Internet, and, specifically, electronic mail and bulletin boards? How should international agencies make use of NITs to promote their programmes for peace and international understanding?

THEME 5: EDUCATIONAL POLICIES

As the use of NITs in education is a matter of societal, cultural and financial choice, the issue is central to the concern of governments and their decision makers. Within the limits of delegated institutional autonomy, it can be an issue at every level of education and training. Yet the formulation of the respective policies for the utilisation of NITs is rarely based on the same criteria in developed and developing countries. The financial constraints faced by the developed countries bear no comparison with those of the developing countries which often cannot afford to set up an adequate infrastructure necessary for the successful use of NITs in education. Therefore, the technology is determined by the scarcity of resources which limits the options available to the policy makers.

In formulating educational policy related to the implementation of NITs, policy-makers are challenged by questions about the appropriate role and function of technology within the context of their educational system. Some view technology as a necessary component of a quality educational experience and have had curricula redesigned to provide students with technology-related skills and knowledge needed for the next century. Others are more interested in how technology may increase the productivity, efficiency and effectiveness of their educational systems, or they emphasise the use of technology for extra or external school activities such as radio, television and tele-learning. And still others emphasise the use of technology as a catalyst to help transform the learning environments within the school.

Whatever the national choices concerning the use of NITs in education may be, it appears evident that the matter does not deal only with technology but also with the question as to how knowledge and information will be accessed in the future. As the teacher is increasingly being transformed into a mentor, guide and manager of learning, his or her previous role as the information dispenser is being taken over by technology. How to ensure a pedagogically successful interaction between the two is the aim - not the promotion of technology *per se.* The mere fact that technology exists is, in itself, no sufficient reason for governments to invest in it. This is a central issue of educational policies.

The Congress will examine these technology-related policy issues and address questions such as:

(a) *Developing National Plans and Policies.* To what extent is it possible to learn from other countries successes and failures in designing national policies for the introduction and support of new technologies in education? Can/should policies be developed for more than one sector of education at a time? How can the success of individual centrally initiated policies be determined in the light of learner performance. teacher performance, and cost benefit? How can each successive layer of education - school, college, employment training - be made to be responsive to what has gone on before? What ways tend to ensure this continuity of practice? In what ways can central administration facilitate a liaison between employers, the community and students to the benefit of each group and the nation?

(b)*Strategies to Bring about Change at Institutional Level.* How do central decisions alter what goes on at institutional level? To what extent can institutions learn from each other? To what extent does the uncertainty of funding lead to poor decision- making? Are there ways in which central policy can still allow institutional autonomy? Are the issues the same for training as for education? To what extent can there be/should there be policies in place to promote equity between institutions? How can training and support be promoted nationally, regionally, and at institutional level so that, for example, the training does not create a demand for technology that cannot be realised? Are there examples that we can share of policies that allow for the support for individuals and institutions to change? Do NITs themselves help in this?

(c)*Strategies for a Future-Proofed Curriculum.* To what extent can any curriculum or examination systems remain independent of the new technologies as they develop? For example, the development of telephone-related technologies, like the Internet, have changed the way students *could* search for information, and the computer has enabled a widening variety of ways through which they could present this information. These changes make it possible to change the curriculum as more skills are made accessible. Should we be making decisions that accommodate these ever changing scenes? If so, how? How can we design strategies that allow for periodic updating of equipment, curriculum, teachers and the community? How can decision-makers stay informed in order to be able to make these decisions with confidence? After more than a decade of computer-related technologies in education (and considerably longer with broadcast technologies), increasing attention is being given to their impact on learning and other aspects of educational productivity. How can the impact of new technologies on learning be measured in terms of educational benefits, efficiency and effectiveness so that public calls for accountability are satisfied? Can this research have any universal relevance? How can we help each other to have the data necessary on which we can each build our policies?

THEME 6: INTERNATIONAL CO-OPERATION

The rapid development of NITs has not only created unforeseen opportunity for global communications but also has made it more necessary than ever before. As everything is linked to everything else, fewer and fewer activities can be done alone. Isolation and information are internally contradictory. It is the new interconnectedness of everything that presupposes international co-operation which then has to be viewed in the broad context of what the

international community together, rather than this or that country alone, can accomplish in a field that is of existential importance to humankind.

In the promotion of NITs for education, UNESCO assumes an internationally important position. In its present Medium-Term Strategy for 1996-2001 (28 C/4) and the Approved Programme and Budget for 1996-1997 (28 C/5), specific actions are included to address the issue of information and communication technologies. The approach combines reflection and action and seeks to respond to two major concerns, namely, to reflect on the impact of the new technologies and to foster their appropriate use in the Organisation's sphere of action. More specifically, UNESCO's Major Programme IV "Communication, Information and Informatics" reflects the increasing convergence of communication, information and informatics by extending the principle of "free flow" to all forms of information that contribute to the progress of societies and by adopting an integrated approach to capacity-building for development through these three areas. The role of UNESCO's General Information Programme (PGI) and its Intergovernmental Council focuses on the challenge of the information technology revolution, taking into account, for example, new possibilities in the application of information technologies in libraries and archives ("virtual" libraries and archives). The Intergovernmental Informatics Programme (IIP), on the other hand, focuses on the application of information technology particularly in supporting the new generation of information systems and services in its programme and activities. Specific activities and projects are carried out also in other Major Programmes, as well as in the transdisciplinary projects. These include, in particular, the use of technologies for extending access to lifelong education for all (Major Programme I), fostering wider access to information or facilitating exchanges and transfer of knowledge and experience (Major Programme II).

Closely linked to these activities are those relating to the adaptation of copyright to the new technological environment, the protection of new categories of works and the encouragement of electronic cultural industries in developing countries with a view to protecting cultural diversity (Major Programme III). UNESCO, which traditionally has a specific and important world role with regard to copyright, recently organized an international symposium on "Copyright and Communication in the Information Society" (Madrid, March 1996). Undoubtedly, copyright rules have a tendency to lag behind progress in the field of technology as NITs could allow very easy copyright breaking of items stored in digital form down the "information superhighway". While there is a need to draw the attention of policy-makers and educators to the copyright of authors whose materials are used for education and training purposes, attention should also be drawn to the need for easy access to both national and foreign educational networks.

The expanding role of NITs in education systems suggests a more intensive cooperation with the producers of both hardware and software, including international companies, especially publishers and computer and media companies. It is important that educators' and trainers' voices can be heard by these companies, but there needs to be an international channel through which these voices can be routed. UNESCO might be considered to be the right "honest broker" to establish this dialogue.

Among the questions related to international co-operation and UNESCO's role in it are:

(a)*UNESCO's Catalyst Role.* What role should UNESCO play, in collaboration with other agencies of the UN system, intergovernmental and nongovernmental organisations, professional associations, private industry and others, to facilitate the sharing of available resources and expertise to strengthen the use of new technologies in education and training, especially in developing countries? In what way can international agencies and programmes support national initiatives and what are the most promising sorts of collaborations that may help support the formulation of better policy-making related to NITs? What specific recommendations should be made to UNESCO and its Member States to ensure that maximum benefit be derived from the use of the new information technologies in education and training? What priorities should be established for UNESCO's strategies in this field? What mechanisms of co-operation should be followed at the international and regional level? What specific global projects could be proposed for UNESCO to foster?

(b)*Information and Copyright Issues.* What are the most effective strategies for increasing the exchange of information and data on the use of informatics in education? How can intellectual property be safeguarded and yet be made widely available? With the complexity of "cyberspace", to what extent is it possible to check up on practice? To what extent and in what ways can education be effective in regulating and /or educating the practice of its staff and students with regard to the intellectual property of others?

(c)*UNESCO's Role as Go-between.* What patterns of co-operation can be suggested for education and industry? Should UNESCO convene meetings between industry and education? What outcomes could be envisaged? What specific co-operation could be imagined with the potential partners: large software development houses, system integrators and hardware manufacturers? What recommendations should be made to ensure continuing dialogue? How should UNESCO best make these (and any other) discussions accessible to everyone who might be interested?

SUMMARY

Advances in information and communication technologies have in recent years resulted in challenging innovations, including a convergence with other technologies, which are providing a very powerful sets of tools to allow individuals and institutions access to other communities, to information, to learning, to scarce resources of expertise and to sharing of ideas and knowledge. The new information technologies have had global impact in shaping the "information society". They have transformed business, industry, government, science, medicine and other sectors of global society. Indeed, they provide exciting new opportunities as well as challenges to the educational systems of the world.

However, inequity in access to information and communication technologies among countries remains a serious problem. Because of their cost and because of the built-in dominance of the culture of the nations mainly developing NITs (not least because of the dominance of the English language in the new media), there is a growing gap between the ability of developing and developed countries to have access to the technologies. Such a gap exists also within several developed countries, with a potential consequence of generating a new type of class society based on an unequal distribution of information.

The very fact that the technology is changing so fast is a disincentive to decision makers. Technology gets out-of-date so quickly that it never seems the right time to make a policy to purchase, and this can become an excuse for inaction. There is also, to many, the disincentive of the dominance of foreign culture, language and values. The technology is not itself essential but its interaction with learning and its role within the context of the overall educational system. This calls for respective educational policies and plans for the introduction and use of communication technologies in education.

Among the most central aspects present in educational policies, often inextricably interlinked, are: Learners, Teachers, Technologies, Policies, Economic, Social and Cultural Issues, and International Co-operation. UNESCO is pleased to invite the distinguished participants of the Second International Congress on Education and Informatics to explore these and other related themes, in view of recommendations to UNESCO and its Member States, and proposals for regional and international co-operation in the field of education and informatics. As tomorrow's progress is based on today's action, the 21st Century has virtually begun.

INVITATION

OF THE DIRECTOR-GENERAL OF UNESCO

Sir/Madam,

I have the honour to inform you that, in accordance with resolution 1.18 adopted by the General Conference at its twenty-seventh session (October-November 1993), UNESCO, in cooperation with the Government of the Russian Federation, is organizing the ***Second International Congress on Education and Informatics (EI'96):*** *Educational Policies and New Technologies, which will be held in Moscow from I to 5 July 1996.*

The first Congress, which took place in 1989 at UNESCO Headquarters in Paris, stressed the need to 'benefit from collective experience and the sharing of scarce resources in the field of new information technologies (NITs) in education' and, to this effect, recommended that international co-operation in this field be strengthened.

Today, co-operation is needed more than ever before. In recent years, remarkable development has taken place in information and communication technologies, whereby each succeeding generation of hardware and software has rapidly given rise to significant innovations and opportunities for convergence with other technologies. Unforeseen media combinations of global dimensions have emerged to shape the "information society" and to challenge those living in it. In the midst of the phenomenon of "information superhighways", education itself is challenged to critically re-examine its position in view of the fact that technologies tend to develop faster than education's capacity to make use of them.

The Congress, which offers an international forum to discuss the future of education and informatics, will analyse national, regional and international trends and experiences in the introduction and use of NITs in educational systems; review the latest developments in NITs and examine their application in education; discuss international, regional and national policies for the use of NITs in education; and make recommendations for international co-operation.

The Congress, which will pursue the above objectives through six central themes: Policies; Technologies; Teachers; Learners; Economic, Social and Cultural issues; and Transverse Themes, calls for broad international co-operation in order to reflect the variety of needs and aspirations of Member States in this increasingly challenging field.

I should be pleased if your Government would suggest names of individuals or institutions to whom invitations could be sent and to contribute to the preparation of the Congress as detailed in the Annex.

In conformity with the regulations for international congresses, the participants and observers are expected to cover their travel and accommodation expenses.

Accept, Sir/Madam, the assurances of my highest consideration.

FEDERICO MAYOR

DIRECTOR-GENERAL

DECLARATION

OF THE 2nd UNESCO INTERNATIONAL CONGRESS

EDUCATION AND INFORMATICS

EDUCATIONAL POLICIES and NEW TECHNOLOGIES

We, the participants of the Second International Congress *"Education and Informatics: Educational Policies and New Technologies"* convened by UNESCO, in collaboration with the Russian Federation, in Moscow from 1 to 5 July 1996,

Referring

to the Recommendations of the first International Congress *"Education and Informatics"* of 1989,

Aware

of the rapid development thereafter in information and communication technologies (ICTs) and in their education application in particular,

Recognizing

the great potential that ICTs possess at the service of education, science, culture, peace and international understanding,

Concerned

by the possible manifestations of misuse of ICTs for disinformation and propaganda, the potential threat to culture and languages, and the overburden of information,

Cognizant

of the increasing responsibility of the Member States, intergovernmental and nongovernmental organizations and others concerned with the development of national, regional and international information infrastructures to enable all peoples of the world to benefit from ICTs,

Addressing

the needs of developing countries in order to bridge the gap between them and developed countries,

Considering

that ICTs are emerging primarily from the industrialized world carrying messages of its content and form, accelerating the further homogenization and loss of culture and language among many peoples of the world,

Recognizing

the mutual benefit of closer co-operation between education and industry, including hardware and software producers and companies delivering telecommunications systems,

Therefore,

declare our commitment to the effective use of ICTs to improve educational practice, to strengthen communication among nations and individuals, to help promote peace and international understanding and to foster international co-operation in a field of such essential importance to the future of humankind.

We, the participants of the Congress, in the above spirit and with reference to the recommendations here below, appeal to:

governments, educational authorities, business and industry, to strengthen their joint efforts in this

field seeking new patterns of co-operation to ensure the availability of adequate ICTs at all levels of education for the ultimate benefit of learners within the framework of lifelong learning for all;

UNESCO and other agencies of the United Nations System, including the United Nations Development Programme, the International Labour Organisation, the World Bank, regional development banks and others concerned, to extend their support to the introduction and application of ICTs in education, notably to the benefit of developing countries.

RECOMMENDATIONS

OF THE 2nd UNESCO INTERNATIONAL CONGRESS

EDUCATION AND INFORMATICS

EDUCATIONAL POLICIES and NEW TECHNOLOGIES

THEME 1:

LEARNERS

UNESCO should make available, via the Internet and other suitable distribution channels, existing high quality case studies and research on the use of Information and Communication Technologies (ICTs) in teaching and learning for all populations (primary, secondary, higher education, adult education, vocational education and special education) and, where it exists, provide evidence of most favoured and most productive examples. The needs of the hearing impaired should be especially considered.

Where there are critical research gaps, UNESCO should encourage (or even commission), research from Member States to produce evidence, with examples drawn from a cultural sample as wide as possible. Pilot projects should be set up in order to test new teaching/learning philosophies using ICTs in education. The studies should not only investigate the delivery of the old curricula through ICTs but also new curricula which the availability of ICTs has enabled.

UNESCO should investigate new evaluation and assessment paradigms to better reflect the cognitive learning processes and skills resulting from the effective application of ICTs. Researchers should be encouraged to compare learning achieved by traditional pedagogy, by an ICT-enriched pedagogy and by an ICT-based pedagogy.

Museums, broadcasting and media institutions, archive collections should be encouraged to make their collections widely accessible to the community (especially to teachers and learners) through the use of the Internet.

Specific skills are required by the learner and teacher to effectively use Distance Education. UNESCO should encourage international co-operation in creating and disseminating programmes that assist in the proficient use of Distance Education.

THEME 2:

TEACHERS

National and international agencies should support the dissemination, by appropriate means, of successful strategies and best practices of teachers' and trainers' use of ICTs. Teachers and their professional associations should be encouraged to involve themselves in the process of change to revalidate their roles and to master ICTs. The development of ICTs must not be left to the commercial and industrial world alone but be developed in co-operation with it.

Research data should be collected (and frequently updated) on the changes in the role of the teacher from an instructor to a guide and mentor. UNESCO should encourage the inclusion into on-line data bases of research data collected in developing countries. UNESCO should make links to these data bases from its sites in the World Wide Web.

UNESCO should collaborate with other agencies to set up models of in-service training and professional development for teachers and trainers which make effective use of the approaches, facilities and opportunities provided by the use of technology, including telecommunications. In particular, UNESCO should encourage the organization of workshops and seminars in developing countries, such as the ones using the UNESCO/International Federation for Information Processing (IFIP) document on *"Informatics for Secondary Education"*.

UNESCO should explore the possibility of linking regional telematic centres world-wide to cover topics such as the use of multi-media, training of trainers, management techniques, instructional

design, pedagogical innovation, etc. and should endeavour to incorporate into such an initiative priority pilot projects, e.g. telematic development centres in Africa.

THEME 3:

TECHNOLOGIES

Policy-makers in Member States at all levels should set up working parties to consider priorities in the provision of technology for education and training, appropriate to the resources and infrastructure within Member States. Member States should consider lodging copies of reports on the strategies they are adopting or considering with UNESCO for it to make these available to help worldwide debate.

UNESCO should look into the possibility of setting up a forum on the Internet in which practitioners report on their use and on their opinions as to the value of emerging technologies in the educative process.

UNESCO is urged to consider co-operating with concerned nongovernmental organizations and professional associations such as IFIP in order to stimulate research on the improvement of computer interfaces for learning, particularly in teacher training and primary and secondary education.

The International Standards Organization, or such an appropriate body, should be invited to review, simplify and update the terminology in the area of new technology, in association with educational experts.

Governments of Member States are encouraged to urge their telephone and communication companies to consider the establishment of appropriate links to educational institutions, either free of charge or at discount rates.

Member States and UNESCO should consider supporting and facilitating the sharing of interactive television technology practices and output between countries.

THEME 4:

SOCIAL, ECONOMIC AND CULTURAL ISSUES

UNESCO should encourage Member States to share their ICT funding strategies and to consider publishing a selection of these where there are elements in the plans that could be of use to other States.

UNESCO should encourage the research community in Member States to address issues such as the value of ICTs in the pursuit of peace and international understanding, in reinforcing or protecting native cultures and in providing educational opportunity worldwide. UNESCO should use its offices as a clearing house for the publicity and dissemination of these research ideas.

It is recommended that Member States develop regional co-operation to encourage the pooling of experiences in the use of ICTs, acquired in comparable environments, in order to avoid the repetition of mistakes and the wastage of time and scarce financial resources. Telecommunications could assist this co-operation.

UNESCO, in co-operation with the World Health Organization, should consider re-assessing the effects of ICTs on the health and behaviour of children and students and disseminate the results and any recommendations to teachers, programme designers, students and the community at large.

THEME 5:

EDUCATIONAL POLICIES

It is strongly recommended that national governments plan and start evaluation programmes on the implementation of ICTs in their educational systems if they are not already doing so. UNESCO should act as a collector and disseminator of this information.

Case studies should be collected on successful techniques for implementing institutional change using ICTs and on their impact, both positive and negative, on changing existing curricula. UNESCO should disseminate these case studies. A comprehensive and systematic study of the causes and consequences of changes on society and learning systems (brought about by the introduction of ICTs in education and training) is needed. Special emphasis should be put on the interdependency of change factors in this area and their impact on strategic planning and policy.

UNESCO should encourage Member States to upgrade their ICT specialists by further education in their own or other countries, by the use of international consultants and/or by distance learning. UNESCO should facilitate this where possible.

UNESCO and Member States are asked to encourage national and international funding institutions to pay due attention to the potential of information and communication technologies as tools to improve educational access and opportunities, particularly for unreached communities and children with special needs.

Member States, who have not already done so, should be encouraged to formulate a national strategic plan for the introduction of information technology into their educational systems. This plan should take account of social, cultural and economic conditions.

It is recommended that UNESCO considers commissioning IFIP, established by UNESCO, to prepare a report on *"Information and Communication Technologies in Education"*. Although the report should cover the widest spectrum of policies, it should also specifically address the needs of developing countries.

Member States are asked to consider looking into ways in which business and industry can work co-operatively with education in order to enhance the teaching/learning environment. UNESCO might consider it appropriate to offer its services as an honest broker to facilitate this process.

In line with the recommendation in the report

"Learning: The Treasure Within" 1996, UNESCO is encouraged, with an eye to the future, to set up an observatory to look into new information technologies, their evolution and their foreseeable impact not only on education systems but also on modern societies.

UNESCO is encouraged to continue its work in copyright concerning the new technologies, working towards international standards of law and practice. Member States are urged to bring forcefully to the attention of their educational communities the illegality of malpractice and piracy.

THEME 6:

INTERNATIONAL CO-OPERATION

UNESCO should examine the possibility of convening a follow-up meeting soon after the Congress, inviting the collaboration of representatives of other agencies of the UN system, relevant intergovernmental and nongovernmental organizations, professional associations, private industry and any other appropriate individuals or bodies, to decide on the priority to be given to each recommendation made by the Congress and to identify responsibility for its implementation. UNESCO is urged to give some priority in its ITC programme to countries in transition and to developing countries, such as those in Central and Eastern Europe, the Palestine Authority and South Africa.

UNESCO should consider one or two major worldwide projects involving ICTs to directly meet the needs of Member States, e.g. *"A Global Network for Tele-training for Teachers"* and *"A UNESCO Institute on Educational Policy and NITs"* (see Annex), to be implemented in collaboration with appropriate partners.

A priority need expressed frequently during the Congress has been for the collection and dissemination of data on best practice. This could usefully include a bank of exemplary test items, case studies, curricular materials and accounts of implementation techniques. UNESCO is asked to consider establishing such a collection, accessed by way of the Internet.

Being aware of the urgent need to support schools in developing countries, the Congress urges Member States to initiate programmes which twin their schools with those in severe need in order to assist them in the acquisition and use of ICTs and to promote cultural exchanges and mutual understanding.

PROPOSALS FOR POSSIBLE UNESCO PROJECTS

UNESCO GLOBAL PROJECT:

"A GLOBAL NETWORK FOR TELE-TRAINING FOR TEACHERS

The proposal indicates plans for a Global Teachers Network Service Organization (GTNSO) which would provide a platform for the design, development and distribution of courses relating to technology in education for teachers throughout the world. The courses, as well as other communication and information services, would be made available via the Internet.

With rapid advances in technology, it is difficult for the existing systems of teachers training and in-service to stay up-to-date in terms of the implications of innovations in teaching and practice. Awareness and experience with the use of new technologies in teaching and learning are not yet found in all teacher education systems.

These new communication and information technologies provide opportunities for a worldwide community of experts to be brought together with teachers through a global project that facilitates the provision of quality courses and resources for teachers through a common service organization. This proposal defining such an organization is based on UNESCO's unique international network of scientific experts and national contacts such as Ministries of Education. A special benefit of such a service organization is that it can not only service existing institutes of teacher education and in-service but also the teacher's emerging needs for lifelong training.

A special feature of this proposal, in addition to the unique human, professional network on which the Network Service Organization can be built, is the provision of "authoring templates" for course materials. Course providers in countries throughout the world can provide course content, in their language of choice, and the content can be fitted into various templates for hyper linked, multimedia distributed access. Currently these templates make use of World Wide Web technologies.

Another strength of the proposal is the collection and availability of examples of models of good practice, involving new technologies and new didactics in the classroom. These models will come from a wide range of cultural settings, and will be eventually expressed in a range of languages as well as media, so that teachers can see, hear, or read about classroom applications of new

technologies and student work developed from those applications.

The proposal is connected with a number of projects already attempting to use network technologies to bring networked services to teachers. At the same time the Project should benefit from the results of all R&D projects on national and transnational levels in which UNESCO is directly or indirectly involved (for example, the Russian DESCOP - Distance Education in New Information Medium, and others).

These are the arguments for presenting this proposal to the UNESCO Congress participants and to the Director-General of UNESCO. We hope that the Member States will support the proposal and include the Project into the final document.

2. A UNESCO INSTITUTE ON EDUCATION POLICY AND NEW INFORMATION TECHNOLOGIES

Proceeding from the recommendations worked out by international forums held under the UN auspices as regards the implementation by all Member States concerned of coordinated actions with the purpose of defining the community's policy and types of activity for the sake of humankind's steady development,

Basing on the fact that education policy should embrace postulates included in the recommendations of the International Commission on Education for the Twenty-first Century: learning to know; learning to do; learning to live together, learning to live with others; learning to be,

Recognizing that education technologies must create an environment allowing colleges and other academic, scientific and vocational training establishments to perform a critical role in the sphere of developing and accomplishing the strategy and policy of development,

Bearing in mind the necessity of applying new information technologies to education purposes for deriving advantages from a collective know-how, as well as a joint utilization of limited resources,

Participants of the Congress deem it essential to endorse the initiative to establish in Moscow a UNESCO Institute on educational policy and new information technologies with the object of working out a model of global lifelong education for all and everybody,

Recognizing that its activity will foster the elaboration, professional estimation, selection and worldwide dissemination of prospective education and information technologies, as well as updated means of communication.

FINAL REPORT

OF UNESCO

"EDUCATION AND INFORMATICS "

FOREWORD

The purpose of the present Report is to give a comprehensive and accurate presentation of the work and outcome of the meeting. Its contents are mainly fact-oriented.

The lines below are meant to bring into the limelight the people and institutions or organizations whose unflagging support, dedication and energy have paved the way for its successful preparation and organization.

It is due to the active and generous support received from the Russian Government, both in financial and technical terms, and the assistance offered by several sponsors, that the Congress was able to reach its objectives.

I would like take this opportunity to thank all members of the International Programme Committee for their high intellectual contribution to the preparation of the Congress programme. Their continuous commitment and enthusiasm were essential to its success.

Equally important was the intellectual and financial contribution made by the Children in an Information Age Programme, headed by Academician Blagovest Sendov, Dr. Ivan Stanchev (Bulgaria); Directorate-General XIII of the European Commission; The University of Twente, The Netherlands (Professors Jef Moonen and Betty Collis); the International Federation for Information Processing (Dr. Peter Bollerslev); the International Conference on Technology and Education (Mrs. Sylvia Charp, Mr. John Foster); and the University of Texas at Austin, USA (Professors Michael Thomas and Paul Resta).

Tribute also should be paid to the almost 100 Russian leading specialists whose intellectual contribution and organizational efforts to the preparation of the Congress have won wide recognition. In this respect I would like to thank particularly Professor Vladimir Kinelev, Minister of Education of the Russian Federation, who chaired the Russian Organizing Committee and presided over the Congress, and his close collaborators from the Russian Organizing Committee: Professor Valeri Meskov, Acad. Yuri Ershov, Dr. Irina Smirnova, Professor Eduard Manushin, Mr. Konstantin Peev, to mention only a few.

Thanks are also due to Professor Viktor Sadovnichy, Rector of Lomonosov Moscow State University, to the academic staff and students of the University for the hospitality and excellent conditions offered to participants.

Last but not least a word of sincere gratitude to my colleagues for their advice, assistance and encouragement, particularly to Heimo Mäntynen, Marco A. R. Dias, Peter Herold and Mariana Pătru.

EVGUENI KHVILON
CONGRESS COORDINATOR

INTRODUCTION

ORGANIZATION, OBJECTIVES AND OUTCOME OF THE CONGRESS

In accordance with Resolution 1.18 of the twenty-seventh session of the General Conference (October-November 1993), UNESCO, in co-operation with the Russian Federation, organized the Second International Congress (Cat. IV) on ***Education and Informatics (EI'96) - Educational Policies and New Technologies*** in Moscow, from 1 to 5 July 1996. The Congress was hosted by Lomonosov Moscow State University.

The first Congress, held in Paris in 1989, had stressed the need *to benefit from collective experience and the sharing of scarce resources in the field of new information and communication technologies (ICTs) in education* and, to this effect, recommended that international co-operation be strengthened. The recent years have witnessed remarkable developments in information and communication technologies, whereby hardware and software generations have rapidly succeeded each other and, in a most innovative manner, converged with other technologies. Unforeseen media combinations have emerged to further shape the *information society* and to challenge those living in it. In the midst of the information superhighways, education is challenged to reexamine its position critically, especially since technologies seem to develop faster than education has the capacity to use them.

The Second Congress, which offered an international forum for the discussion of problems of immediate concern for all countries in the world, was intended to pursue the following objectives: (i) to *analyze* national, regional and international trends and experiences in the introduction and use of new information and communication technologies in educational systems; (ii) to *review* the latest developments in the field of new information and communication technologies and *examine* their application in education; (iii) to *discuss* international, regional and national policies for the use of these technologies in education; (iv) to *make recommendations* for inter-

naticnal co-operation.

At the end of its work, the Congress adopted a *Declaration* and *Recommendations* addressed to Member States and to the Director-General of UNESCO, as well as proposals for international co-operation and specific major projects in the field, notably to the benefit of developing countries.

As common for international congresses of Category IV, UNESCO invited Member States, international governmental and nongovernmental organizations, other UN specialized agencies, professional associations as well as private companies active in the field of introduction and application of new information and communication technologies in education to designate participants and observers in their personal capacity. Participants and observers included ministers, members of parliament, decision-makers, teachers, researchers, students, software and hardware developers, representing seventy-one countries and nine international governmental and nongovernmental organizations. Given the big interest called by this important event, a considerable number of Russian participants and observers attended the Congress.

BACKGROUND DATA AND PREPARATION OF THE CONGRESS

In order to ensure a good preparation of the Congress, UNESCO set up an International Programme Committee (IPC), which included academicians, presidents of universities, researchers and experts, representing all regions of the world. Academician Yuri L. Ershov (Russian Federation) and Professor Jef Moonen (The Netherlands) acted as IPC Co-Chairpersons. For the coordination of all preparatory activities and co-operation with UNESCO, the Government of the Russian Federation established a Russian Organizing Committee, consisting of ministers and rectors of leading Russian higher education institutions.

In order to identify the priorities and needs of Member States concerning the introduction and implementation of information and communication technologies in education, ten regional and sub-regional expert meetings/seminars were organized from 1994 to 1996 in preparation of the Congress. Four regional expert meetings were held in 1996 in: Austin (USA) for North and Latin American, as well as Caribbean countries; St. Petersburg and Vladivostok (Russian Federation) for Europe Region and Asia and Pacific countries, respectively; and Dakar (Senegal) for African countries. Six sub-regional meetings took place in Harare (Zimbabwe, 1993); Yalta (Ukraine, 1994); Enschede (The Netherlands, 1994); Sofia (Bulgaria, 1994); Moscow and Novosibirsk (Russian Federation, 1991, 1996).

Based on the proposals and recommendations put forward at the regional expert meetings, the International Programme Committee and UNESCO Secretariat elaborated and distributed a main working document and other reference documents which outlined the programme, the six major themes and the sub-themes to be examined at the Congress in the light of the objectives set.

PROGRAMME AND THEMES

In keeping with the established programme, the Congress conducted its work in plenary and commission sessions. Each Congress day began with a plenary session in which a keynote speaker made the main presentation on a major theme, followed by presentations and discussions in three commissions. Commission I focused its debates on *trends and experiences in the introduction and use of ICTs in educational systems*; Commission II, on the *latest developments in ICTs in education*; Commission III, on *co-operation for the use of ICTs in education*.

Six major themes were selected to address the needs of all those involved in the educational process at various levels. The first one dealt with *Learners* (learning tools, new roles for learners, new options for learning inside and outside educational institutions); the second was devoted to *Teachers* (current practices with new technologies, pre- and in-service teacher training new roles for teachers); the third theme focused on *Technologies* (computer science, computer-enhanced instruction and "traditional educational technologies, multimedia and telematics); the fourth theme dealt with *Social, Economic and Cultural Issues* (the role of ICTs in helping to ensure equal opportunities for the development of skills and knowledge; how the new learning and teaching methods, using the advantages of the already existing networks, can contribute to the overcoming of the social, economic and cultural barriers with reasonable and cost-effective solutions, negative and positive changes in the society under the pressure of the technology development); the fifth theme covered *Educational Policies* (developing national plans, strategies for change at institutional level, strategies for a future-proofed curriculum); and the sixth theme centred on *International Co-operation* (the needs for international co-operation in the human resource development area, the increasing role of UNESCO in promoting international co-operation in the field of open and distance education among interested partners).

The debates of the plenary sessions, which amounted to twenty hours in all, were daily broadcast via the Internet.

In addition to the plenary and commission sessions, twelve workshops were organized on the last two days of the Congress. More detailed information about the workshops is provided in para. 61 of the report.

In conjunction with the Congress an international trade fair (EDIT'96) was organized, in which 80 organizations, both Russian and foreign, participated (higher education institutions, research institutes developing educational software, etc.), as well as 15 leading computer companies, IBM, Apple, Novell, Oracle, Informix, to name only the most important. On display were the latest achievements in educational media and technology, telecommunications and information resources of global computer networks, general and special purpose computer equipment, broken down into ten categories: electronic educational media; telecommunications; distance education; general and vocational education; multimedia in education; information resources of higher education; expert and intellectual systems; simulation and computer-design systems; support of scientific and technological enterprise in higher education; and future technologies in higher education. The total trade fair space amounted to 1,000 square meters.

EXECUTIVE SUMMARY

OPENING CEREMONY

The opening ceremony was held on 1 July 1996 in the Grand Hall of Lomonosov Moscow State University. Mr. Vladimir G. Kinelev, Deputy Chairman of the Government of the Russian Federation and Chairman of the State Committee for Higher Education, welcomed participants and read out a message addressed to them on behalf of President Boris Eltsin.

Mr. Colin N. Power, Assistant Director-General for Education of UNESCO, addressed the audience welcoming participants on behalf of Mr. Federico Mayor, Director-General of UNESCO.

Mr. Kurt Bauknecht, President of the International Federation for Information Processing (IFIP), an organization affiliated to UNESCO, then took the floor.

The next speaker was Mr. Armando Rocha Trindade, President of the International Council for Distance Education (ICDE), also affiliated to UNESCO.

At the end of the opening ceremony Mr. Viktor A. Sadovnichy, Rector of Lomonosov Moscow State University, addressed the audience welcoming them and expressing confidence in the success of this high-level international forum.

OPENING PLENARY SESSION

According to item 2 of the provisional agenda, the Congress elected Mr. Vladimir G. Kinelev, Chairman of the State Committee for Higher Education of the Russian Federation, as President of the Congress by acclamation. After the adoption of the Rules of Procedure, the President of the Congress requested participants to approve the constitution of a Bureau.

A group was elected by acclamation to draft the Declaration and Recommendations of the Congress.

The President introduced the provisional agenda (ED-96/ICEI/1) which was adopted.

The opening plenary session began with the presentation of three keynote papers, the purpose of which was to explore the current trends and pedagogical issues in the application of new information and communication technologies throughout the world, to analyze their strong impact on social, economic and cultural development in general, and to examine policy and strategy issues related to the expansion of the access of millions of young people and adults to education through communication technologies, including open and distance education.

The first presentation, entitled "Education and Civilization", was made by Mr. Vladimir G. Kinelev, Chairman of the State Committee for Higher Education (Russian Federation), who emphasized the great responsibility incumbent on today's policy-makers, educators, scholars to foresee the development trends of ICTs and come up with appropriate solutions to overcome negative social, economic and cultural effects. He made a brief overview of the rapid changes which science and technology have made particularly over the past two centuries, stressing that education has become an issue of concern to a wide range of stakeholders: teachers, scholars, scientists, and decision-makers. He also pointed out that the new information and communication technologies have opened new opportunities for teachers and students alike, the creation of global networks facilitating the access to, and the dissemination of, knowledge and skills. He further stressed that today's educational system should be capable not only of equipping students with knowledge, but also with skills and habits which enable them to study independently throughout their lives. He concluded by saying that education for the 21st century should be education for all, providing equal opportunities for individual development.

In his speech on "New Perspectives for Learning in the Information Age", Mr. Colin N. Power, Assistant Director-General for Education of UNESCO, referred to the profound revolution which education is undergoing today, as profound as the invention of printing, and to the ways in which ICTs are transforming the perspectives of teaching and learning in all societies. He stressed that these technologies offer students the possibility of exploring domains of knowledge for themselves, of becoming genuinely active participants rather than passive recipients of knowledge dispensed by the teacher. The role of the teacher is also radically changing under the impact of ICTs, from that of a solitary information provider to that of a manager of class learning. He drew particular attention to the concern of UNESCO to ensure that the information revolution does not serve to widen the gap between the haves and the have-nots, between those who are and those who are not connected to the information superhighway, in other words between developed and developing countries. In this context he mentioned UNESCO's Major Programme IV ("Communication, Information and Informatics") of the Approved Programme and Budget for 1996-1997, which is focused on capacity-building in the developing countries in the field of communication, information and informatics, its International Programme for the Development of Communication, General Information Programme and Intergovernmental Informatics Programme. He pointed out that education is for UNESCO the single most effective means to curb population growth, eradicate poverty, reduce child mortality and foster democracy, peace and sustainable development. At the end of his speech, he mentioned the recommendation made to UNESCO by the International Commission on Education for the Twenty-first Century in its report, namely to create an 'observatory' to explore and ponder the likely impact of ICTs on human freedom and development and on educational and learning process in particular.

The opening plenary session ended with the speech given by Dr. Norio Matsumae, President of Tokai University (Japan), on "New Direction in Education". The paper focused mainly on the need to reevaluate educational values for the 21st century and the impact that changing technology or society have on education. The speaker's arguments focused on six principles: (i) the need to redefine human values starting from a reflection on the tradi-

tional concepts for the purpose of finding out the new direction in which education develops; (ii) the need to create a basic idea on the target of education with due consideration of Japan's postwar education; (iii) the complementarity of state and private educational institutions and their contribution to developing a sense of fair competition, as illustrated by the Japanese educational system; (iv) this fair competition has a positive impact on society from the perspective of the introduction of advanced information technologies: (v) the danger that advanced technologies pose to the preservation of traditional culture and values and the important role played by education in preventing undesired effects; (vi) the beneficial use of advanced information and communication technologies in higher education in the next century, including satellite-based distance education, and the role and responsibilities of universities in this new age.

THEME 1: LEARNERS

The first theme was introduced by two keynote speakers, Mr. Blagovest Sendov, President of Parliament (Bulgaria) and Mr. Tahar Hafaied, Director, Institut National de Bureautique et de Micro-Informatique (Tunisia).

In his keynote speech, entitled *In a Global Knowledge Space: Towards Global Wisdom*, Mr. Sendov drew attention to the challenges, both political and technological, that the world is confronted with on the threshold of the 21st century. The information society built upon global information networks offers new challenges to policy-makers, researchers, teachers and learners. He pointed out that the fact that the Congress was held in the European Year of Lifelong Learning was not accidental, on the contrary it reflects the concern of UNESCO and of the European Commission to ensure the conditions for the worldwide dissemination of a technology-driven educational reform. Such a reform would give learners all over the world unlimited access to information and locally available educational services, expertise and resources. However, in the speaker's opinion, ICTs should not be used to the detriment of cultural values, traditions, national identity. In this respect UNESCO is called upon to promote programmes aimed at preserving the cultural diversity in the world. One of the most important changes is the enormous information overload due to the low cost of multimedia information production and distribution and the diversity of distribution channels. This information overload could trigger off an information overskill problem, as the filtering of the great volume of information is very difficult to make and only a small amount of it can be transformed into usable knowledge. It is precisely in the selection of information that the role of teachers is most important. The speaker concluded that UNESCO, other UN specialized agencies, IGOs and NGOs, national governments should coordinate their efforts and launch programmes aimed at smoothing the transition to a communication and information technology-based education.

Mr. Hafaied developed in his speech, *Training in the Context of New Information and Communication Technologies*, some ideas touched on by the first speaker. He drew attention to the fact that the globalisation phenomenon in the application of new information and communication technologies brought about competitive strategies and instituted a new total quality management system in all sectors of activity. The new technologies have become decisive instruments in the development strategy of any country and the information infrastructure has a great impact on the management of most socio-economic activities. The training system (pre-, in-service or continuing) should better equip learners with the knowledge and skills necessary to help them cope with a rapidly changing environment. The speaker argued in favour of a transdisciplinary and dynamic educational system based on a systemic, interactive approach which takes into account the expected objectives. The traditional role of teachers is radically changed. They should be capable of rationally using the new information and communication technologies and of mastering the methodological concepts to allow them to simulate and navigate through the information flow, selecting and restructuring information according to well-defined educational objectives. The speaker stressed the importance of pre- and in-service teacher training courses, which should integrate cognitive, psychological, pedagogical and communication modules. The strategy to be adopted in order to bridge the gap between the traditional and the new, technology-based approach consists in the progressive integration of new information and communication technologies so as to eliminate the phenomenon of rejection due to high costs and human resources involved. Thus the new pedagogical solutions advanced by teachers and teacher trainers would in their turn lead to an evaluation feedback from the peers and ultimately to increased co-operation and participation in the training process.

The discussions in Commission I focused on the peculiarities related to the stages of introducing new information and communication technologies at different levels of education, in the fist place in secondary and higher education. In a first stage special attention should be paid to the acquisition of computer literacy skills, to the teaching of informatics in schools and higher education institutions. Thus the use of the new technologies gradually expands to various knowledge areas. The second stage is linked to the emergence of personal computers in secondary education, which are used not only in the teaching of informatics or foreign languages but also in the teaching of physics, mathematics chemistry and biology. However, several participants noted that only a few elite schools could use ICTs in the first stage. Concrete experiences in the teaching of informatics were provided from secondary schools in Switzerland and Russia. The third stage refers to the use of ICTs in higher education. Universities worldwide have developed programmes aimed at introducing ICTs in order to increase the efficiency of the teaching-learning process, to create more opportunities for distance learning, to give students more time for individual study. The special tasks of universities is to advance knowledge through research in the field, to experiment the application of ICTs in education and to caution against excesses. A general remark was that more attention should be paid to the human aspect when introducing new ICTs in distance education. More studies in psychology should be conducted to promote individualization, division of

learners by learner types and the adaptation of learning materials. In spite of the rapid development of new information and communication technologies, the access to them remains restricted, many countries still lacking the necessary equipment.

Participants in Commission II devoted particular attention to the fundamental reorganization of society brought about by the introduction of personal computers and technologies linked to the Internet. These technologies, unlike books and TV, enable global communication between end-users without the need of intermediaries. The opinion was expressed that the changes in educational systems and in the role of the teacher lag behind those in the field of new technologies. However, the information disseminated by means of the new technologies becomes widely accessible and provides new educational opportunities through parallel educational channels. Concern was expressed with respect to the lack of sufficient rules of behaviour permitting to evaluate the correctness of the information disseminated via the Internet and to control possible misuse, particularly concerning international transfers where different legal systems apply. There is also the problem of increased error risk due to the concentration on limited sensory channels of communication. Laws cannot be expected to ensure the necessary behavioural changes which will require an increasing reliance on co-operation rather than competition in human relations. The suggestion was made that academic communities could provide a useful model for testing and emulation in this context, given that their working methods and approaches are already more co-operative and less competitive than in other sectors of society. Two case studies of programmes to introduce informatics in national school systems were presented at length (Israel and Russia). Other discussions centred on encouraging students to produce, and not only use, computer programmes and on providing sufficient training and back-up for teachers.

The discussions in Commission III focused on the Canadian experience in the creation and operation of the Tele-University in Québec and on the achievements in the globalisation of teaching and learning. An interesting presentation was made about a project involving the transfer of educational film to digital format for use on the Internet. The importance of distance education for a wide category of users was stressed, in particular for handicapped as well as gifted children and for the professional retraining of teachers themselves. Concern was voiced over the lack of worthwhile information on the Internet. Attention was drawn to the problems teachers in Central and Eastern countries face (e.g. Hungary) in developing curricula after a forty-year period of overcentralized national educational policy which tended to minimize the input of teachers. Other issues of interest referred to evaluation of successful educational programmes and to comparison criteria of new and old educational methods. According to one opinion, success is a function of three variables (the "3P" model): expected payoff, level of problems that have to be overcome and intrinsic pleasure in being involved with a computer-related innovation. One of the advantages of new information and communication technologies lies in the cross cultural transference of technological innovations in education. The problem of copyright and royalty payment to authors of educational materials 'broadcast' on the new communication technologies should be solved as a prerequisite to their successful application. Two recommendations were made to UNESCO: the first, to set up a working group which should examine the pedagogical aspects related to the use of new information and communication technologies, the present and future data exchanges between countries; the second, to collect and disseminate 'best practice' case studies on projects using new information and communication technologies.

THEME 2: TEACHERS

The second theme was introduced in the plenary session by Mr. Qian Kunming, Deputy Director, Distance Education Centre of Central Radio and TV University (People's Republic of China) and Mr. Alexei L. Semenov, President of Moscow Institute for Teacher Development, Vice-Chairman of Moscow Department of Education (Russian Federation).

Mr. Kunming's paper, *New Information Technology and Teachers*, gave an overview, based on statistical data, of teacher training programmes at the national level which make use of ICTs, a phenomenon which has gained momentum over the last years. Faced with the challenges of the 'information society' and of the 'information highway', the traditional teacher-centred educational model had to be changed and new policies be developed. He illustrated his arguments by taking his university, Radio and TV University of China, as a concrete example. The success of the teacher training programme based on ICTs, introduced by the University (1.5 million college graduates in 8 years only), prompted the Chinese government to extend the use of the new technologies in the training of primary and secondary school teachers. A national network of satellite TV education was established, which broadcasts two sets of educational programmes through a Chinese communication satellite. Special emphasis was laid on the courses produced by China TV Teachers College, covering a wide range of subjects (156 in total), 12,000 hours of visual teaching programmes, which are very popular among teachers. The growing role of distance education has turned the latter into an independent educational model. The wide use of the new information and communication technologies has radically changed the traditional teacher-student relationship. Notwithstanding the rapid development of ICTs, the latter can never replace the direct interpersonal exchange in the educational process. The speaker concluded by stressing the key role of the human factor (i.e. the teacher), the only one capable of inculcating moral values in students.

Mr. Semenov placed his presentation, *Informatics in Russian Secondary Education*, in the general framework of the in-depth educational reform going in Russia at all levels and covering all aspects, teacher training included. His conclusions are based on first-hand experience in the introduction and application of new information and communication technologies in secondary schools all over the country. The experiment conducted in secondary schools once again underlined the key role that teachers play in the reform of the educational proc-

ess and that particular attention should be therefore paid to their pre- and in-service training. The assimilation by teachers of the necessary skills in mastering the new technologies was conceived as a modular, multi-stage process, designed to overcome possible psychological barriers. This process was backed by the development of federal and regional guidelines regarding the application of information technologies followed by all secondary schools. According to the curriculum, information technologies were included in the general domain of technology studies, involving the development of software environments (e.g. general applications, construction kits, combination of logo and hyper-encyclopedias on CD-ROMs). The success of the programme was ensured to a great extent by the good co-operation relations established between teachers-specialists in new technologies and non-specialists in the teaching of various subjects. Given the vast amount of information disseminated, teachers and students came to regard the Internet as a form of alternative and informal education, a source for student investigation and data collection projects, teleconferences in the framework of the regular curriculum. The speaker concluded that the Russian teachers involved in the project were ready to share their experience with colleagues from other countries and develop co-operation in the field.

The discussions in Commission I began with an evaluation of the results of what is referred to as the "first wave" in the application of computers in education. Proposals were then made for the "second wave" of computer network applications. Access to infrastructure and economies of scale at national or regional level was stressed. In order to minimize the problem of teachers facing difficulties in the access and use of computers, developers/project initiators should work through with teachers all problems related to the use of computers in the classroom. It was emphasized that there are no grounds for concern over the fact that the increased use of ICTs might lead to lack of communication with the students or for a need to protect the latter from harmful information. Governments and educational institutions should not carry out large-scale teacher-training programmes. It is better to concentrate efforts on small projects which are both cost-effective and relevant to immediate concerns. Mention was made of the lack of a large commercial market of computer software and commercial networks for educational purposes. The setting up of cost-free networks for teachers and students is a must in the face of the new challenges. Computer networks permit teachers to have wider access to information and resources and to choose relevant software for their teaching programme. Several speakers pointed out that the development of educational software should not be left to the commercial and industrial world alone. Teachers and their professional associations should be encouraged to become pioneers, innovators and initiators of the wide application of new technologies in education. An interesting presentation was made of a project on how information superhighways can be used for the purpose of introducing pedagogical innovations. Attention was drawn to the fact that the use of ICTs should focus on the pedagogical, and not technological, aspect. The teachers' role as coordinators and 'navigators' was emphasized. They should stimulate reproductive, problem-based and quality learning by using ICTs as one of the tools among others. Integrated curricula, active students and passive teachers, critical thinking and individualization are the key approaches which should be applied in computer-based teacher training programmes.

Commission II launched its debates by questioning whether the new information and communication technologies do actually benefit education. A case study conducted in Bulgaria suggested that they could, on condition that they help introduce a discovery approach to learning and that teachers are well prepared and enjoy their new roles. It was demonstrated that the application of computers can actually empower students, minimizing their traditional role of passive recipients, an autocratic teaching style being no longer possible. Another case study referred to the use of the Internet in the schools of Montana (USA), a state which, in certain respects, can be compared to some developing countries because of its isolation and relatively poor economy. The Network Montana project was developed on a cost-effective basis by planning for the whole state, enlisting the co-operation of industrial partners and making use of the communication channels developed for larger Internet users. A concrete example was the earth sciences curriculum delivered via the Internet, which makes extensive use of real data and image analysis software available on the Internet. It was noted that such experiments cannot be conducted in developing countries, on the one hand, because of the lack of corresponding infrastructure, and the considerable financial expenditure involved, on the other hand. The proposal was made that UNESCO should help these countries in evaluating these technologies and advising on their use.

Among the issues discussed in Commission III was the importance of 'strategic planning' for educational technology projects using new information and communication technologies, which has the following main stages: staff development, curriculum development, equipment development, courseware development and laboratory/practicum development. It was argued that the move to multimedia, like the move to effectively adopt any new teaching and learning methodology, can only be successful and viable if it is undertaken as part of a coherent long-term plan designed to provide solutions in a system-wide manner. One of the projects presented involved several US schools in a model of computer use, called Computer Supported Collaborative Learning. Aimed at changing the role of the teacher and the student and based on pedagogical goals of constructivism and 'intentional learning', the project has created a knowledge building community, using telecommunications, within and without the school, plus group support system software to achieve these goals.

THEME 3: TECHNOLOGIES

The third theme was introduced in the plenary session by Professor Jean-Pierre Arnaud, Conservatoire National des Arts et Métiers (France) and Mr. Rockley L. Miller, President of Future Systems Incorporated (USA).

Professor Arnaud's keynote speech, *Quelles technologies pour l'éducation? Les Nouvelles Tech-*

nologies Educatives à l'heure du déploiement (Which Technologies for Education? New Educational Technologies at the time of Deployment), brought to the fore several questions linked to the application of new technologies in education: (i) the purpose for which a student should acquire more in-depth knowledge about informatics and computers (what solution can be found to the "computers as object of study versus learning tool" dilemma); (ii) the growth of tertiary-professions favours the emergence of an information industry and calls for a change from the so-called processing informatics to communication informatics: in the light of these developments, what is the impact of information superhighways on educational systems and methods? (iii) as social and economic transformations accompany these technological changes, more and more time is devoted to the search for information, which is one of the principal components of knowledge acquisition and training: do the information and communication systems operating in educational institutions keep the pace with this evolution? can training remain a local or a national concern at the time of global networks? The answers lie in the new approach to learning, which should be regarded as a lifelong education process, giving everybody the opportunity to continuously update their knowledge and know-how throughout the active life, to enable them to cope with the everyday changes in the social and economic sphere. That is why the application of informatics in lifelong education has been developing at a more rapid pace than in pre-service and higher education. The speaker argues that the emergence at the end of the 1980s of the global networks and the definition of communication architectures have offered their users new models for the organization of their information systems, informatics changing its vocation from an information-centred to a knowledge-management system. The entire argumentation is based on a clear fact, namely that technologies are only a means to reform the teaching/learning process and not a substitute, and that software developers should systematically include in their projects an educational component accessible to all actors involved (teachers, institutions, enterprises).

Mr. Miller, the second plenary keynote speaker, whose paper was titled *A Matter of Mathematics: The Impact of Moore's Law on the Future of Education, Training, and Global Communications*, began by explaining why Moore's Law has proved incredibly reliable over the past two decades of computer evolution and has had a profound impact on the computing industry and all those parts of society that have benefited from harnessing that growth in computer power. Gordon Moore, founder of Intel Corporation, had predicted that the transistor density - and thus the raw processing power - of silicon-based microprocessor would double every 18 months. The speaker argued that the same law, which is expected to remain reliable for the next twenty years, is now having a major impact on the field of telecommunications, an impact especially demonstrated in the exponential growth in the vast international network of computers known as the Internet. With respect to the impact of technology advancement on public policy and social development, the presentation raised several hot issues of debate at the national and international levels: (i) the perceived widening gap between the 'haves' and 'have-nots', between developed and developing countries; given a proper measure, how can the same technologies be used to narrow it? (ii) the impact of technology advancement on the free flow of information across national borders, can the global marketplace of ideas be controlled by any governmental force, including the United Nations? (iii) can this flow be harnessed to serve every community of people? (iv) what policies and perspectives are necessary to harness Moore's law on behalf of the public good and to allow any country to ride the upward spiral of exponential advancement? The speaker provided statistics in support of his arguments on the fast development of the CD-ROM and multimedia markets over the last years, explaining why more and more educators, trainers and public policy bodies have become aware of the immense potential of computers and the wealth of information disseminated through such means, including the Internet.

The debates in Commission I began with a CD-ROM presentation on interface to interactivity, a necessary condition to an effective learning environment which can be reached through the use of ICTs. An important feature of educational interactive multimedia is that they bring a personal touch or human enthusiasm into the learning materials. Software design should be based on pedagogical needs, i.e. equally content- and learner-oriented. It is important to see how various technologies complement each other to produce the most relevant interactive learning materials (classical as well as ICTs). This presentation was followed by an analysis of the latest developments in ICTs and their application in education. High expectations were put on large computer information systems to solve social and economic problems. As a result, deficiency in applying ICT analysis in many areas called for a more in-depth analysis of the use of such technologies. Some pertinent conclusions emerged from this analysis: (i) an activity should only be "computerized if the structures are well understood and have reached a certain degree of formalization"; (ii) structures should be precisely mapped into computer algorithms before they are honed for higher performance; (iii) when introducing technology, one should build upon existing structures; however deficient they might be, and advance in small steps to new patterns and practices; (iv) the social interaction component should be more and more present in technology. Another presentation referred to distance learning, where more emphasis should be placed on the teaching of mathematical models. With respect to distance education, UNESCO was invited to support training in this area as it requires special training.

The debates in Commission II centred on the complementary nature of science and technology. The regret was voiced that computer science is taught mainly as technology (*learning to use*) instead of paying more attention to its fundamental laws as in other sciences. It was noted that generic informatics tools exist for particular disciplines and that higher-level tools should be able to incorporate the laws of programming educational interfaces in any discipline. A recommendation made referred to the introduction of mathematical modelling in school

curricula at an early stage. Thus computing could help illustrate the concept and practice of modelling. It was argued that computer science "laws" are of a practical rather than abstract nature and that they could be readily learned by students. The opinion was expressed that laws and concepts should be introduced in primary and secondary school curricula instead of programming techniques, since the latter could be learned at the professional level when needed. Another aspect stressed was the importance of taking the clients' needs into consideration in developing educational software and of incorporating true interactivity for the user. Software should be designed within a strategic approach in which the context of usage is clearly defined, including the role of the computer among other learning tools used. A number of practical guidelines were developed within this concept, allowing the incorporation of all the required information in the software and taking into account the motivation of the users. Another interesting project, developed by CITCOM, a subsidiary of France Telecom, referred to the setting up of distance education networks based on videoconference techniques in 15 countries and pinpointed universities as the largest users of such systems. However, the project stressed that these new systems should not be seen as replacing the traditional educational techniques, but rather as useful tools in certain contexts. Another experiment revealed the possibilities of resorting to unused TV channels for educational teletext, but with little interactivity or use of a feedback channel in the educational process. A conclusion of the debates was that technologies exist independent of the educational context. The need of reinforcing defined educational methodologies using ICTs was stressed. Attention was also drawn to the importance of studying the psychological aspects of computer use in education and to the role of computers in meeting the special needs of gifted students.

Commission III focused its discussions on the experience of several countries and organizations in the application of ICTs in education. The examples referred to the organization of local schools and regional school networks in Finland; projects carried out by the UNESCO International Research and Training Centre at Glushkov Institute for Cybernetics in Kiev (Ukraine) on Internet literacy, creation of teleteaching networks, promotion of information and communication technology-based didactic laboratories for lifelong teacher training; the development of educational computer networks by the Informatics Centre of Lomonosov Moscow State University; and the structure of the Local Area Network at Minsk State University (Belarus). UNESCO was invited to make known the work and results of the Moscow Congress at the International Conference on Education, to be convened in October 1996 in Geneva, and to support, in co-operation with other partners, initiatives aimed at launching an international database of successful, right-scaled projects which give clear guidelines on teaching and learning methods. UNESCO was invited to promote, in co-operation with other partners, much closer international partnerships at the school level with regard to their experience in the use of ICT-based educational materials.

THEME 4: SOCIAL, ECONOMIC AND CULTURAL ISSUES

The fourth theme was introduced in the plenary session by Dr. P. A. Motsoaledi, Minister of Education of the Northern Province (South Africa) and Dr. Heinz-Werner Poelchau, Ministerial Counsellor (Germany).

Dr. Motsoaledi focused in his keynote speech, titled *The Penetration of New Information Technologies into Developing Countries: Cultural Hegemony or Mutual Exchange*, on the social, economic and cultural implications for his Province, one of the most deprived regions of the country during the apartheid years, with respect to the introduction and use of ICTs. While fully aware of the need to accelerate this process, comparing it to a "revolution within a revolution", he argued, based on concrete facts, that it raises a number of questions which need to be looked at from the perspective of ICTs being imported from the West to a developing country. The inadequate provision of math and science education at primary and secondary school level, the underqualification of matriculating students entering teacher training colleges, thus preparing to perpetuate the poor standards they themselves worked under, called for the urgent initiation of a range of projects using ICTs. The aim was to provide the reconstruction of education with an adequate infrastructure. The speaker argued that the introduction and application of ICTs in education should be seen as a mutually beneficial exchange between the developed and developing countries and not as a form of cultural hegemony. Since all technologies and inventions bear the imprint of the cultural setting of the countries of origin, developing countries should strive towards becoming technology self-sufficient and not technology dependent in the long run. They are continuously in danger of being consumers of foreign culture. That is why the speaker stressed that the preservation and the nurturing of cultural values should not be alienated from the production process and the invention of new technologies. This is where the positive role of international exchanges comes in, the conclusion being that: developing countries should be encouraged to enter into international co-operation projects in the field of ICTs which promote development, cultural diversity and democracy.

The second speaker, Dr. Poelchau, although representing a developed country, placed the issues under discussion in a wider context. In his speech, *New Information Technologies as a Challenge for General Education and Vocational Training: Chances for International Co-operation from the point of view of the Federal Republic of Germany*, he referred to the rapid developments in the field of new technologies and to the multifacetted challenges the latter pose for society, in an attempt to answer whether ICTs can provide solutions to ever growing and diversifying social needs. In an increasingly interconnected world, he stressed the central role that ICTs can play in disseminating information and knowledge, in promoting economic development, in safeguarding cultural identity and ensuring individual wellbeing. Like the preceding speaker, he warned that a misuse of ICTs might further widen the existing gap between developed and developing countries, between the so-called *information-rich* and

information-poor, and argued, therefore, in favour of expanding international co-operation in the field. This phenomenon calls for appropriate educational policies and concerted action at national, regional and world levels. Such policies would help to overcome social disparities, ensure wide access and equal opportunities. The speaker outlined the actions in the economic and social spheres taken by Germany over the past decade in order to ensure the transition from an industrial to an information society, leading to a 50 per cent increase in the number of jobs in the information processing sector. This has been made possible following the adoption of new educational policies in the mid-80s aimed at encouraging the use of ICTs in general education and vocational training and attracting the participation of private companies in the development of educational software and training programmes. By way of conclusion, the speaker suggested that international forums be set up for exchanges of experiences in the use of ICTs, inviting UNESCO to launch such an initiative.

The debates in Commission I continued some of the issues raised in the two keynote speeches. An interesting presentation was made concerning the application of scientific films in education using a compact interactive video disk, a project developed by the Austrian Federal Institute for Scientific Film. The opinion was expressed that the multimedia encyclopedias allow learners to study independently but they cannot replace the traditional teacher-student interface. The new curricula using ICTs should not be based only on the latest products, they should incorporate the resources existing in archives. Educational institutions and companies producing educational software should co-operate more closely. In this respect a proposal was made that UNESCO should coordinate at international level an appropriate mechanism which should facilitate the acquisition of educational software, regulate its legal use and ensure a market specially targeted at schools. Another presentation referred to the introduction and use of ICTs in the teaching of the humanities, stress being placed on the need for universities to find adequate solutions to the computerization of these disciplines. A major concern would be to make better known the specific nature of the humanities, a prerequisite for a successful definition of the role and place of new technologies in education in a longer perspective. The new information environment fully meets the most urgent requirements concerning the teaching and learning of the humanities. The expanding informatization of the educational process in these disciplines calls for the elaboration of new strategies so as to ensure students wider access to the knowledge and information imparted by teachers. Information self-sufficiency and information freedom are two major objectives to be pursued in university-level education. The importance of preserving and nurturing human values in the teaching of natural and exact sciences, as well as of engineering-technical subjects was stressed.

In Commission II discussions focused on issues related to the methodology and market for interactive media used in distance education from the viewpoint of a commercial publisher. A clear-cut distinction was made between products for collective versus individual use and those used in real time versus local or asynchronous mode. It was shown that multi-target applications on today's market may be overtaken by finely targeted products for very specific educational use. A clear commercial strategy is needed before a company can invest in multimedia production. The new technologies may become important factors of industry growth but on condition that they are accepted by the market. Real progress could be achieved by countries if they agreed to develop multilingual applications and consequently share resources, each specializing in a particular area. An issue high on the agenda, particularly of Eastern and Central European countries is the development of educational networking. Such networks are considered as the only possibility to overcome the information and organization marginalization of their educational and research institutions, the difficulties to publish and disseminate ideas and results, as well as to ensure the integration of these countries into the world community. The results of an interesting project, developed by the Conservatoire National des Arts et Métiers (France), in the field of distance education courses for adults were presented, which uses the on-line versus local approach and individual versus collective self-learning. However, a hybrid of on-line and local delivery was seen to be generally most appropriate. Self-learning is typically supplemented by real time telecommunication links to remote video presentations and student discussion meetings. An analysis was made of the impact of the development of informatics and of new information technologies on the socio-economic and technical-scientific development of society. Two recommendations were made to UNESCO: to draw the attention of the world community to copyright problems in respect of educational programmes and to organize workshops for African countries in particular, aimed at ensuring a wider use of educational software.

The debates in Commission III touched on such issues as the development of distance education in certain Latin American and Caribbean countries, as well as the current status of international co-operation in this domain, with particular reference to UNA-CRESALC projects. Stress was laid both on the organizational and technological progress achieved in this field and on the main problems facing distance education in the region, the latter including high dropout rates (about 90%); lack of policy continuity; low interaction between students and teachers; obsolescence of materials; and scarcity of staff development programmes. In order to deal successfully with the above problems, international co-operation, both inside and outside the region, is particularly important. The analysis of the development of distance education in Latin American and Caribbean countries ended with several recommendations addressed to developing countries and countries in transition. A project, entitled *International Visual Communications*, run by InterNews, a nongovernmental organization, which was designed to meet the educational needs of the hearing-impaired (200 million members), pointed to the particular opportunities that ICTs (especially, visual communication) create in this field and the need that the traditional educational policies with respect to the education of the hearing-impaired be changed. This

process would not only respond to the requirements of this community but would also enrich the common educational and cultural heritage. A case from Zaire drew attention to the fact that the developing countries should not be left out of the "information revolution". Emphasis was placed on the need for the development of appropriate educational policies with regard to the purchase and use of computers for educational purposes, as well as for the protection of intellectual property rights. An appeal was made to UNESCO to assist in this respect.

THEME 5: EDUCATIONAL POLICIES

The fifth theme was introduced in the plenary session by Professor José A. Valente, Universidade Estadual de Campinas (Brazil) and Professor Tjeerd Plomp, University of Twente (The Netherlands).

In his keynote speech, *The Role of Computers in Education: Achievement and Comprehension*, Professor Valente started from the assumption that in most cases educational processes are restricted to asking students to do various activities, which they can, or cannot, do successfully. However, the fact that they may be able to accomplish these activities does not mean that these students necessarily comprehend what they have done. To substantiate his arguments, the speaker referred to the distinction, made by Piaget, between achievement with success (*savoir faire*) and the comprehension of what is achieved, according to which the passage from the level of achievement to the level of comprehension is being done thanks to the grasp of consciousness. This passage requires the transformation of action schemes into notions and operations. With the computer, the student can do lots of activities and achieve them successfully. However, depending on the type of software used, and the teacher's involvement in the computer activity, the student may, or may not, understand what he/she has accomplished. This is the case when the student uses a tutorial or many multimedia software. The speaker stressed the need for a new approach, one that encourages students to engage in a programming activity that demands different actions which can create the conditions for comprehending what he/she is doing. This process of programming can be seen as a cycle consisting of description-execution-reflection-debugging-description. In this cycle, "debugging" constitutes a unique opportunity for the student to construct his/her knowledge and understand what he/she is doing. Programming, the speaker argued in conclusion, is an opportunity to engage in the passage from achievement to comprehension, as it involves certain actions which are essential for the development of important skills that are not often present in the educational process today, nor in many types of educational software.

The second keynote speech, *New Approaches Needed to Teaching, Learning and the Use of Information and Communication Technologies in Education*, introduced by Professor Plomp, centred on the new challenges facing society, in general and all the actors involved in the education process, in particular, as a result of the impact of the use of ICTs in education. One major challenge the educational system faces today is to prepare individuals to cope successfully with the change from an industrial to an information society. Other challenges refer to the capability of educational systems (i) to find solutions to the social, cultural and economic problems of the society; (ii) to ensure individualized and flexible training, suited to specific needs, as the growing individualization in and diversification of society call for new approaches to education; (iii) to provide opportunities for lifelong learning and new demands for learning, since the guarantee for open and equal access to education for everybody is, under the current circumstances, becoming almost unaffordable. Immediate objectives, to be pursued by educational systems, such as managing large amounts of information, developing learning strategies to facilitate effective learning and assuring that all citizens are skillful in assessing, selecting and dealing with information are considered of critical importance. The speaker argued in favour of a new balance between a teacher-oriented and a student-oriented process, with much more emphasis to be given to the latter. He pointed that ICTs provide a means to instrument such revolutionary changes called for by the transition to an information society. The solution proposed was that today's schools and teacher training institutes should design programmes providing bridges from "old" to "new" definitions of education. Their main focus should be to generate and support "emergent practices", with ICTs as a medium, in order to prepare both students and teachers for their new roles in an information society.

Commission I focused its debates on current policies regarding the use of ICTs in several countries. For example, in France, the Ministry of Education has launched a number of initiatives aimed at modernizing educational management in schools; introducing relevant ICTs in technical and vocational training; ensuring the use of ICTs as a teaching aid in various subjects; expanding the use of ICTs in secondary schools by connecting them to Internet; and, last but not least, providing access for students to computers. Inter-school networking and twinning with secondary schools in other countries have also been developed. Leading schools which have put into practice ICT-based systems and programmes should be encouraged to make their resources available to other schools. Stress was laid on the importance of pre- and in-service teacher training programmes as teachers should play a pioneering role as far as the application of ICTs in education is concerned. Another case presented a programme developed by the Norwegian Ministry of Education, Research and Church Affairs for the 1996-1999 period designed to promote the use of ICTs at all educational levels. The programme pointed to the need of upgrading teacher skills in the use of information technologies and to the increasing role of distance education in teacher training. The experience acquired over a 25-year period showed that the main obstacles to the widespread use of ICTs in education had been the lack of computers, of a curriculum adjusted to their use and of adequate teacher education. While technology is no longer a problem and efforts have been made by most countries aimed at upgrading curricula, difficulties still persist in teacher education, a serious problem being the lack of funding for teacher training courses. In this context, distance education is seen as playing an important role. It was noted, however, that even

the most sophisticated technology can never substitute the human factor, the face-to-face contact between a teacher and a student. Other issues discussed touched on the importance of elaborating a more clear classification and terminology in the field of ICTs and the need to promote a wide range of research on the effective use of ICTs.

Commission II began its debates with the presentation of a project carried out by IBM-CLIE (Centro Latinoamericano de Investigación en Educación), a research centre in Mexico, on the development of educational tools and approaches meant to prepare students to better cope with the new challenges they will face in a society rapidly transformed by information technology. Skills in knowledge navigation, new learning culture and role transformation are acquired through education based on the *Genesis* concept which stresses the development of imagination, initiative, observation and flexibility. This concept has been introduced in the curricula of about 1,500 schools in several Latin American countries, through the use of specialized microcomputer-based software modules developed by IBE-CLIE. An extension of the programme, called *Quorum*, employs networking in the region to provide a "knowledge production space" enabling children to co-operate in building conceptual knowledge maps. A case from Slovakia stressed a major problem facing Central and Eastern European countries, namely the so called double "brain drain" phenomenon, as it involves, on the one hand, students choosing to study in neighbouring countries and, on the other, graduates emigrating abroad. In order to minimize the effects of this phenomenon, the Slovak Technical University has developed policies intended to upgrade the information infrastructure, to encourage the study of all subjects in English as the latter is the dominant language of technology, to promote the international recognition of its diplomas, as well as to expand co-operation with Western countries. Three areas for further discussion were identified: (i) the Internet as a potential promoter or destroyer of cultural and linguistic diversity; (ii) the meaning of the "knowledge-based society" and the role of schools in bringing it about; and (iii) problems of access to information networks, particularly for rural areas. The SchoolNet project, sponsored by the ten provincial education ministries and the federal government of Canada, aims to link all 16,500 schools in the country to the Internet by 1997.Besides its pedagogical objectives, as it is designed to help teachers acquire the necessary skills to use technology in the classroom, SchoolNet hopes to strengthen communications and sharing among teachers who are scattered across the country. International co-operation, and particularly UNESCO's support, was considered to be very important in the preservation and dissemination of cultures and languages in an information society. A proposal was made that an international coding scheme for the content of databases and telematics applications be adopted.

The discussions in Commission III particularly wide-ranging in coverage of issues and in expressing a broad diversity of opinions. One opinion voiced the concern that ICTs should not dictate educational policy. Without denying the positive role of the new technologies, attention was drawn to the negative aspects of an endless thirst for information, a kind of "infomania". The problems faced by developing and least developed countries were particularly stressed: lack of political will and financial resources necessary for the development of ICTs; shortage of teachers; too small and widespread projects not backed by sound research and evaluation; not enough distance education curricula; lack of infrastructure, such as electricity and telecommunications; limited access to ICTs (technologies are accessible only in towns whereas the majority of the population live in rural areas); software inappropriate to cultural environment; software piracy. It was noted that instead of narrowing the gap between developed and developing countries in the field of ICTs, as recommended at the first UNESCO Congress, an opposite trend has been taking place. It was therefore proposed that associations of participating institutions be created at regional level, in which some members would act as "centres of excellence". Another issue centred on the need for research into students' concepts and attitudes to technology so as to train technologically aware and innovative youth capable of coping with the challenges of the twenty-first century. Several recommendations were made to UNESCO: (i) to assist African countries to formulate intellectual property legislation with a view to protecting the rights of African programmers; (ii) to set up a network of special teacher training centres in Africa; (iii) to help establish a database of ICT projects as an aid to policy advisors; (iv) to monitor the creation of an international network of women specialists in ICTs and to pay increased attention in its future action to gender-related information technology issues.

THEME 6: INTERNATIONAL CO-OPERATION

The sixth theme was introduced in the plenary session by Mr. Henrikas Yushkiavitshus, Assistant Director-General for Communication, Information and Informatics of UNESCO, Professor Armando Rocha Trindade, President, International Council for Distance Education (Portugal) and Mr. Wim Jansen, Task Force Educational Software and Multimedia (European Commission).

In his keynote speech, Mr. Yushkiavitshus gave a comprehensive outline of UNESCO's programme activities in the field of new information and communication technologies in the broader context of the emerging information society, of which both informatics and education are major building blocks. The speaker stressed that although the economic and commercial interests are the main driving force behind the building of the information superhighways, the development of education, culture and science as distinct and integral parts of human civilization cannot be left totally to the control of market forces. As an intergovernmental organization, UNESCO is concerned with ensuring access to the new technologies to its Member States, particularly to developing countries in order to reduce the gap between the "haves" and "have-nots". With the advent of the information age, learning is increasingly becoming a *lifelong* requirement giving individuals the possibility to be better equipped with the ever more diverse knowledge and skills characterizing an information society. In the field of education, information technologies can complement traditional

educational methods and enable educational systems to adapt to different learning and training needs of societies. New tools such as interactive TV, computer simulation, telematics and teleconferencing provide an unparalleled opportunity to "reach the unreached" and to make lifelong education for all feasible, especially for learners for whom access is limited by time and space, age, or socio-cultural environment. As no country or even group of countries can hope to solve problems related to education and the information society single-handed, international co-operation is seen as a necessity and UNESCO is called to play the catalyst role in this process, in keeping with the ideals enshrined in its Constitution. Several actions undertaken by UNESCO aimed at expanding international dialogue in this area were mentioned such as a series of pilot projects, developed in co-operation with the International Telecommunication Union, on the educational application of interactive television in various developing countries (India, Mexico, Morocco); INFORMAFRICA, a programme launched in 1990 designed to help African countries to introduce informatics in their educational systems; or the Regional Informatics Network for Africa project, carried out by the Intergovernmental Informatics Programme of UNESCO. UNESCO's efforts in the promotion and defence of copyright and intellectual property rights were also stressed.

The second speaker, Professor Trindade placed emphasis in his speech, *International Co-operation in Open and Distance Learning*, on the increasing role of distance and open education in an information society. While admitting that certain skills and a number of subject matters cannot be taught to isolated users studying at home, even if linked to the teaching system by the most sophisticated telecommunications network, he argued that educational institutions should adopt a "mixed-mode" model of operation. This solution would ensure the necessary flexibility in the teaching and learning of various disciplines as it allows a balanced combination of face-to-face interaction and distance learning approaches. The speaker further added that although a mixed-mode model of operation is not formally adopted, institutional co-operation between distance teaching systems and conventional ones, belonging to the same linguistic and cultural area, always bear fruit. International co-operation in scientific and methodological research, exchanges of academic staff members are both profitable and motivating for all parties involved. The distance learning approach has been used successfully in vocational training, either in the initial stage or as continuing, lifelong training. Unfortunately, in spite of the diversity of organizations and institutions offering open and distance learning services and products, there is not yet a structured market in the field. This makes certain services and products very expensive for the current individual end-user when they are provided by private operators. The speaker mentioned another deterrent factor, namely the fact that continuing education has not been yet recognized as an individual and social right , which prevents the underprivileged categories of users from access to its benefits on a permanent basis. He concluded, however, on an optimistic note, reiterating the idea expressed by the previous speaker, that international co-operation is of paramount importance to pool experiences, to reduce costs, to create synergies and economies of scale. Intergovernmental and nongovernmental organizations such as UNESCO and the International Council for Distance Education should join their efforts and pursue common strategies in order to improve, democratize and reinforce education and training opportunities all over the world.

Mr. Jansen made a presentation of the European Commission's Task Force Multimedia Educational Software and of its main goals. The latter can be summed up as follows: (i) to identify the most appropriate R&D activities; and (ii) to promote the use of multimedia in education and training at all levels on-line and off-line. These goals have been set in order to better respond to the increase and diversification of the education and training needs that are developing as a result of the emerging information society, to upgrade and strengthen European industry by improving provision of high quality training material, and to enable companies, in particular small- and medium-size ones, to open future markets. The Task Force is seen to make a major contribution to increasing European employment, economic and social cohesion, by respecting cultural diversity, and bringing sustainable services to the citizen. In a world of growing competition, notably from the USA, European countries should strive to create major opportunities and benefits for a quickly expanding home market, which in turn requests further research to develop the next generation of products and services, and to train a better skilled workforce at lower cost. All these actions are aimed at preparing the individual to better cope with the new challenges of the information society. Various programmes such as Socrates and Leonardo da Vinci have been developed to stimulate research efforts through co-operation.

The debates in Commission I covered a presentation of the aims and objectives of the International Federation for Information Processing (IFIP), its relations with UNESCO and the International Council of Scientific Unions (ICSU). The presentation was followed by a briefing on the history of computer processing and the objectives of using computers in teaching and on the activities of IFIP's Technical Committee on Education (TC 3). The importance of using computers in curricula, stimulating computer-based learning and of producing information on teaching strategies was stressed. In this connection, mention was made of an IFIP publication on the pedagogical and psychological impact of information technologies, as well as of a modular curriculum for secondary school using ICTs. Another presentation concerned the impact of new technologies in the schools of Europe and the G7 nations, particularly in Canada, France and the UK, which introduced information technologies in national curricula. Statistics show that there are a lot of disparities among countries with regard to the number of microcomputers, percentage of primary and secondary schools with one or more computers and student/computer ratio. The importance of adequate teacher training programmes using ICTs was stressed, to enable teachers to make effective use of information technologies and thus to improve the quality of the educational process. A suggestion was

made that an inter-governmental programme for the legal support of distance education be established to ensure state licence, as well as accreditation at national and international levels. Such a programme should also deal with legal protection against discrimination.

The debates in Commission II referred particularly to the need for policy- and decision-makers to redefine the mission of the school in a fast changing society under the impact ICTs. They are confronted with problems of adapting their educational systems and, consequently, curricula and teaching methods, so as to better respond to the emerging needs of an information society and facilitate insertion into the socio-economic sphere. Experience shows that ICTs play a decisive role in increasing the efficiency of the teaching/learning process and the adaptation capacity of educational strategies to the real demands of society. However, in a world of highly diverse educational systems, a prerequisite for the success of these changes is that they should take into account national specificities. Emphasis was placed on the need to promote education throughout life as knowledge and information acquired in school become rapidly obsolete. It was shown that teachers will play new roles as a result of the application of ICTs as present-day societies witness a shift from a mass educational to a partially individualized, "custom-tailored", process. A proposal, titled *A Global Network for Teacher Tele-Training*, continued some of the issues earlier discussed. It indicates plans for setting up a Global Teachers' Network Service Organization (GTNSO), which would provide a platform for the design, development and distribution of courses relating to technology in education for teachers throughout the world. The courses, as well as other communication and information services, would be made available via the Internet. With the rapid advances in technology, it is difficult for the existing pre- and in-service teacher training systems to keep pace with the innovations in teaching methods and practice. Participants suggested that the proposal be included in the recommendations of the Congress.

Commission III centred its debates on the results of some projects aimed at expanding international co-operation in the use of ICTs in education. One such project, developed in the Russian Federation, referred to the creation of a telecommunication infrastructure for science and education. The presentation was accompanied by an on-line demonstration between two Russian cities, Moscow and Novosibirsk. Attention was drawn to the importance of extending economic support for the introduction and application of ICTs in education, research and development, especially in countries undergoing transition. Telematics creates new possibilities for reinforcing co-operation between countries members of the Commonwealth of Independent States. In this context a proposal was made for the establishment in Moscow of a UNESCO Institute on Educational Policy and New Information Technologies, which would foster international co-operation in the use of ICTs in the region. Another presentation, expressing the viewpoint of the Economic Development Institute of the World Bank, stressed the fact that it is not only information technology that is changing. Many countries are undergoing both economic and political transitions, which bring with them enormous demands for knowledge, not just from students, but also from the public at large. Much of this demand is for knowledge that is built on the experience of other countries. The major problem for international organizations, such as UNESCO and the World Bank, is how to increase the chances for knowledge to flow, not from the rich to the poor, but among nations and individuals as information equals. The continuing global effort to reduce poverty through sustainable and equitable development should be at the centre of concerns for equitable access to technologies and the knowledge they carry. Governments play a key role in ensuring equity and in providing those public goods, such as education, that enable individuals to share in the benefits of growth. The importance of international partnership programmes was emphasized with a view to avoiding duplication of effort and costly mistakes. Several initiatives at the world level were mentioned, such as the Economic Commission for Africa's programme for telecommunications development, USAID's Leland Initiative to build Internet access in Africa, the World Bank's INFODEV programme in which both the Bank and the private sector are co-operating to improve telecommunications policies and applications, or the pilot project launched by the Economic Development Institute of the World Bank to establish international Internet networks in the former Soviet Union.

WORKSHOPS

In addition to the plenary and commission sessions, twelve workshops were organized on 4 and 5 July 1996 on the following topics: *Information Superhighways and Education*; *The Psychological-Pedagogical Impact and the Medical Consequences of the Application of Modern Information and Communication Technologies*; *The Software Environment - A Perspective for Effective Involvement*; *Transfer of Knowledge and Skills through Information and Communication Technologies*; *National Policies - Transfer of Technologies*; *Individual Distance Training*; *Analysis of UNESCO/IFIP Documents published in 1994-1995 (Part I: Informatics for Secondary Education -A Curriculum for Schools; Part II: A Modular Curriculum in Computer Science)*; *Logics, Informatics and Education; Information Technologies and Humanities Education*; *Development of Pre-University Education via Modern Information Technologies and Methods*; *Medicine: New Approaches to Knowledge Acquisition and Improvement*; and *Forming Integrated World Data Bases and Knowledge about Planets of the Solar System and Their Use in Research and Education.* The workshops were chaired by leading experts, academics and researchers, such as David Walker (United Kingdom); Peter Waker (South Africa); Alain Meyer (France); Tom van Weert (The Netherlands); Harald Schütz (Germany); K. K. Kolin; Yury N. Afanasiev and Alexei L. Semenov (Russian Federation).

A number of recommendations made by participants in the workshops were included in the Declaration and Recommendations of the Congress. The issues discussed are covered in depth in the Congress proceedings to be published.

CLOSING SESSION

Academician Yury L. Ershov and Professor Jef Moonen, Co-Chairpersons of the International Programme Committee of the Congress, took the floor to present a summary of their personal views on the discussions having taken place during the Congress, stressing the increasing role ICTs play in all educational systems today and the need for national governments to develop adequate educational policies and programmes on their implementation. The views of both speakers converged in stressing that the success of the policies aimed at expanding access to, and the use of, ICTs in education depends to a great extent on an improved coordination of the efforts made by various international organizations, UNESCO playing a unique role in strengthening international co-operation in this field.

Mr. Ivan Stanchev, Workshop Programme Coordinator, reported on the results of the twelve workshops. The topics of the workshops were related to the six major themes of the Congress. He stressed the wide coverage of the issues discussed, the diversity of opinions expressed and the large number of proposals which would be included in the recommendations of the Congress. More than 200 participants presented papers and took part in the debates. The main conclusions resulting from the discussions were the following: (i) ICTs lead to new forms of learning, such as open and distance education, individualized training, which complement the traditional system; (ii) teachers and trainers should be trained properly to use the new technologies through well-developed and flexible pre- and in-service teacher training programmes; (iii) there should be a closer co-operation between educators as ICT users and technology developers, with a view to broadening the access to network connection between teachers, schools and higher education institutions and providing a full multimedia platform; (iv) ICTs are recognized as a powerful tool for changing the educational systems of developing countries and countries in transition; (v) ICTs are also changing the cultural perception of the learning process and are leading to more individual-oriented education and training; (vi) governmental support is needed for the communication networks to be used by educational institutions, especially in developing countries and countries in transition; (vii) the need to establish a real functioning system for international co-operation between teachers and for UNESCO to play an important role by encouraging supporting the internationalization of information and curricula exchange in the area of teaching the basics of ICTs.

Then followed the oral reports on the work of the three commissions. Ms Katerina Martcheva, President of Commission I, gave an overview of the discussions which had taken place in the Commission. She emphasized the high interest of participants - decision-makers, academics, researchers, in the topics discussed, as demonstrated by the big number of recommendations made. The issues discussed included an analysis of the latest developments in the field of ICTs and the best approaches to the latter's introduction in curricula, of the trends and experiences in the application of ICTs in educational systems, as well as the results obtained at national, regional and international levels. The proposals put forth by participants, while emphasizing the important role of ICTs, voiced concern for the preservation of the social, cultural and linguistic diversity.

Mr. Gerald McConaghy, Rapporteur of Commission II, took the floor. He stressed the large representation from many countries and the variety of views expressed. He summarized the main issues discussed at length, such as the importance of promoting and enriching culture and language through the use of new technologies and the Internet; the provision of equal opportunities in access to computers and the Internet; the important role of teacher training, particularly as it relates to the use of technology as part of the teaching experience and methodology; the need for the sharing of information, of various models that have been used, of programmes; and, last but not least, the need for closer co-operation between education and industry through the development of partnership schemes. He underlined the common interest all participants shared in trying to promote ICTs as an important tool to help young people learn.

Mr. Alexei M. Dovgyallo, Vice-President of Commission III, made a summary of the results of his commission. He stressed that distance education was given particular attention in the discussions and many recommendations were made in this respect, especially from the perspective of the needs of developing countries and countries in transition. A proposal made by the Russian participants and supported by the rest of participants to be included in the Recommendations of the Congress referred to the creation in Moscow of a UNESCO Institute for information technologies in education, which should focus its attention, among others, on scientific expertise of short-term forecasts in the field of new information technologies in education.

Mr. John Foster, Rapporteur-General of the Congress, then summarized the results of the Congress, the general conclusions, recommendations and suggestions for action drawn up by participants during the Congress.

The President of the Congress requested participants to adopt the Declaration and the Recommendations, mentioning that the final text will include all the recommendations made during commissions and workshops.

Mr. Colin N. Power, Assistant Director-General for Education of UNESCO, addressed the audience recapitulating on the work of the Congress and assured participants that their recommendations would be taken into account insofar as possible in the Organization's future programme, especially those concerning the strengthening of national, regional and international co-operation.

Mr. Viktor A. Sadovnichy, Rector of Lomonosov Moscow State University, took the floor on behalf of the host institution. He stressed the role of international co-operation and exchanges in promoting the use of, and research on, ICTs in education.

Mr. Vladimir G. Kinelev, President of the Congress, thanked participants for their contribution to the success of the debates and declared the Congress closed.

REPORT

UNESCO'S MAIN ACTIVITIES IN THE FIELD OF EDUCATION AND INFORMATICS AFTER THE FIRST INTERNATIONAL CONGRESS ON EDUCATION AND INFORMATICS

INTRODUCTION

The purpose of this document is to provide an overview of UNESCO's activities carried out after the First International Congress on Education and Informatics held in Paris in 1989. In line with its recommendations, the Organization's activities have focused on the promotion of international cooperation in the application of new information technologies in education and training with the aim to alleviate educational disparities within and between the countries, improve the management system of education and to broader access to various types and forms of education and training within the context of a future complex learning society.

This concern was reflected in UNESCO's Third Medium-Term Plan (28 C/4) for 1990-1995, which stressed the need for cooperation -with inter-governmental and non-governmental organizations to promote the use of the new information and communication technologies in education. Based on the Third Medium-Term Plan, the subsequent Approved Programme and Budget for 1990-1991, 1992-1993 and 1994-1995 foresaw national and regional activities which were carried out within the framework of the Organization's Regular Programme, Participation Programme and extra-budgetary operational projects. The Regular Programme activities consist of the organization of seminars, research, publications, promotion of networks and pilot projects. Assistance is also provided to Member States in the planning, implementation and consolidation of national and regional projects through extra-budgetary operational projects. Within the Participation Programme, contributions are also made to national activities in informatics and education through consultancy services, purchase of equipment, fellowships and study grants.

While these three programmes constitute the main modalities for the promotion of information technologies in education, it is important to single out the Intergovernmental Informatics Programme(IIP) which UNESCO's General Conference created in 1985. In order to meet the challenge posed by the widening gap between the developing and developed countries, the IIP has centred its development objectives around the valorization of human resources for informatics and through informatics, the main areas of activities being the training of specialists, teachers and informatics users, the promotion of informatics networks, the development of software, research and development and the development of policies and strategies in informatics. From 1988 to 1995, more than 180 projects were carried out within the framework of IIP.

The present report focuses on the main activities in the broad field of education and informatics initiated by UNESCO in close cooperation with related NGO's, IGO's, Aid agencies and professional associations. The activities are presented under the following five categories:

(i) The introduction of information technologies in schools, universities and in instittjites of non-formal education Information technologies as a subject matter, as a main or support learning tool

(ii) Information technologies and the role of teachers

Awareness raising, training of teachers in the use of information technologies at school, development of educational software

(iii) Development of informatics in education

Development of educational software, training of experts and users, promotion of networks and cooperation schemes, policies and research, socio-cultural considerations

(iv) Information technologies as a tool for educational management. Use of informatics for educational statistics, management and administration in the educational system

(v) Information technologies for the development of distance and open learning the use of information technologies as instructional methods or means of communication for student support.

(I) THE INTRODUCTION OF INFORMATION TECHNOLOGIES IN SCHOOLS, UNIVERSITIES AND INSTITUTES OF NON-FORMAL EDUCATION

DEVELOPMENT PROJECTS

A project on the introduction of informatics into a national education system in Syria was carried out with the aim of developing a computer education programme in secondary education. Four Informatics Teacher Training Centres were established and 120 teachers were trained to be responsible for teaching computer science as a subject in secondary school. As many as 5,500 students in 14 pilot schools were involved in the training process.

In Bulgaria, a national Research centre for Educational Informatics was established within the framework of a project on the introduction of informatics in education of children in Bulgaria. The centre serves as a focal point for all national activities related to the application of advanced information technology to children's education and promotes research, exchanges and training in methods and

techniques for introducing informatics into the education of children. The project outputs were awareness of the introduction of computers and related tools into the process of education and education of teachers; development of research, adaptation of training systems; implementation of new methods and new tools - hardware, software, videoware etc.; establishment of a system of scientific and technical publications and information bulletins; exchange of experience in the above fields.

The project «Development of computer education programme in Egypt» was designed to introduce and teach informatics as a subject of instruction in secondary school, and to prepare the groundwork for the use of computers as educational tools in teaching other subjects as well as in school administration. More than 3,000 teachers and 20 teacher trainers were trained and an Educational Software Development Unit has been set up.

The REDALC Project (Support to Telematic Academic Networks for Research and leaching in Higher Education, Science and Technology in Latin America and the Caribbean) is executed by the UNESCO Office in Caracas,(CRESALC) in cooperation with the Latin Union, the Foundation for Networks and Development (FUNREDES) and the support of the Commission of the European Union. The main products of this project are:

- Inventory of information and communication systems for higher education and scientific and technological development in Latin America and the Caribbean.
- Methodology for the evaluation of academic information and communication systems.
- Methodology for the development of academic networks in higher education, science and technology in developing countries.
- Methodology for the creation and development of virtual communities and interest groups in the academic world for research, teaching and cooperative work. The Project *"Quality and Technology in Higher Education in Latin America and the Caribbean "*, as a follow-up of the REDALC Project and Network for the improvement of quality in higher education, was carried out by CRESALC between 1986 and 1989. The main products of the Quality and Technology project are two books published by CRESALC and four regional and sub-regional training workshops. (See Sections Publications and Training activities).

UNITWIN/ UNESCO Chair Programme

An innovative approach to the transfer of knowledge. Following the decision of the 26th Session of the General Conference of UNESCO, the UNITWIN/UNESCO Chair Programme was established with the aim to assist in the institutional development of higher education in the world and to promote rapid transfer of knowledge by developing university networking and linking arrangements among institutions. The programme lays special emphasis on co-operation among higher education institutions in the developing world and encourage networking at sub-regional, regional and inter-regional level. Focusing on graduate studies and research, the programme promotes visiting professorships and covers a wide range of fields: sustainable development, environmental and population issues, science and technology, social and human sciences' peace, democracy, human rights, the educational sciences, culture, communication. In Latin America, there is a UNITWIN Network of UNESCO Chairs on new technologies of information and communication in distance education for which the University National Abierta in Venezuela is the focal point in collaboration with UNESCO Office in Caracas .

3 UNESCO Chairs are established:

- UNESCO Chair in Information Technology, Universidad de la Habana, co-ordinated by the University of Murcia (Spain) and the Universidad Nacional Autonoma of Mexico
- UNESCO Chair in Computer sciences. University of Mauritius
- UNESCO Chair in Informatics for the Humanities, Institute of Mathematics and Informatics, Vilnius. The present Chair organized in 1994/1995 2 basic courses for postgraduate students:

- Informatics for the Humanities (1st level course) computerized data processing, data bases, academic and research computer networks.
- Informatics for the Humanities (2nd level course) image analysis, multimedia systems. Special courses for developers of telelearning materials in the field of informatics for the humanities are under preparation. To support the teaching and research activities, the Chair had 3 visiting professors, as well as a number of study tours and fellowships.

Within the framework of the UNESCO Associated School Project (ASP), a new ASP international telecommunication pilot project was designed and conducted on 16 November 1995. Entitled *"This is Our Time"* the project involved some 30 schools in 20 countries worldwide and focused on enabling ASP students to share their ideas about the 50th Anniversary of the United Nations and UNESCO and to learn about each other. The pilot project was conceptualized and designed by an ASP school in the Netherlands and funded from extra-budgetary resources.

Under the project *"Promotion of Science and Mathematics Education through Large-Scale Secondary Teacher Training Using Information and Communication Technologies in Uruguay"*, action was initiated and co-ordinated with OREALC, Santiago, in 1994-1995. The project activities started in 1995 and will be continued through 1997. It is planned to use and replicate in the region the experience gained and results achieved in Uruguay.

In addition, numerous national projects and activities have been supported through UNESCO's Participation Programme including the introduction/reinforcement of informatics in technical institutes and universities (Guinea, Sierra Leone, Georgia, Botswana, Republic of Czech , Pakistan, Sao Tome-et-Principe), the use of informatics and information network for educational management (Seychelles, Fiji , Mongolia, Syria, Regional Africa, Gambia), teacher training (West Samoa, The United Arab Emirates, Saudi Arabia), informatics in secondary education (Tonga, The United Arab Emirates, Bulgaria, Burundi, Romania), regional meeting on information technologies and education (Japan), training seminar in educational technology/informatics (Jordan, Oman, Romania, Togo), computerization of the world register of university

studies in Jewish civilization (Israel), training on the use of UNESCO CDS/ISIS Software (Canada), development of computer assisted learning (Turkey), specialists training (Ukraine).

RESEARCH AND POLICIES

Within the framework of the international programme «Children in the information age» a workshop *Informatics at school today and tomorrow* was organized by the Ministry of Education and Science of Bulgaria, the Bulgarian Mathematical Society and UNESCO in Sofia, Bulgaria in November 1994.

Under the project USEIT (Use in Systems of Education of Information Technologies) and in close cooperation with the International Association for the Evaluation of Educational Achievement (IEA), a survey on the situation and tendencies of the countries with regard the introduction of informatics in schools was conducted with the participation of 200 schools in 12 countries

The draft version of an inventory of *"Examples of Secondary School Curricula and Teacher Training Materials"* was prepared in 1995. The teacher training materials include - among others - programmes relating to the use of information and communication technologies for large-scale teacher training.

A sub-regional seminar on the introduction of informatics in secondary education was organized by the UNESCO Regional Office in Dakar (BREDA) in Ouagadougou, July 1989, with the participation of 30 experts from the sub-region in charge of projects in informatics education. The seminar focused on the elaboration of national policies for the introduction of informatics in education and the definition of a strategy for a progressive and selective introduction of .informatics as a teaching tool.

A case study on the experience in Ivory Cost of the introduction of informatics in technical and vocational training was carried out by BREDA. The study provided some information on the potential and means for the introduction of informatics in technical and vocational training.

A sub-regional consultation on the use of micro-informatics in science and technology education was organized by BREDA at the Institute de Recherches Mathematiques of the University of Abidjan (Ivory cost) in September 1989 with participation from Burkina Faso, Cameroon, Mali, Senegal and Ivory Cost.

The consultation examined five sub-themes: Programme and methodologies for computer-assisted learning; Programme and methodologies for a computer-assisted learning in the area of applied mathematics; the software available or to be produced; sub-regional and regional cooperation in the use of micro-informatics in science and technology education. The meeting recommended that micro-informatics for science and technology be introduced at senior secondary school level. Appropriate software to be produced locally by specialists in the sub-region based on existing programmes and manuals were also discussed as a modality for sub-regional cooperation.

A sub-regional seminar on the introduction of informatics in technical and vocational training was organized by BREDA in Dakar in July 1993.

The seminar discussed issues such as the introduction of informatics as both subject and a learning tool in technical and vocational training and the maintenance of equipment. Particular interest was the training of teachers in informatics as a subject, and the training of other teachers in the use of computer in the area of specialization. A programme for the training of trainers ;is well as a specific programme for the training in maintenance was suggested.

TRAINING ACTIVITIES

Regional training workshop for national coordinators of information systems for higher education, science and technology in Latin America and the Caribbean, within the framework of the REDALC Project (Brazil, 1991).

Regional training workshop for users of telematic networks in higher education and science and technology institutions in Latin America and the Caribbean, within the framework of the REDALC Project (Dominican Republic, 1992).

Sub-regional training workshop for the Andean sub-region in the use of new information and communication technologies in higher education and scientific research activities, within the framework of the REDALC Project (Ecuador, 1993).

Regional Training workshop on Mediatics and Telematics in the Academic World, in cooperation with the University of Quebec at Montreal, Canada, as part of the project *"Qualify and Technology in Higher Education in Latin America and the Caribbean "* (Venezuela, 1993).

Regional Workshop on Computer as a Teaching Aid in Higher Education (Alexandria, 13-14 October 1990).

PUBLICATIONS

«*Informatics in Secondary Education*» (English) published in the framework of UNESCO/IFIP cooperation scheme.

«*Calidad, Tecnología y Globalization en la Educación Superior" (Quality, Technology and Globalization in Higher Education"*, as part of the project *"Quality and Technology in Higher Education in Latin America and the Caribbean "* (Published by CRESALC in 1992).

«*Una nueva manera de comunicar el conocimiento"* (A new way to communicate knowledge), as part of the project *"Quality and Technology in Higher Education in Latin America and the Caribbean"* (Published by CRESALC in 1993).

"Present and Prospects of Telematic Academic Networks in Latin America and the Caribbean ", as part of the REDALC Project (To be published by CRESALC in 1996).

As a follow-up action to the International Congress on Education and Informatics held in Paris in April 1989, a publication entitled *The Influence of Computers and Informatics on Mathematics and the Teaching* as Document no. 44 in the Science and Technology Education Documents Series in 1992.

A Guide book for the teaching of informatics in secondary level technical and vocational training was published by BREDA in 1994. The book describes some methodologies for the elaboration of teaching programmes in secondary level technical and vocational training.

(II) INFORMATION TECHNOLOGIES AND THE ROLE OF TEACHERS

RESEARCH AND POLICIES

In February 1994, a workshop was organized in conjunction with the Commission of the European Communities, the University of Twente and UNESCO under the theme *Teacher education and information and communication technologies: Issues and Experiences for Countries in Transition* (Enschede, The Netherlands). UNESCO granted 25 fellowships for the participation of specialists from Central and Eastern Europe. The workshop examined the use of communication and information technologies (CIT) in teacher education in Europe, and identified cooperative links for further partnerships among Western, Eastern and Central European CIT specialists in teacher education. Following the workshop, the publication *Information technologies in teacher education* (English) was published.

A study entitled *"Teacher Education, Open Learning and the Use of Information Technologies. An International Perspective"* is being finalized under contract with the Center for Research in Teacher Education, School of Education, The Open University.

TRAINING

In Africa, two sub-regional seminars on teacher training in informatics in technical and vocational training were held: in Harare, Zimbabwe in May 1993, and in Dakar, Senegal in July 1993. The major objectives of these meetings were to orientate those responsible for introducing computers into education towards the locally developed and produced materials and methodology for the training of teachers in informatics in order to facilitate the teaching and learning processes in technical and vocational institutions. The seminars focused on teaching informatics as a subject matter, the pedagogical applications of computers for teaching various subjects, and caching in computer maintenance.

PUBLICATIONS

Within the series Teacher Education, a handbook for teachers *Informatics in General Education* was published in 1994 (series No. 3).

(III) DEVELOPMENT OF INFORMATICS IN EDUCATION

DEVELOPMENT PROJECTS

The Programme INFORMAFRICA - Informatics in the Service of the Development of education in Africa was created in 1990 with the aim of helping African countries to introduce advanced technologies for educational purposes. The activities consist of training in and through informatics of teaching staff: management and administrative personnel in education) training of maintenance personnel that could take up the responsibility of maintaining the hardware locally at a relatively low cost rather than importing expatriates at high costs, training in the production of educational software at low cost with the participation of teachers and computers/software specialists.

INFORMAFRICA has started by a regional seminar organized by UNESCO within its Priority Africa Programme and in cooperation with the Agency for Cultural and Technical Co-operation (ACCT) in December 1990 in Lome, Togo, with the participation of 37 African Member-States. The seminar discussed the policy and strategy of incorporation of informatics in education, programmes of action for research and development, the production of educational software, maintenance and the problem of national languages, and the modalities for inter-African and international cooperation.

Within the framework of INFORMAFRICA, UNESCO through its Regional Office in Nairobi, has been involved in the following activities:

Conferences/Seminars/Workshops

- An international conference and exhibition on «Computer-based automation in developing countries (AUTO-DC '95)» was held in May 1995 at Enugu, Nigeria with the participation of 198 experts from various fields such as educators, researchers, computer consultants, vendors, computer managers/directors, planners and users.
- A workshop on informatics education was held in August 1995 at Ogbomoso, Nigeria with the participation of teachers from the universities, secondary schools. Federal Colleges, Ministry of education and private sector. The outputs of the workshop include recommendations regarding pre-university education in informatics and curriculum proposals for the teaching and learning of informatics in Nigerian secondary schools.
- In March 1995, a regional Forum de L'informatique, de la Bureaucratique, des Résuaux et de l'Electronique (FIBRE 95) was organized by the Centre National de Développement de l'informatique (CENADI) in Cameroon, with 237 participants from the sub-region.
- A national workshop for the drafting of curriculum for the teaching and learning of informatics in secondary schools in Kenya was organized by the Kenyan National Commission for UNESCO, involving educators, curriculum developers and informatics experts.
- A National Conference «Computers and National Development» was organized by the Computer Association of Nigeria (COAN) in Ilorin, Nigeria in May 1994. The Conference brought together 200 participants comprising educators, researchers, computer consultants, vendors, computer managers/directors, planners and users from within and outside Nigeria.

Projects

Under the project «Introduction of Computer Literacy in Secondary School in Malawi», a survey of computer courses to be introduced in secondary

schools was carried out and training modules were produced. Computer equipment was procured and training workshops for teachers were organized. Introduction of the computer courses in selected secondary schools is expected to start in April 1996.

Research

The Centre des Techniques Informatiques (CTI) Lome, Togo, undertook a research study on the introduction of informatics into the education curriculum at secondary school level in the sub-region, between December 1994 and March 1995. The output of the study covered the strategy and policy for informatics education in secondary schools.

Training

- A three month training course in Micro informatics maintenance was organized at Yaba College of Technology, Nigeria, from September to November 1995 with the participation of 26 Nigerian trainees from the public and private sector.
- A «training the trainers» course in informatics was organized at the University of Swaziland in September 1995 with the participation of teachers from the local teacher training colleges. The course content included an introduction to computers and to computer applications(dBase, Wordprocessor and Spreadsheet).
- An on-the-job training programme in computer utilization was developed for and implemented at the Directorate of Public Service Information Technology Management in Namibia between May 1994 and August 1995. Computer equipment was also procured for this purpose.
- Under the project *Establishment of Computer Training Programme for Tanzania Women Scientists,* 8 women researchers and technologists were trained in computer skills at various levels between June 1994 and November 1995.

In order to widen the use of informatics in many areas including education and training, the development of national, regional and international networks in informatics is an important activity. Through IIP, UNESCO contributes to the launching and development of regional informatics networks which aim at linking institutions at regional level and serving as a bridge between national and international networks.

The Regional Informatics Network in Africa (RINAF) was established, with the objective of bringing together African scientists and academicians and facilitate exchange of scientific and technological information, thus fostering cooperation between them through:

- providing opportunities for countries in the region to share scarce resources (hardware, software, information, data etc.);
- serving as a gateway for Africa to link up with other similar networks in the region; minimizing duplication of time, money and materials in developing similar facilities;
- providing a unique opportunity for African students and academicians to interact via network brain-tapping and exchange of views on diverse topics;
- providing means for African informaticians to explore the resources of high performance computers and large databases that reside outside Africa.

A survey of the African institutions earmarked for participation in RINAF as communication and service nodes was made, as well as the specification and installation of additional hardware and software needed by the regional nodes, and training for regional nodes officials and on-the-spot training for operators responsible for the networks in the regional nodes were organized.

Experiments were carried out involving the exchange of messages and data between regional nodes and with international networks such as Internet and Rio, via links between Algiers and Pisa and between Dakar and Montpellier.

A workshop on the networks and the educational applications of informatics for the RINAF nodes in Southern Africa was organized in Zimbabwe in June 1994 .

In Arab States, the RINAS network aims at linking the countries of the Maghreb (Algeria, Morocco, Mauritania, Libya, Tunisia) and five Middle Eastern countries (Egypt, Jordan, Lebanon, Syria, Yemen) with the other Arab countries grouped in GulfNet. The actions taken within the context of the RINAS include:

- writing the technical specifications and supplying the additional hardware and software needed by the institutions chosen for RINAS to enable them to establish links with each other.
- making an inventory of the services offered by each institution, including messaging and data base, with a view to making them accessible through the network. A messaging system enables the institutions to communicate with each other and to communicate with other institutions through international networks.

In Europe, The RINEE has been the subject of a feasibility study involving network specialists from Eastern Europe. RINEE is in an experimental phase in six Eastern European countries (Bulgaria, Czech Republic, Estonia, Russia, Slovak Republic, Ukraine). The feasibility study has, made it possible to define:

- a general architecture for the links between the institutions in each country chosen as communication nodes.
- The technical means needed to establish the links and the additional hardware and software required. The additional equipment has been supplied and has made it possible to set up a messaging system and to gain access to Western European networks.

The BALTBONE network is a network that links the research and higher education networks of the three Baltic countries. Equipment has been supplied to Estonia, Lithuania and Latvia so as to link together three institutions, one in each country, themselves connected to the national research and education networks. The same equipment provides links with the international networks via the countries of Northern Europe.

In Asia, network-related activity is intense and corresponds to a highly diverse situation on the various economic, technical and human levels. An effort has been made to harmonize and coordinate initiatives under both RINSCA (South and Central Asia) and RINSEAP (South-East Asia and the Pacific).

A co-ordination meeting for RINSCA and RINSEAP was organized in New Delhi in November 1991. A regional seminar on the management of informatics networks was held in Melbourne in April

1993, jointly with the third RINSEAP planning meeting. The meeting examined the results of a study of the feasibility of an informatics network within RINSEAP carried out by New Zealand with IIP financing.

Within the framework of IIP, the following activities provided support to regional information networks:

- Computerization of student management at the National University of Engineering; testing of the Nicaraguan academic research network and organization of the international informatics congress, Nicaragua, 1992.
- Strengthening of the Sabaragamuwa affiliated University College's Regional Computer Centre, Sri Lanka.
- Establishment of a postgraduate training course in informatics applied to the water sciences, at the Ecole Inter-Etats d'Ingénieurs de l'Equipement Rural, Burkina Faso, 1989.
- Strengthening post-university training in software engineering, Sudan ,1994.
- Support to the education and research network, Baltic countries, 1992.
- The use of networks in distance education, Lithuania, 1992,
- Regional information network on educational software, Argentina, 1992.
- The development and production of educational software in Spanish-speaking countries of South America, 1989.
- Teacher training in informatics with a view to developing informatics application for education, Bolivia, 1992.
- New training syllabus in educational informatics, Cuba, 1992.
- Evaluation of educational software developed in Korea, 1992.
- Strengthening of a management system at Nouakchott University Services, Mauritania, 1992.
- Computer training for Government Offices staff in Equatorial Guinea, 1994.
- Organization of the Ibero-American Congress on educational informatics, Venezuela, 3992.
- Organization of the Congress on computers, education and society, Dominican Republic, 1992.
- Introduction of the use of micro-informatics in science and technology teaching in secondary schools, Nigeria, 1989.
- Computer-based education. El Salvador, 1991.
- Software production for science and technology teaching. Ivory Coast, 1989.
- Introduction of computer literacy in secondary schools, Malawi, 1994.
- Development of multimedia applications for handicapped children, Argentina, Paraguay 1994.

The Learning Without Frontiers Programme (LWF) Following the recommendations of the *Ad hoc forum of reflection on UNESCO's role in the last decade of the twentieth century,* convened by the UNESCO Executive Board in October 1993 (142EX/37), the Learning Without Frontiers Programme was launched with the aim of promoting learning increasingly free from restrictions as to when, where, at what age and in what circumstances it is to take place. Member States are encouraged and assisted in finding ways to «reach the unreached» and to diversify their education services to meet the learner's specific needs throughout their active life using diverse delivery systems -both formal and non-formal- including open and distance learning modalities.

Recognizing the potential of modern advances in technology to lower barriers surrounding traditional, institution-based education, specific attention is given to the integration of emerging technologies with existing ones while developing approaches that benefit the unreached and underserved.

A number of activities have been initiated within the framework of LWF programme, such as the coordination of the Joint Distance Education Initiative of the Nine High Population countries, launched by the nine high population countries as an attempt to exchange experiences in the use of distance and open learning in the provision of education for all.

Feasibility studies are carried out in India and Morocco for a Joint UNESCO/ITU pilot project for teacher education which makes use of television, telecommunication and computers. The project focuses on developing a learning model for in-service teacher training using the emerging capacities of interactive television. It is anticipated to lead to the definition of a flexible, durable system spanning a range of needs found in developing countries where the educational problems are most acute. "The system will incorporate the necessary flexibility to accommodate the range of delivery and telecommunications channels likely to be available to it, including terrestrial broadcasting, satellite and the public switched telephone networks(PSTN).

In collaboration with the International Centre for Distance Learning (ICDL), a data base on the use of electronic media in open and distance education is being developed and an analytical study prepared.

RESEARCH AND POLICIES

Following the recommendation of the first International Congress «Education and Informatics» a seminar «A European Platform to develop a mechanism for cooperation in the field of information technologies in education» was held in Moscow in June 1991 with the purpose of reviewing the present situation concerning the use of information and communication technologies in education and to elaborate on a possible platform for a more intensive cooperation. The meeting which brought together 70 participants from 19 European countries representing various fields such as education, technology, communication, information, and industry, focused on the central role of the teacher at all levels of education and training, and as a consequence, the crucial importance of the training of teachers in order to enable them to master the use of computers. It was emphasized that in order to create an effective interaction between hardware, software and educational personnel, the use of information technologies should be included in early phase of designing educational policies and planning curricula and teacher training programmes.

The importance of fast and easy access of educators to educational data bases was emphasized. In this respect, a special attention should be given to efforts to establish computer networks at

sub-regional and regional level, as well as international networks such as BARN or INTERNET.

The development of educational software was given considerable attention whereby the close co-operation between educationists and software developers was viewed as a prerequisite of relevant software. At the same time, the protection and preservation of languages and cultural identity should be taken into consideration in the context of international standardization of information technology.

Modalities of European cooperation such as exchange of documentation, software, researchers, trainers as well as human, scientific, technical and financial means were discussed. In order to encourage sub-regional and regional cooperation, it was suggested to provide more opportunities for specialists in Eastern Europe to participate in international seminars, congresses and summer schools. Organizations such as UNESCO should support cooperation projects with Eastern European countries concerning hardware, software, and training.

The seminar had a positive impact as regards future perspectives concerning the role of information and communication technologies in education and the development of a cooperative framework.

Within the framework of the project Information Technology in Education of Children (ITEC), a multinational investigation was made on the impact of classroom computer use on children's high level cognitive functioning. The study which involved 25 countries, focused particularly on the reflection to the psychological and social consequences for the children from the application of the information technologies in education and the systemic investigation of the influence of different types and modes of information technology application in education on children's specific cognitive and social skills. The results of the study were presented at the Fourth International Conference «Children in the Information Age: The Impact of Technology in Education on Children» , Albena, Bulgaria, May 1991.

An international UNESCO symposium on *Copyright and Communication in the Information Society (global infrastructure, protection of rights, economic and cultural impact)* was held in Madrid, March 1996. Among other themes, the symposium focused on the author's rights in cyberspace, questioning whether additional law is needed to secure authors' rights in cyberspace, and suggesting that, while the need for more legal protection in cyberspace at national and international levels is being raised strongly, the issue of law reinforcement should be approached carefully through observing how cyberspace and markets for digital copies of copyrighted works develop and broadening discussions among governments, authors, users and publishers, in order to find out the right form of regulation suitable for everybody. The symposium discussed as well the potentials and challenges of the information highways in the widening of access to education.

- An expert meeting was held in Yalta, Ukraine, in September 1994 in conjunction with the East-West Conference on computer technologies in education,

- Regional Consultative Meeting of Experts on the Utilization of Micro Computers in the Teaching of Science and Technology (Cairo, 28 May-1 June 1989). This meeting was organized by UNEDBAS in cooperation with the Egyptian National Commission for UNESCO. Twenty five participants attended the meeting from the United Arab Emirates, Jordan and Egypt, representing educational institutions, information and computer centers, universities and other scientific institutions concerned with the use of computers in mathematics and technology. During the meeting, the participants formulated a number of recommendations related to the exchange of experience and expertise among the Arab States, the establishment of computer associations and the provision of support to those already established.

- Study on the *"Objectives of Computer Education in Science and Technology»* presented at the "Regional Consultative Meeting of Experts on the Use of Computers in the Teaching of Science and Technology" held in Cairo, 28 May - 1 June 1989 (Arabic, 15 pages).

- A Regional Seminar on Information and Computer Networks in the Arab Region (Damascus, 9-14 September 1989) was organized and conducted by the UNESCO Regional Office in Cairo (ROSTAS) and supported by UNEDBAS .

- A Regional Expert Meeting on Science and Technology Popularization and Networking (follow-up to UNESCO Project 2000+ on Science and Technology for All (Damascus, 16-19 May 1994) was attended by 11 participants, among them 6 women, from 11 Arab Member States, namely Algeria, Bahrain, Egypt, Iraq, Jordan, Kuwait, Lebanon, Morocco, Qatar, Syria, Tunisia. Recommendations related to popularized scientific concepts in the programme and curriculum of formal and non-formal basic education were adopted. Attention was also devoted to the diversification of educational aids and technologies and exchange of information knowledge and experience in the context of regional and international co-operation.

PUBLICATIONS

«A Modular Curriculum in Computer Science» was published in the framework of UNESCO/ IFIP cooperation scheme.

«Les Nouvelles Technologies: Outils d'enseignement » by Henri Dieuzeide;

«Education and Informatics Worldwide: State-of-the-Art and Beyond» makes a attempt to look beyond the more immediate future in terms of a closer interaction between education and informatics at international and regional levels.

PARTICIPATION IN SEMINARS AND CONFERENCES

EDUCOM Conference in Atlanta, USA. This Conference gathered together about 4.500 researchers and educators from all regions of the world interested in the use of information and communication technologies at all levels of education (November 1994).

Iberoamerican Conference of the Iberoamerican Network for Education and Informatics (RIBIE) (Santo Domingo, Dominican Republic, June 1993).

Annual International Networking Conference of the INTERNET Society (San Francisco, USA, August, 1993).

III Regional Forum on Telematic Academic Networks in Latin America and the Caribbean

(Caracas, Venezuela, November 1993).

Annual International Networking Conference of the INTERNET Society (Prague, Czech Republic, June 1994).

IV Regional Forum on Telematic Academic Networks in Latin America and the Caribbean (Buenos Aires, Argentina, November 1994).

International Conference on Tele-Teaching (Trondheim, Norway, August 1994).

Annual International Networking Conference of the INTERNET Society (Honolulu, USA, June 1995).

V Regional Forum on Telematic Academic Networks in Latin America and the Caribbean (Lima, Peru, April, 1994).

Annual International Networking Conference of the INTERNET Society (Montreal, Canada, June 1996).

(IV) INFORMATION TECHNOLOGIES AS A TOOL FOR EDUCATIONAL MANAGEMENT

DEVELOPMENT PROJECTS

Within the framework of the Major Project of Education in Latin America and the Caribbean, UNESCO has developed computer analysis models to counter the deficiencies inherent in the poor quality and reliability of statistical data in order to promote research and information *for* decision making in education.

UNESCO is sponsoring an «item bank» and conducting academic performance measurements in 12 countries. Eventually, this data will be processed and related to all information available on schools which are part of the respective samples. Progress has also been made in terms of functional illiteracy characterization, with seven countries having been measured, so far.

The creation and systematic use of basic indicators on education is another area where considerable progress has been observed. The limited use of available information may be attributed to the scarcity of analytical models, computer time and software programmes, and specialized human resources. The Regional Information System in Latin America and the Caribbean (SIRJ) has been responsible for developing models that measure access to primary education , entry age, permanence in the system, progress in the higher grade basic education, and grades ultimately passed. SIRJ has also developed analytical models designed to integrate the finding of multiple research on the causes of low quality education , high repetition and temporary drop out rates.

Through its Regional Office for Asia & the Pacific (PROAP), UNESCO provides support to the development of Educational Management Information Systems (EMISes), which consist of the establishment of reliable information systems for the processing and production of education information such as education indicators in Asia and the Pacific countries. EMISes are broadly used by planners and administrators to assess the performance of the school system and the level of attainment and investment policies, and they are key tools to monitor the progress of education and to ensure the sustainability of funding and renewed interest in the education and training.

HEMIS (Higher Education Management Information System) is a component of the broader field of higher education management which covers, *inter alia,* institutional and staff development. HEMIS refers to the use of computerized management of universities and similar institutions: academic records, enrolment and timetabling are a few examples of its many applications UNESCO has undertaken activities in this area to promote research and training. The International Institute for Educational Planning (IIEP) as well as the UNESCO Regional Office in Bangkok (PROAP) organized training seminars within the framework of HEMIS. A study on the needs of African universities in this area was completed in 1995 within the framework of the joint UNESCO/ACUCHEMS Higher Education Management Programme.

TRAINING

- As a part of Ghana Government's action plan to increase management capacity in higher education, a training on the skills of computer-assisted time tabling and academic programming was organized for University Officers at Legon University , University of Science and Technology and University of Ghana.

- Regional Seminar on Strengthening Information and Data Base on Girls and Women Education with emphasis on rural areas (Cairo 2 - 7 November 1995).

This meeting was jointly organized with ISESCO and in cooperation with the Institute of National Planning in Cairo. 18 participants, among them 6 women, from Jordan, United Arab Emirates, Oman, Sudan, Syria, Iraq, Palestine, Qatar, Morocco, Mauritania, Yemen, Lebanon and Egypt attended the meeting. The output of the meeting was the production and distribution of one manual on the improvement of data collection methods with respect to education of females in basic education in early 1996.

PUBLICATIONS

«Micro-informatique, gestion et planifIcation de l'education en Afrique» was published by BREDA with the aims of reinforcing capacities of educational planners, administrators and managers in the application of informatics in the management of education system in Africa.

(V) INFORMATION TECHNOLOGIES FOR THE DEVELOPMENT OF DISTANCE AND OPEN LEARNING

DEVELOPMENT PROJECTS

Interactive Distance Education through Tele-Seminars: A combination of satellite T.V, written materials and discussions through INTERNET. In Latin America, UNESCO has initiated a pilot project on tele-seminars through the use of the Spanish satellite HISPASAT with the purpose of creating a powerful interactive learning tool among universities in the region. Under the coordination of UNESCO Regional Office in Santiago (OREALC) and in cooperation with the Iberoamerican Association of Educational Television (ATEI), a first tele-seminar on environment education was organized in the first semester of 1995. The material composed of video programmes and written material presenting a variety of experiences in the field of environment education was co-produced by 7 institutions from Chili, Colombia, Honduras, Mexico and Spain. The programmes transmitted via HISPASAT during 7 weeks was complemented by the use of E-Mail in order for all participants to interact with each other. This activity targeted to postgraduate students in education, teachers and professionals interested in the topic opened innovative discussions in environment education in 18 Universities in 10 countries of Iberoamerica.

A second Tele-Seminar on the topic « Quality in Education » was carried out in November/December 1995 and March/April 1996 with presentations of 10 institutions from 9 countries and the participation of 38 institutions from 11 countries.

Creation and support to the Network for Innovations in Distance Higher Education (RIESAD), within the framework of UNITWIN Programme and the Programme "Learning without Frontiers . The network is coordinated by the National Open University of Venezuela with the cooperation of the main distance education universities and higher education institutions from Brazil, Bolivia, Costa Rica, Ecuador, Mexico and Peru. This project and network has produced several training workshops, multimedia courses and telematic courses through the INTERNET (See Section Training activities). CRESALC will publish a book on *"Present and Prospects of Distance Higher Education in Latin America and the Caribbean"* which gathers the first results of the project and the main trends problems and innovations of distance education in the region (See Section Publications).

UNESCO Series of Learning Materials in Engineering Sciences. Taking advantage of recent advances in information technologies which make affordable the production of multimedia learning materials, UNESCO has developed a series of distance learning materials in engineering sciences which provide new generations of engineers entering the world of industry and practising engineers already working in it with opportunities of studying at their own pace a subject which requires constantly an updating of knowledge. The first series of learning materials for undergraduate level engineering course were conceived for Africa within the framework of the project «African Network of Scientific and Technological Institutions» linking 50 scientific and engineering departments located in 32 sub-Saharan African countries. In 1991, a bulletin *UNESCO Series of Learning Materials in Engineering Sciences for Africa* was published.

A *Multimedia Postgraduate Learning Materials in Environmental Engineering* was developed comprising six modules on environmental engineering. The learning packages which are at the same time suitable for delivery and use in the formal classroom environment, consist of a combination of the following:

- structured written texts;
- video and audio cassettes;
- Interactive Computer Assisted Learning Programmes.

The structured text is presented to the end-users in the form of computer diskettes for viewing on a computer monitor or capable of being reproduced in loose or bound sheets at the user's end. This form of presentation has the advantage of mass production and therefore results in a relatively cheap unit cost to the end-user as compared with the high cost of standard text books.

The package is designed to be user-friendly and has a self-assessment software which enables students to assess their own understanding on a regular basis at their own pace.

The International Institute for Educational Planning (IIEP) has started in cooperation with the Russian State Committee for Higher Education (SCHE), a distance learning course on institutional management in higher education using Internet. The course which uses IIEP training materials is attended by senior administrative staff from 10 selected universities in the Russian Federation.

RESEARCH AND POLICIES

An Open Classroom Conference was organized by the European Distance Education Network (EDEN) and The International Council for Distance Education (ICDE) with the support of UNESCO in Oslo, Norway, in September 1995. The Conference's discussions, which focused on various topics concerning distance education and the use of technologies in education, were transmitted through satellite to schools and universities in Europe interested in the use of information technologies.

TRAINING ACTIVITIES

Regional Workshop on New Information and Communication Technologies in Distance Education, as part of the RIESAD Project and Network (Venezuela, 1994).

Tele-conferencing Workshop on Distance Edu-

cation, as part of the RIESAD Project and Network (Several countries simultaneously through satellite communication and follow-up by electronic mail through INTERNET, 1995).

PUBLICATIONS

- Book on *"Present and Prospects of Distance Higher Education in Latin America and the Caribbean "*, as part of the RIESAD Project and Network (To be published by CRESALC in 1996).

- World Wide Web information server on the INTERNET with information, documents and publications about distance higher education in Latin America, as part of the RIESAD Project and Network (In preparation, to be opened to the public in 1996).

ANNEX I

DOCUMENTS AND PUBLICATIONS

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Directory of the international network for information in science and technology education (INISTE). Paris, UNESCO, 1992, 157 pp. ED-92/WS/8 (Bilingual: E,F)

Education and informatics worldwide. The state of the art and beyond by Jacques Hebenstreit et al. London, Jessica Kingsiey; Paris, UNESCO, 1992,253 pp. ISBN 1-85302-089-3 & ISBN 92-3-102798-0

Education and informatics: strengthening international co-operation. International congress, Paris, 12-21 April 1989. Final report. Paris, UNESCO, 1989, 1 16 pp. ED/89/CONF/402/COL.4 (E,i-)

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Education in informatics for women by women: International workshop edited by Ingrid Ellebrecht et al. Hamburg, Germany, 30 November - 3 December 1992. Hamburg, UNESCO-UIE, 1993, 125 pp. (UIE reports, 12) ISSN 1014-9880. (Bilingual: E/G) (Available only from UIE)

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Glossary of educational technology terms. Paris, UNESCO-IBE, (IBEdata). Bilingual: E/F, 1987, 263 pp. ISBN 92-3-002517-8. Bilingual: E/G, 1992, 276 pp. ISBN 92-3-002790-1) ; Bilingual: 17R, 1986, 239 pp. ISBN 92-3-002437-6 ; Bilingual: E/S, 1986, 243 pp. ISBN 92-3-002436-8.

Guidebook for the development, distribution and evaluation of educational software. Bangkok, UNESCO/PROAP, 1990. BKL/90/OP/458-650 (Available only from PROAP)

IIP/PH. Documents of Intergovernmental Committee for the Intergovernmental Informatics Programme. Final reports, conclusions and main working documents of the sessions 1986 - 1994. Paris, UNESCO/IIP. (E,F)

The Influence of computers and informatics on mathematics and its teaching by Bernard Corny and Anthony Ralston. Paris, UNESCO, 1992, 133 pp. (Science and Technology Education Documents Series, 44.)

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Informatics as a subject matter. Seminar on teacher training in informatics in technical and vocational training, Harare, 24-28 May 1993. Harare, UNESCO Office, 1993, 47 pp. (Available only from UNESCO Office Zimbabwe)

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Informatics Newsletter. Biannual Newsletter. UNESCO Regional Office for Science and Technology for the Arab States (ROSTAS). Cairo, UNESCO/ROSTAS.

Information technologies in teacher education. Issues and experiences for countries in transition. Edited by Betty Collis, Iliana Nikolova and Katerina Martcheva. Proceedings of a European Workshop, University of Twente, Enschede, Netherlands, 20-23 February, 1994. Paris, UNESCO, 1995, 317 pp. ISBN 92-3-103072-8

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ANNEX II

LIST OF ABBREVIATIONS

- ACCT Agence de Cooperation Culturelle et Technique
- ACU Association of Commonwealth Universities
- ASP UNESCO Associated Schools Project
- ATEI Iberoamerican Association of Educational Television
- BALTBONE Baltic countries education and research network
- BREDA UNESCO Regional Office for Education in Africa
- CDS/ISIS Computerized Documentation System/Integrated Set of Information System
- CEPES UNESCO European Centre for Higher Education
- CHEMS Commonwealth Higher Education management Services
- CIT Communication and information technologies
- CPSC Colombo Plan Staff College for Technician education
- CRESALC UNESCO Regional Centre for Higher Education in Latin America and the Caribbean
- EIMIS Educational Management Information System
- FUNREDES The Foundation for Networks and Development
- HEMIS Higher Education Management Information System
- HISPASAT Spanish satellite
- IBE International Bureau of Education
- ICDE International Council for Distance Education
- ICDL International Centre for Distance Learning
- IEA International Association for the Evaluation of educational Achievement
- ITIP International Federation for Information Processing
- IGO Intergovernmental Organization
- IIEP The International Institute for Educational Planning(UNESCO)
- IIP Intergovernmental Informatics Programme
- ILO International Labour Organisation
- INFORMAFRJCA Informatics in the Service of the Development of education in Africa
- INISTE International Network for Information in Science and Technology Education
- ISESCO Islamic Educational, Scientific and Cultural Organization
- ITEC Information Technology in Education of Children
- ITU International Telecommunication Union
- LWF Learning Without Frontiers
- NGO Non-governmental Organization
- OREALC UNESCO Regional Office for Education in Latin America and the Caribbean
- PROAP UNESCO Principal Regional Office for Asia and the Pacific
- PSTN Public switched telephone networks
- REDALC Project Support to Telematic Academic Networks for Research and Teaching in Higher Education, Science and Technology in Latin America and the Caribbean
- RIBIE Iberoamerican Network for Informatics and Education
- RIESAD Network for Innovations in Distance Higher Education
- RINAF Regional Informatics Network in Africa
- RINAS Regional Informatics Network in the Arab States
- RINEE Regional Informatics Network in Eastern Europe
- RINSCA Regional Informatics Network in South and Central Asia
- RINSEAP Regional Informatics Network for South-East Asia and the Pacific
- ROSTA UNESCO Regional Office for Science and Technology in Africa
- ROSTAS UNESCO Regional Office for Science and Technology in the Arab States
- SCHE Russian State Committee for Higher Education
- SIRI Regional Information System in Latin America and the Caribbean
- VIE UNESCO Institute for Education
- UNEDBAS UNESCO Regional Office for Education in the Arab States
- UNESCO United Nations Educational, Scientific and Cultural Organization
- UNEVOC UNESCO International Project on Technical and Vocational education
- UNITWIN University Twinning
- USEIT Use in Systems of Education of Information Technologies

ANALYTICAL SURVEY

ON THE ISSUE OF "EDUCATION AND INFORMATICS"

(NOTIONS, CONDITION, PROSPECTS)

PREFACE

This analytical survey on the issue of "Education and informatics" was prepared by a group of Russian specialists representing the International System Research Center for Higher Education and Science, Institute of Problems of Informatics of the Russian Academy of Sciences and the Russian Academy of State Service affiliated with the President of the Russian Federation at the request of UNESCO Education Department in the framework of preparation for the Second International UNESCO Congress entitled "Education and Informatics" (Moscow, July 1-5, 1996).

At the first Congress that took place in 1989 in UNESCO headquarters in Paris it was emphasized that "application of new information technologies in education is vital for using the advantages of the collective expertise and joint utilization of limited resources" and for this purpose expanding the international cooperation was highly recommended.

The letter of UNESCO General Director F. Mayor dealing with the Congress, its objectives, programs and topics, participants as well as other aspects distributed by the UNESCO headquarters in January 1996, states that the international cooperation in that sphere is now becoming even more critical than ever. In recent years the sphere of information and communication technologies is tending toward significant progress and as a result, generations of computer equipment and software are rapidly substituting one another and these innovations integrate into other technologies. It has also resulted in emergence of previously unexplored combinations of information means that leads to forming an "information society". Creation of information super highways urges the education sphere to detailedly revise its situation which is extremely vital given the conditions of rapid development of technologies in comparison with the possibility of their application at all levels of education.

Even countries with the most advanced education system fail to effectively solve the range of problems the education endures entering the 21st century. The Congress would be a fine meeting point for nations of the whole world. It will contribute to the development of international contacts in the education sphere, precise formulation and coordination of national education systems. Basically, the major issue the Congress is dealing with is the national and international strategies in the education sphere, organizational and technological forms for implementing this policy. The modern strategy in 1 lie education sphere is formulated based upon new information technologies and the legal and legislative principles that form the foundation of concrete decisions and results. That is why the word "Education" was deliberately put in the first place in the title of this Congress.

In this regard, the Congress will be dealing with an analysis of national, regional and international trends as well as the expertise of introducing and applying the new information technologies in education systems. It will also include a review-of state-of-the-art works in the sphere of new information technologies and study of their application in the education sphere as well as discussion of international, regional and national policies in using new information technologies in education and formulation of recommendations with regard to international cooperation.

It is essential that organizers of the Congress assumed that education is the top priority that is why the UNESCO General Conference chose Russia as the host country for holding the Congress which has achievements in education recognized all over the world. In addition to the role of the host of this global meeting, Russia will also act as a country running in the forefront of the education sphere and applying new technologies for developing it. The country possesses centers for computerization of higher and secondary education supported by the state. This centers offer methodological works and test samples of program complexes in a number of program spheres. There are also a series of tools for mastering and perfecting professional skills in technically complex professional spheres. These centers hold conferences and seminars, release numerous publications on the issue on the agenda.

For example, materials of the International scientific methodological conference entitled "New Information Technologies in University Education" alone (regarding mostly Russia and just certain CIS member-states) published by the Russian State Higher Education Committee and the Scientific Research Institute for mathematical and information education fundamentals affiliated with the Novosibirsk State University (Novosibirsk, 1996) totaled 24.5 quires. More than 220 reports offer works of specialists in the following directions:

- problems of higher education informatization;
- computer technologies in teaching natural science disciplines',
- computer technologies in teaching humanitarian and social economic disciplines:
- teaching informatics:
- distance education in higher schools:
- teaching computer systems in schools:
- instrumental means for developing teaching computer programs:
- application of computer networks and telecommunication systems in education.

It is important to point out that reports delivered on all topics are extremely practically articulated.

The Russian National Report entitled "Policy in the Sphere of Education and New Information Technologies" that will be delivered at the UNESCO International Congress offers an inclusive review of numerous directions in development of education and application of new information technologies. This report actually reflects the official opinion of state institutions education administrative organizations regarding the issue in hand.

On the other hand, it seems interesting and useful to set forth independent expert opinions represented by famous Russian specialists in the sphere of education and informatics regarding problems that are to be discussed at the Congress. The analytical survey was given birth in this regard. Its authors, according to the topic sequence of the Congress, analyze the current situation in Russia as opposed to other countries with regard to directions that fully correspond to the subject of the forthcoming international forum and render their opinions on each direction according to their own experience and domestic works available.

The section dealing with Russia's policy in the sphere of education and informatics sets forth the major principles and strategic objectives of Russia's education policy, shows the necessity of the country's education system informatization as an indispensable condition and a critical stage for the informatization of the entire country. It also describes the major directions of works covering practically all sides of pedagogical and scientific activities that will undergo reforms as a result of applying the new information technologies as well as renders a review of conditions and trends in developing the course of informatics in secondary and higher schools all over the world. It is pointed out that studies of informatics in the form of an obligatory course in secondary and higher schools that commenced quite recently - in the last ten years - is currently being conducted on a permanent basis in all higher education facilities and colleges of not only the developed countries but in many developing ones as well. In this context, the trend toward dispersing the course in the education sphere is showing a persistent growing curve, the contents of the course is undergoing changes and gradually assumes new features. The reason for these changes lies in the fact that the process of society informatization is now taking a global scale embracing practically all countries of the world including Russia. That is why knowledge of informatics fundamentals, its possibilities and prospects for development becomes necessary for basically all members of the modern society.

The survey also deals with the still controversial issue of choosing the name for the course of informatics. One of the compared titles is "Computer Science" (this term is popular mostly in the US, Canada and several countries of Latin America) and the other is "Informatics". The authors deem the second name more appropriate since it reflects the information orientation of the subject sphere of this scientific and educational discipline to a greater extent.

The survey emphasizes the necessity, importance and timeliness of drawing the attention of UNESCO leaders as well as those of education authorities, scientists and pedagogues of various countries of the world and the mass media to the fact that today informatics is one of the most important and lucrative "points of growth" of the world science with a new complex of information sciences forming around it. In this respect, it is necessary to recast not only the contents of the informatics course and technical disciplines similar to it (such as computers and cybernetics) but also a number of humanitarian disciplines such as philosophy, economics, sociology and psychology. The works of Russian scientists present information and scientific knowledge as important strategic resources for further development of the civilization and the problem of activation and effective use of these resources is given the top priority as the most important one among other scientific technical and social economic problems the modern society faces.

The preparation and organization of teaching the special educational course entitled "Social Informatics" which is a new and prospective complex scientific and educational discipline, is undoubtedly deemed as an achievement. Russia's expertise in introducing such courses as "Theoretical informatics" and "Information Technologies in the System of State Service Bodies" appears to be unique.

The analysis shows that during the last ten years of active application of new information technologies in education, the pedagogical software did not drastically change teaching in secondary schools with the computer serving more like an instrument assisting teachers in conducting their classes traditionally. On the other hand, application of computers made it possible for higher schools to introduce an effective computer experiment in a number of courses.

The major obstacle for developing pedagogical software is not the lack of instrumental means but the lack of purely pedagogical materials for implementing it on computers. It is necessary to form creative groups composed of practicing teachers, teachers-methodologists, artists, screenplay writers, programmers and other specialists.

It is also pointed out that the new model of using in schools one or two modern multimedia computers instead of purchasing a set of educational computers is most expedient.

The possibility of using network technologies in education are determined (just as with respect to developing pedagogical software) not by the technical characteristics of telecommunication systems but by the contextual and methodological contents which does not always manage to keep up the pace of development of technical means. On the other hand. using E-mail, teleconferences, distant databases and other modern information means for education purposes opens broad horizons for developing education technologies.

Expansion in application of new information technologies in education is getting underway given the conditions when teachers, pedagogues and students are not quite prepared for the new roles. The new role of the teacher is confined to the fact that he gains additional options for supporting and building the identity of the student, for creative search and organization of joint work, preparing and choosing the bast variants of education programs. There is also a possibility to give up the teacher's routine activities intrinsic to the traditional education by providing him with intellectual forms of labor. The

information technologies release the teacher from the necessity to set forth a considerable portion of educational materials and operations related to practicing skills and knowledge. Expanding the sphere of application and increasing the effectiveness of using information technologies in the field of knowledge and skill conveyance require international coordination and joint efforts of specialists from different countries in working on the development of information and technological education means.

It also renders a review of models for using information technologies in schools showing that the traditional class-lesson model of interaction between students and information technologies has become outdated. It should be replaced by collective project and individual models. The major distinction of these models lies in the fact that they enable the informatization of the education process, make it possible to accomplish goals with minor costs and are particularly well suited for modern schools.

The strategic role of information technologies as a factor of social and economic development of modern society, may undoubtedly be regarded today .is commonly recognized. It is determined by a number of major features of information technologies specified in the work, that stipulate the necessity to give them the top priority both in the sphere of national scientific and technical policy and that of education.

It also points out the possibilities informatics provides for creating new solutions for a number of vital problems of modern culture. The possibilities of multimedia technologies are in particular so immense that the Russian culture scientists ungroundlessly refer to creation of a new direction in the cultural sphere namely - screen culture. It is extremely important that this direction find the proper reflection in the sphere of humanitarian education.

The analytical survey on the issue in hand would have been incomplete if the authors had not described a number of "transparent" topics, among which the priority ь given to the problem of distance education. The survey analyzes its possibilities, expedient spheres of application, drawing the conclusion that the distance education may successfully integrate into the existing systems of internal and external, open education, education at home or without abandoning the major activities. However, now we have to refer to the distance education mostly in subjunctive mood or in the future tense. Creation and implementation of the Federal Program "Development of a uniform distance education system in Russia" should bring the distance education considerably closer to the implementation phase.

In concluding the survey, a general prospective structure the education course entitled "Fundamentals of Informatics" is offered for the system of secondary and higher education in Russia. The structure is based upon a problem module principle and hence is quite flexible. The contents of the course is viewed in the form of critical comparison with the foundation materials of a similar course rendered in the Russian national report entitled "Policy in the sphere of education and new information technologies". It may be asserted that the contents of the course set forth in the survey shall contribute to practical implementation of the role of education as a forerunner in the process of intellectualization of the Russian society.

1. POLICY

1.1. FORMULATION OF NATIONAL PLANS AND STRATEGIES

The international cooperation in developing new information technologies and their efficient application in education is one of the major issues for humanity. There is no doubt that informatics is one of the most important "points of growth" of the world community, with broad prospects.

It is self-evident that information and its superior form - knowledge is the ultimate factor that determines the development of society in its entirety.

Major principles of Russia's education policy and general education programs are designed to resolve issues related to shaping culture in general, fostering intellectual, moral, emotional and physical evolution of individuals, formulating scientific concept of the world, assimilation of individuals in society. Russia occupies a respectable position in the world education system especially with regard to furthering methodological teaching principles. It is widely acknowledged in the world that Russia represents one of the top three countries with regard to level of comprehension in such general education spheres as mathematics, physics and chemistry.

The strategic objectives of Russia's state policy in the educational sphere are:

- creation and implementation of conditions for ensuring constitutional rights of citizens to obtain education, expanding boundaries for character-building of individuals and spheres of their self-evolution;
- development of mentality in the Russian society based upon general human values, adapting awareness of masses to shaping respect for human rights, public concerns as well as those of territorial and national communities;
- shaping a system of education capable of adapting to conditions and norms human existence as well as new type of interaction between theory and practice;
- introduction of promotional education principles and methodology of active approach, converting education into the sphere of comprehending different types of mentalities and activities;
- integration of the Russian education system into the world general education system.

The organizational basis for Russia's state policy in the sphere of education is formed by the Federal program on development of education, ratified by the supreme legislative body of the Russian Federation. The program stipulates concrete mechanisms for achieving the projected strategic goals.

One of the most important mechanisms embracing all of the major directions of education system reform in Russia is its informatization which may be regarded as an essential condition and a critical

stage of Russia's entire informatization. The transition of community from industrial stage to the information one is based upon new information technologies (NIT).

Informatization of education will allow over the long run to effectively apply the Following vital benefits of NIT:

- a possibility of building up an open system of education ensuring a particular curve of self-training for each individual;
- a drastic change in organization of comprehension process by virtue of reshaping it toward the system mentality;
- efficient organization of comprehension activities for trainees in the course of education process;
- organization of an education process that furthers an active approach toward that process throughout all stages (demands-motives-goals-conditions-means-acts-operations);
- individual approach in the education process and preservation of its integrity based upon projectable nature and versatility of automated educational programs;
- a possibility to organize and apply radically new comprehension means.

Informatization of education is one of the most important means of implementing a new state educational paradigm, within the framework of which the focus is replaced - from the pragmatic goals confined to a single specialty to acquisition of general knowledge; from the historic context of scientific knowledge development to a modern concept of structure and integrity of science contents.

1.2 FORMULATION OF THE STRATEGY FOR REMODELING THE EDUCATION SYSTEM (AT THE LEVEL OF EDUCATION INSTITUTIONS)

It is self-evident that information and its superior form - knowledge is the ultimate factor that determines the development of society in its entirety.

In order to effectively use the huge volumes of information and knowledge accumulated in the course of modern information revolution for resolving real issues, it is necessary to formulate a strategy for remodeling the education system including that at the level of education institutions.

It requires a special information policy with its major provisions conceptually absorbed and set forth applicably to the education system in Russia. A series of programs stipulating implementation of large-scale projects with regard to the following directions is devised and executed.

Informatization of the education and upbringing process:

- transition from the disciplinary model of education contents to a system one with the major objective - to teach understanding of the world, society, oneself and one's occupation;
- radical replacement of the scientific methodological, educational methodological and information basis of education;
- providing equal opportunities for individuals with regard to obtaining an education of personal and public importance, that is capable of assisting them in spiritual and intellectual self-evolution as well as in finding the best possible niche in the job market;
- reducing terms of education by means of resorting to methods of modern intensifying and increasing effectiveness of the education process;
- formation and introduction of scientific methodological and educational methodological materials in order to support training in new information technologies.

Creation of modern information environment for the education system:

- ensuring links and interaction between information technologies and education institutions in the course of multi-phase education process (information links between subjects and objects in all stages of continual education);
- formation of information systems serving for purposes of particular educational institutions;
- forming and putting into operation functional complexes based upon local computation networks for automation of administrative activities at various levels and in different directions;
- creation of distribution databases in different subject spheres and educational topics.

Information integration of Russia's education system into the world education system:

- formulation of a new strategy for the international scientific and educational cooperation;
- ensuring independence of educational facilities in determining the locality and functional contents of international information networks and increasing their international mobility;
- creation of a global information computer network accessible for various higher education institutions ensuring their integration into international networks containing scientific, technical and educational information;
- cooperation in developing international educational standards for education;
- organization of international cooperation in exchanging expertise of the NIT application in education.

The major working directions set forth above embrace practically all aspects of pedagogical and scientific activities that may undergo transformation resulting from application of new information technologies. The above-mentioned directions fully reflect contents of the problem and in their entirety form an adequate conceptual information field required for organizing their implementation.

1.3. INFORMATICS COURSE IN THE EDUCATION SYSTEM: CURRENT CONDITION AND PROSPECTS FOR DEVELOPMENT

1.3.1. Condition and development trends of informatics course in secondary and higher school

Studies of informatics as an obligatory course in secondary and higher schools have started comparatively not long ago - within the last ten years. Primarily, this course was introduced into the training program for students of universities and technical higher education institutions of the developed countries and then started spreading out rapidly in the school education system as well.

Today the informatics course is studied practically on permanent basis not only in all higher education facilities and colleges of the developed coun-

tries but also in a majority of the developing ones. The trend of expanding the course on within the sphere of education persists through. The reason for such an event is confined in the fact that there is a serious permanent social demand for informatics studies in the society. It is caused by a hectic progress in means of computerization and communication, penetration of information technologies in basically all spheres of social practice and a pending necessity to efficiently apply them for solving a number of vital social and economic problems [1,2].

As far as the substance of informatics course is concerned, today in secondary schools and humanitarian higher education facilities it is mostly oriented at acquiring computer literacy, i.e. basic knowledge and skills in the sphere of applying modern computers and telecommunication systems for processing and transferring information, solving elementary tasks using the most of mass information technologies.

Apart from this, universities and technical higher education facilities offer broader knowledge in the sphere of technical and information support of informatics means and software, computer and telecommunication systems as well as in the sphere of new information technologies (NIT). This chapter of informatics course usually includes information regarding various types of intellectual and expert systems, methods and means of information modeling, hypertext and multimedia systems, computer graphics and virtual reality.

Particular chapters of the informatics course dealing with new information technologies have been lately more and more often included in educational courses taught at humanitarian higher education facilities as well as in lyceums and colleges. It is entailed by the global character of social informatization that embraces practically all countries of the world including Russia. That is why knowledge of informatics basics, its possibilities and prospects for development is an inalienable condition for the entire modern society.

1.3.2. Modern concept of informatics as a science and educational topic

The ever-disputed issue of choosing a name for the modern informatics course shall undoubtedly be dwelt upon in the context of the discussed problems. Not only is the nature of this issue educational and methodological but also philosophic and scientific for it is closely linked to the modern concept of informatics substance as a science and hence that of the educational course corresponding to that science. Ancient philosophers used to say "to name correctly means to understand correctly" and this issue is in serious controversy today.

For example, today the term "computer science" is commonly known in the United States, Canada and several South American countries. This term is used as a name for both scientific and educational courses dealing with procedures related to processing, storage and transfer of information via computers and telecommunication systems. Thus, the "computer orientation" of topics taught in the framework of these scientific and educational courses is accentuated.

As far as Russia, the CIS member-states and the Western Europe are concerned, a term of French origin - "informatique" is more popular. It is a apparently a derivative of two other French terms - "informatione" (information) and "avtomatique" (automatic).

In our opinion, the term "informatics" is more appropriate for naming the scientific and educational courses at hand because it to the greatest degree reflects the information orientation of their substance. Ukrainian scientists share this opinion with us. A fine example of it would be to cite the name of two academies of sciences that have been recently established in the Ukraine. On of them is entitled "The international academy of computer sciences and systems" and focuses its major activities on the issues of creating and effectively using computers and systems based upon them, that society deems extremely important for implementing modern and prospective information technologies.

The other academy of sciences - the Ukrainian Academy of Informatics chose studies of information, information-related processes in the society and social consequences of its informatization as the major objectives of its research.

As it appears, these two closely linked areas are considerably different in their essence.

Taking these facts into consideration, we may positively assert today that "informatics" and "computer science" are not two different names for the same scientific and educational courses. They are two closely related courses with different contents. In this context, due in the fact that contents of informatics is rapidly expanding, this difference will become more and more noticeable.

It is also worth pointing out that not only does informatics as an independent science and educational course have its own clearly outlined area of problems, but also its own research method - information-oriented approach. Applying this method makes it possible already today to reveal, analyze and perceive many new characteristics and principles of information and processes related to it that are under way in the society and the world around us.

The information culture becomes today an inalienable part of the general culture of the society and this may be regarded as the effect of objective civilization development laws.

1.3.3. Prospects of informatics development in the near future

Informatics as a science is currently undergoing a stage of intensive development Having been created in the framework of a science dealing with administration processes - cybernetics, the contents of informatics is rapidly expanding and we can witness that it turns from a technical course covering methods and means of processing data via computers into a fundamental natural science handling information and processes related to it that are under way in the nature and society [3].

We can reasonably assert that informatics is one of the most important and prospective "points of growth" of the world science with a new set of information sciences forming around it [4]. That is why it is of paramount importance to timely focus attention of the UNESCO heads, education bodies, scientists and teachers from different countries of the world as well as the mass media on that phenomenon in or-

der to adequately reflect it in programs, methodologies and curriculums of the higher and secondary education systems as well as in the system of advanced training of specialists with higher education and primarily pedagogues.

This implies that changes must be introduced not only to the contents of the course dealing with informatics and other technical courses related to it (computerization, cybernetics), but also a number of humanitarian courses such as philosophy, economics, sociology and psychology. It is extremely vital to include this provision in the Recommendations of the UNESCO Second International Congress on "Education and Informatics".

1.3.4. Contribution of Russia's scientists to the development of informatics as a science and educational subject

Russian scientists have been lately energetically conducting fundamental research in the sphere of information-oriented problems of the modern society development including philosophic problems related to analyzing the role of information and scientific knowledge in the further evolution of civilization and transition of the society to a new paradigm of safe and stable development. This research is based upon the noosphere concept of biosphere evolution created by works of such world famous Russian scientists as K.E. Tsiolkovsky, V.I. Vernadsky, A.L. Tchizhevsky, and N.V. Timofeev-Resovsky. Today this concept gained momentum in he works of such Russian philosophers as N.N. Moiseev, A.D. Ursul, A.I. Rakitov, Abdeev and others [3-6].

Information and scientific knowledge are viewed in the current works of Russian scientists as essential strategic resources required for the further development of the civilization and the problem of activation and efficient application of these resources is given the priority among other scientific technical and social economic problems of the society today [7,8].

Results of this research are energetically discussed by scientists and pedagogues in scientific press, during seminars and conferences and are already reflected in a number of pilot educational courses on informatics taught in Russian higher education institutions.

For example, the course entitled "Theoretical informatics" taught in a number of years in the Russian Academy of State Service and to students of the Moscow State Social University, includes topics dealing with information, knowledge, information processes and information technologies that are set forth by the pedagogues precisely from the philosophical perspective and that of the general system position.

With regard to analyzing the role of information processes in modern society as well as impact of the global imformatization process upon the development of society and humans, these problems are dealt with in a special educational course entitled "Social informatics" which since 1989 is studied by graduate and postgraduate students of a number of Russian humanitarian higher education institutions in Moscow, Saint Petersburg and Nizhny Novgorod [10].

It is necessary to mention that social informatics as a new and quite prospective complex scientific and educational course has lately become more popular in the Russian educational system. A number of problem-oriented departments of social informatics have already been created and are successfully functioning in the Moscow State University named after Lomonosov, the Moscow State Social University, the Nizhny Novgorod State University and in Youth Institute. In 1994 an association of these departments was established. Problems of social informatics are given a great deal of coverage in Candidate's and Doctor's thesis works and regularly discussed at scientific and scientific methodical seminars.

The Supreme Attestation Commission of Russia was filed a motion by the scientific community on introducing a new scientific specialty - "Social informatics", which would assist in activating training of scientific personnel for this vital and socially important scientific problem.

Russia's expertise in applying the informatics and information technology courses when providing training and advanced training of specialists for state service authorities shall be undoubtedly taken into account. In particular, such courses are taught at the Russian Academy of State Service affiliated by the President of the Russian Federation. Starting in 1994, this Academy operating in the framework of the continuous higher education system for state officials also trains specialists that after accomplishing their thesis obtain the qualification of "System analyst in information technologies" [11].

Employment of specialists with such qualification in federal and municipal authorities of Russia already draws a great deal of attention It will positively contribute to fostering more effectively the process of informatization of the Russian society supported by the fact that the Academy of State Service has a number of branches in different regions of Russia.

1.3.5. Russia's international cooperation in dealing with new problems of theoretical and social informatics

Starting in 1989, Russia's scientific, methodological and pedagogical expertise in studying the aforementioned new problems of theoretical and social informatics is quite regularly discussed during international conferences, congresses and forums with specialists both from the Western and the "near abroad" countries - republics of the former Soviet Union - participating in them. For example, at the International Congress on "Information processes and technologies" (Moscow 1993) three out of four major plenum reports were dedicated to these problems [12-14]. Moreover, international conferences on the social informatics issues have almost gained the status of being "annual" Another conference entitled "Social informatics - 96" will take place in Moscow in April, 1996.

Results of scientific research and pedagogical expertise of the Russian scientists in informatics are now studied by specialists from a number of universities in the US, Great Britain, Western Germany, France, Spain, Portugal and India. Particular problems such as for example, those related to developing methods for distance education and multimedia technologies, are internationally cooperated in on a long-term contractual basis with such countries as

Great Britain and Spain and in the sphere of theoretical and social informatics - with scientists from the Ukraine [15,16].

In order to foster a broader and more inclusive international cooperation, it is vital to obtain financial support from the UNESCO and governments of the countries that are members of this organization. This support is primarily critical for publication and distribution of scientific works and monographs covering the future problems of informatics as well as for conducting scientific and methodological conferences and seminars on the most essential problems.

Regarding the issue of generalization and distribution of the generated scientific and methodological expertise in studying such courses as "Theoretical informatics", "Social informatics" and "Information technologies in the system of state service authorities", in our opinion, Russia's experience in this field is unique and worth being studied in detail.

2. TECHNOLOGIES

2.1. COMPUTERIZED EDUCATION

2.1.1. Current condition

In the last ten years of applying NIT in education, pedagogical software has not radically changed the teaching methodology in secondary schools. Computer is at best an instrument assisting teachers in the traditional way of conducting classes. According to expert estimates, computerization in higher schools allowed to introduce an effective computer experiment in a number of courses.

By Fall 1995, 34 thousand out of 35 thousand complete secondary schools had computers or computer classes with the average number of computers per school totaling nine. Schools are mostly equipped with different types of computing machines, for example 22 types of computers were used in Tomsk region in 1993 and 17 types in Novosibirsk region. During the last years, the type of computers acquired for secondary education was mostly confined to IBM PC or Macintosh but their number (according to experts) can hardly reach 10-15% of the entire number of all computers installed.

Only 365 schools out of 30.5 thousand (1.2%) had computers (according to the official statistics of the Russian Federation Ministry of Education with incomplete information on Chechnya and Dagestan). It suggests that application of computers and NIT in education provided for junior students did not exceed the limits of experiment.

With regard to complete secondary schools, the following conclusions may be drawn. Software and methodological support of the educational process informatization may be divided into six categories of educational computer programs:

1. Knowledge control and testing.
2. Training programs for solving problems.
3. Informative reference systems with materials of studies, "talking" systems, combinations of the above-mentioned directions.
4. Professional programs as a topic of studies.
5. Modeling programs, powerful graphical training and reference systems, complex computergames, framing modeling environments, multimedia systems.

Testing programs are the most spread out ones in Russia because they are easy to create. Almost in every sphere several testing and controlling root programs have been created for different types of computers.

Program and methodological complexes (PMC) have become popular lately as well. One of the first organizations to develop them was KUDITs (Moscow) operating in the framework of an IBM pilot project. PMC represent an autonomous product that includes:

- methodological support;
- software;
- information support.

Methodological support is the key component of these complexes. PMC present an opportunity to use the assistance of a teacher or study independently.

Until now no training environments have been created that serve for purposes of the masses, despite that there are projects aimed toward that end implemented in Pereyaslavl-Zalessky (Robotlandia), in Moscow (INT - Logomiry) and in other locations. Very few modeling, simulation and multimedia systems exist. In many ways it is related to the structure of the computer base in secondary education and higher educational facilities. The computer base in secondary education has already been described above, however, most of computers in higher schools are based on microprocessor 286. These models can hardly be deemed as a testing site for the modern instrumental programs and are hard to develop modeling and other multimedia systems on.

Despite the fact that a series of instrumental programs (such systems as "Urok", "Computer Stratum" etc.) were distributed in Russia in quantities totaling several thousand units, it almost ceased the development of domestic instrumental programs and those prepared by single authors and now such world popular author systems as Authorware Professional etc. are not used broadly. On the other hand, dozens of almost identical training programs covering small parts of the curriculum appeared on the market. Training in foreign languages (English primarily) for which quite inclusive courses containing different classes of educational means, may be pointed out among them.

The ordinary textbooks are still the major "instrument" of students. Any text is easier to read in a usual book than on the computer screen Electronic textbooks, on the other hand, is more comprehensive and effective in cases when it:

- ensures feedback;
- helps quickly find the necessary information that may be difficult to pinpoint in an ordinary textbook;
- considerably saves time in the event of frequent references to hypertext explanations;
- along with a concise text shows, talks, models etc. (This is where the possibilities and advantages of multimedia technologies are self-evident).

2.1.2. Prospects

The intensive development of training programs is carried on by enthusiasts and in the framework of programs on informatization of education, electronic textbook for higher schools, electronic textbook for secondary schools etc. So is the development of courses embracing the entire educational process during many years (for example the course entitled Information culture).

A large-scale certification of pedagogical programs originating in the Institute of Education Informatization (for secondary schools) has started. It is expected to expand it in the near future. The development of first multimedia training systems many of which will be applied in teaching humanitarian courses, is still underway.

2.1.3. Recommendations

It is necessary to continue the certification of pedagogical programs and publication of detailed information regarding the certified programs.

It is also vital to pursue experimenting in creation of training environments as cue of the most promising directions.

The major hurdle for developing pedagogical programs is the lack of purely pedagogical materials for implementation on computers rather than the lack of instrumental means. It is necessary to organize creative groups combined of teachers-practicing, teachers-methodologists, artists, writers, programmers etc. as well as to continue organizing contests of designers and support programs for such groups.

The work of teachers must be assisted by the most user friendly computer (today this type of computer is represented by Macintosh). The objective is not the installation of computers in educational facilities, but their lucrative application for teaching purposes. It needs to be emphasized that teachers value not the processing speed of the processor or frequency of it etc., but the fact of computer being user friendly and the complex character of the offered solution. Teachers must not waist time choosing the computer configuration that suits his course the most.

2.2. MULTIMEDIA

2.2.1. Current condition

Due to the fact that in the previous years there was a lack of powerful computers for designing multimedia systems in Russia, such systems rarely fall under the consumer goods category. The major surge got underway in Russia in 1994-95. About 80 compact disks were created in Russian mostly containing cultural and historical data.

Multimedia technologies are linked with the process of creating and using multimedia products, i.e. electronic books, multimedia encyclopedias, computer films, databases etc. The primary characteristic of these products is a combination of textual, graphical, audio and video information and animation in the computer. The secondary one is the volume of information offered to users. The category of multimedia products may include the ones with the data volume totaling approximately several hundred megabytes. As opposed to ordinary programs, in this case information itself is a factor. It may be represented in several ways and most importantly, it is always structured - both the textual and the graphical ones. Thus, from the terminological perspective, it implies not only a multimedia environment but also a hypermedia one to draw a parallel with the hypertext technology.

Hypermedia products (despite that the term multimedia product is usually used) of this type may be used during classes, students may also process a large amount of materials represented in a form other than the textual one. All of it is possible in the interactive (dialogue) regime when not only do teachers (or students) passively watch and listen, but also participate in the process of selecting materials, making notes and preparing the proper summaries.

2.2.2. Prospects

The goal "Humanitarization of education via informatics" becomes quite achievable with the help of multimedia computers and such programs as computer encyclopedias, tourist guides, electronic books, reference software on literature, art, music. A good case in point here (as far as the Russian-language programs are concerned) would be the "Hermitage", "Russian Treasures", "Moscow Kremlin, directory", "Cathedrals of Moscow" etc. The process of informationalized education given the use of multimedia technologies depends above all on the human factor, that is to say on how the teachers will take the innovations suggested.

It takes simple instrumental (author) means for teachers to prepare something and use it during the class. Nothing better and easier than Macintosh hypercard has yet been invented. It was the hypercard that could bridge the gap between a computer and teachers in the United States. Certain difficulties might be encountered when using the hypercard in Russia, since there is a language used in it which is close to the original English, but Alas!, to English and not to Russian. This, in turn, calls for an adequate Russian-language equivalent of the author means.

The development of the first multimedia training systems is still underway, many of them will be applied in teaching humanitarian topics. Most of electronic textbooks and encyclopedias must be designed not by the teachers operating given local conditions but by qualified designers including specialists in humanitarian arts and natural sciences. Teachers may base their preparations to concrete classes on these materials.

2.2.3. Recommendations

It is time that we reject the complex of computers as the only model applicable in educational organizations which is even more dramatic since schools can rarely afford buying 10-15 latest computers at a time.

In this case, a new model of using one or several multimedia computers in schools might come in handy. One computer a school is an electronic board for teachers, telecommunication unit for connecting with the rest of the world, practice for groups of students, a desktop publishing device in schools, electronic library or art center in schools (center of culture and information). Naturally, it is impossible to use one computer for all of the above-mentioned purposes, but any educational facility may chose the one that is the most adequate for meeting their re-

quirements whereas other model may be purchased in the form of acquiring additional computers. The most important aspect of it is that computers (a computer) installed is schools should immediately provide feedback and not be locked up in a classroom with no software installed. This scheme allows to use multimedia options of computers that meet the standards not lower than MPC-2.

The best computer for these purposes is Macintosh which according to 1994 estimates, is easy to handle for librarians and teachers specializing in particular topics. Macintosh is deemed as the world's best multimedia machine - it is reliable and simple. The extra price is compensated by the options it offers and low maintenance costs In the event that IBM PC compatible computers are chosen for this purpose, it is important that educational organizations are oriented at using multimedia computers that meet the standard not lower than MPC-2.

Libraries in schools must become multimedia centers contributing to informatization of schools and should serve as a source of information both in the printed and electronic forms for teachers and students. It is also possible to rename this facility into media library (mediateka), electronic gallery etc. The name is not as important as is the fact that libraries should become information centers that avail processing multimedia information, instill in students skills required for living and working in the modern information-oriented society. Such electronic libraries in schools should also offer modern multimedia encyclopedias, art galleries, tour guides describing sights of different countries and a set of additional materials on educational topics etc.

The major obstacle in the way of developing pedagogical programs is not the lack of instrumental means but 1) the lack of exclusively pedagogical materials to be implemented on computers; 2) the lack of specialists-"directors" - somewhat similar to movie directors, capable of combining the source pedagogical and education materials in one attractive multimedia product. It is important to organize creative task forces combined of teachers-practicing, teachers-rnethodologists, artists, writers, "directors", programmers etc. as well as to continue organizing contests of designers and support programs for such groups.

2.3. OPTIONS FOR APPLYING NETWORK TECHNOLOGIES IN EDUCATION

No matter how complex the essence of telecommunication means is, what ideas are used in that field, only the following options are available for users:

- retrieve (read) information;
- transfer (send) information;
- place information;
- search (scan) information - an option that only recently became available disc to the rapid growth of INTERNET.

That is why the options of using network technologies in education are in the first place determined by the contents and methodological essence of telecommunication systems rather than their technical characteristics [17].

2.3.1. Electronic mail

Application of telecommunication in education was initiated in our country in the end of the 1980-scientific in the form of E-mail [18]. Primarily it became clear that E-mail may not be used as a base for individual or collective correspondence between students. All attempts of that sort gradually entailed the fact that all contacts were ceased. However, in the early stages of contact, within a limited period of time, this correspondence may be used as a way for students to meet each other. The principal result obtained during the initial years of using E-mail in schools is confined in the fact that success may be achieved only through specially organized and coordinated educational activities of students based upon E-mail.

The result of secondary importance may be considered the understanding of the fact that the program employing E-mail can fit the limits of system of classes with great difficulties.

The third result is confined in the fact that E-mail is an economizing means of education process informatization since it requires only one inexpensive computer per school. In a number of cases, when schools did not have any computer available the authors had to organize and support the course of educational activities via E-mail. In terms of operation, [19] E-mail may be naturally used in schools according to a collective project model.

2.3.2. Teleconference

In the Western countries, where the development of telecommunication is somewhat ahead of our achievements, on-line conferences became one of the major means of distance education [20], Teleconferences assist in organizing collective work of students, implement methods of business games and brain attack. All of it becomes possible due to the implementation of a virtual class based upon teleconferences. This technology is almost unknown in our country - only a handful of publications [21-24] took place as well as several attempts of the department for education informatization problems of the IIP RAS to implement an educational course employing teleconferences. Nonetheless, this technology has a vast potential with regard to education and hence, is presented in the survey in the form of a separate section.

Participants of teleconferences may be divided into groups for working on particular topics and their access to certain topics may be limited. In general, there are broad horizons for organizing the educational process. At this point it would be appropriate to mention that off-line teleconferences. The problem is that it takes a certain period of time (hours and even days) to send a sentence and place it via off-line conferences and to read it at the teleconference and obtain it on your computer. Thus, applying to off-line teleconferences you will every time retrieve only a part of the information contained there at the moment when you receive the information on your computer. That is why your sentence may be outdated, repeated, inappropriate in the event that the discussion unfolded in a new direction and so forth. Another weak point of off-line teleconferences is the impossibility to select new materials for reading.

Working at on-line conferences, each participant may scan the contents of the conference and

determine what he wants to familiarize himself with, after which he obtains only the required information on his computer. Participants of off-line conferences never know in advance what new materials became available and subsequently they have to order all of them. The more intensive work is the worse off-line conferences are. In case of a slowly evolving conference with a small number of participants application of this conference may be deemed justified to the extend of considering justified slowly evolving education.

2.3.3. Database

Means of telecommunication make information stored in distant from users databases accessible to them. A fine example of distant databases is the information stored in INTERNET servers. One of the most interesting functions implemented in INTERNET is the option of browsing or surfing the information. Users search for information in INTERNET either for particular reasons or just for looking around and finding out what is available. INTERNET contains enormous amounts of information so it may take a very extensive period of time just to switch from one sector into another scanning the available information. The emergence of such means of conducting the search of information as GOPHER and WWW had a bomb effect.

2.3.4. Potential and prospects

According to facts set forth above, we may draw the conclusion that the major methods of working with network technologies are confined to firstly project activities and secondly - distance education. Distance education is implemented in this case either in the form of self-studies using the education materials stored in distant servers or on-line teleconferences. On-line education is obviously different from the traditional one which is based upon personal contacts. Some of the most significant differences are:

- people from geographically distant places can be "present" in classes without physical transportation to one place;
- it helps save time and transportations (which basically means financial benefits, although it requires initial and current costs to participate in on-line education);
- participation in conferences is possible within a certain period of time - it may be accessible either within a definite period of time (for example one month) or within an unlimited period (for years);
- interaction (responses to messages etc.) is not simultaneous and immediate;
- participants may contribute to the conference at any moment when they feel it appropriate i.e. they do not have to wait for their turn and cannot interrupt others;
- contribution to the conference may be maid 24 hours a day, seven days a week;
- participants of the conference may contribute to it from any geographic location which means that the participants who due to their occupation travel a lot may communicate from basically anywhere;
- interaction between the participants takes place (not necessarily though) in a more regular, slow manner;
- all contributions to the conference are automatically recorded and may later be used as a database;
- participants may also use other sources of information of the system not determined by the program they are participating in;
- social aspects of participation, process and results of teleconference usually differ from those in case of personal communication;
- the possibility of collective work in groups is increased - teleconferences may sustain collective education via such means that may not be achieved in case of meetings in person.

INTERNET offers unique education options. Although there are no general methods of using INTERNET in the educational process, they are likely to emerge in the near future. It allows us to draw the conclusion that it is necessary to take into account the possibility that systems worked out for the education system which are currently designed and projected may be plugged in INTERNET in the future.

3. TEACHERS

3.1. INFORMATION TECHNOLOGIES IN EDUCATION AND NEW POSSIBILITIES IN TEACHING METHODOLOGY

The education technology in Russia implies a means of implementing contents of education stipulated by educational programs and representing a system of forms, methods and means of education that ensure the achievement of the set didactic objectives.

The peculiarities of the new information technologies in education are the following specific environments in which they are implemented and components related to it:

- technical (type of the applied equipment);
- program and technological (software catering for the implemented education technology);
- organizational and methodological (instructions for students and teachers, organization of the education process);
- subject matter of knowledge.

Automated computer-supported training courses serving for one or several education purposes gained popularity. These courses include programs, methodological and educational materials (photo slides, printed, audio and video materials etc.) required for different types of educational work.

Various works in the sphere of didactic programming considerably developed as well. In pedagogical literature this term is sometimes referred to regarding the issues of selecting and structuring educational material as well as optimal organization of the education process. One of the major objectives of didactic programming is a combination of a target system regulating optimal education admini-

stration actions under the implementation of which the condition of knowledge and skills reaches proximity with the required standard.

Currently, there is a growing trend of developing and applying author integrated environments supporting different information components such as texts, dialogues, schemes, pictures and including analytical and imitative models of the studied objects and phenomenon, databases and bases offering expert knowledge, support systems for implementing particular professional actions such as scientific, engineering and technical calculations, automated projecting etc.

Modern information technologies grant students access to nontraditional sources of information, increase the efficiency of self-reliant work, offer totally new opportunities for applying creativity, acquiring and mastering different professional skills, allow to implement principally new forms and methods of education using means of conceptual and mathematical modeling of phenomenon and processes.

Educational modeling creates illustrative effect for the studied object thus increasing the interest of students to this form of education and studies of processes in their dynamics results in a more thorough processing of educational materials.

Since modeling itself becomes an educational objective with regard to a number of subjects, instrumental software is being developed in Russia that assists teachers and students design and modify training models in the interactive mode thus eliminating the necessity of programming.

Information technologies in education make it possible for teachers to use both particular types of educational work and entire sets of them for achieving didactic goals i.e. to project a training environment. Teacher-oriented instrumental means allow the user to quickly renew the contents of automatic training and controlling programs keeping up with the emergence of row knowledge and technologies.

Teachers are offered additional options for supporting and directing the character-building process of the trainees, creative thinking and organizing their cooperation, designing and selecting the best variants of education programs. Teachers become the major suppliers of the education subject goals taking into account the varying character and significance of educational courses (humanitarian, economic, natural science etc.) in a concrete educational facility. There is also a possibility to reject the routine types of teachers' activities intrinsic to the traditional education, offering them an intellectual form of labor. Information technologies release the teacher from the necessity of setting forth a considerable part of educational materials to students and routine operations related to polishing skills and abilities.

Due to the access to telecommunication networks, not only do teachers considerably increase their information stock, but also get a unique opportunity to communicate with their colleagues basically all over the world. This creates perfect conditions for professional communication, conducting joint educational, methodological and scientific work, exchanging educational projects, software, data etc.

For this purpose banks of data and knowledge are created that accumulate normative, reference, instructive, photographic and other types of information. Means for analyzing business and other information related to activities of educational facilities are also being created.

In the framework of the specified directions at the level of educational institutions, interlinked computer systems are being created that ensure automation of functions related to educational process management which above all will allow to reduce the pending expenses for organization of education process administration in educational institutions. This project implies the development of electronic means of access to library and reference information, rating calculation of each student and educational facility.

3.2. CONVEYANCE OF SKILLS AND KNOWLEDGE VIA INFORMATION TECHNOLOGIES

Conveyance of skills and knowledge may theoretically be divided into two pans - intellectual (creative) and technological. The intellectual part includes collection of knowledge, their systematization (structuring), generalization (separation of major knowledge aspects within a subject sphere), conveyance of knowledge in the form of "lively" communication of teachers and students (lectures, seminars consulting). The technological part includes testing, training in order to determine eligibility for studies, examination of the amount of knowledge mastered as well as self-control of the depth and knowledge of the mastered information. The border between the specified parts is quite hypothetical and possesses flexibility.

In the course of accumulating knowledge and perfecting the methodology of teaching an evolution shift of the border takes place with expansion of the technological border and simultaneous expansion the subject sphere outer border by means of including into it new knowledge (skills) or depth of their understanding.

The creative origin in the sphere of conveying knowledge and skills is the human prerogative. information technologies in this sphere ensure the information support of the process in the form of profession-oriented databases, means of data telecommunication, means of their visualization for perception as well as in the form of auxiliary means of systematization and generalization of knowledge.

The technological part is implemented via device and program means and directed to ensuring testing and training in all forms.

The concrete combination of means and techniques of both parts of the knowledge and skill conveyance process in all of the numerous subject spheres determines the paradigm of the national education system.

A considerable role is played by the technological component in sustaining the self-study process -compilation of training programs, schedules of classes, transparent topics for training specialists in peculiar subject spheres. The last direction may include models of training systems, models for evaluating the efficiency of funds invested in the education system and other components of modern information technologies.

Russia possesses a world famous higher education and professional training of average qualifica-

tion specialists system. There are centers for computerization of the higher and secondary education supported by the state. The specified Centers offer methodological projects and test samples of program complexes in particular program spheres (in separate subject (curses). There is also an extensive list of training software for practicing and perfecting professional skills in technically complex professional spheres.

Prospects for development of information technologies in the sphere of knowledge and skill conveyance

The modern condition of information technologies in the sphere of education support may be characterized by the fragmentary structure of components. There are components that solve particular private issues of specialist training. The major direction of expanding the sphere of information technologies application in the field of knowledge and skill conveyance may be regarded the creation of complex system for education informatization.

Such system may include:

1) Creation of profession-oriented databases containing scientific, professional and educational information on industrial basis,

2) Setting standards in the sphere of presenting and transferring information related to the education support process;

3) Creation of a concept, principles and functional structures that ensure actualization of information used in the educational sphere;

4) Design of technological means for overcoming language barriers when distributing information for education purposes;

5) Creation of an industry manufacturing applied program packages serving for the major elements of conveying knowledge and skills (creation of quite versatile program nutshells for introducing automated elements into the education process).

6) Creation of sets for information and technological support of education m the most spread out subject spheres.

Russia's contribution to the development of information and technological components of the education process

Russia possesses personnel, knowledge and generated expertise in training highly qualified specialists. This expertise may be used when creating:

1) Databases containing scientific, professional and educational information in profession-oriented spheres where positive results were achieved;

2) Uniform program components and program systems catering for particular functions of the education process.

3) Standards of presenting and distributing profession-oriented information.

4) Methodologies for applying means of automation and information technologies in the sphere of conveying knowledge and skills.

5) Computer training programs for perfecting professional skills in technically complex professional spheres.

Expanding the sphere of more effective application of information technologies in the field of conveying knowledge and skills requires international coordination and joint efforts of different countries directed toward creation of information and technical means of education.

3.3. PRACTICING INFORMATION TECHNOLOGIES IN SCHOOLS AND PREREQUISITES FOR RESHAPING

The massive introduction of computers in secondary schools in Russia that lasted for more than ten years did not live up to the expected informatization of the education process. Reasons for that are quite obvious now. The major method for organizing work places of students was regarded the computer lab. The major topic implying the use of computers has become the course of informatics and computer basics. Thus, it appeared that computers were used mostly for the purpose of studying them. Informatics teacher combined their ordinary responsibilities with the material ones for the computer lab. Computerization of the education process was restricted to the computer lab in the framework of a single course.

Starting in 1985 deliveries of computer sets for equipping laboratories were centralized. Each school of this type endured the necessity to hire a teacher of informatics. Since the large-scale training of teachers had lagged way behind, the most natural and probable way out was requalification of programming engineers into teachers of informatics. The major educational activities during informatics classes became studying one of the programming languages - Basic as a rule. This situation still persists in many schools despite the emergence of a large number of programs designed for studying particular topics in the framework of other courses as well as such programs especially designed for versatile application of computers as instruments as text and graphics processors, desktop publishers, electronic tables and databases. Event the transition from the eight-bit mode computers to the sixteen-bit mode ones had a slight impact upon the commitment to Basic.

Thus a typical situation would be the one when the only person is an average school who was capable of using computers and knew their target purpose was the informatics teacher. Since all computers were concentrated in the lab they were used only during informatics classes. In this event, the class was divided into two groups because the number of computers was limited to 10-15 units. If a school acquired computer programs for studying other courses, these rare classes were held in the computer lab with the informatics teacher obligatorily participating in them since he was the only teacher capable of starting these programs and the one who assumed the material responsibility for computers.

Educational programs and curriculums were centralizedly approved and set as standards throughout the country. No initiative was allowed. Now we can witness more favorable conditions for practical implementation of new organization models for using computers in schools. These models include the following:

1) Independence of schools. Each school may decide as to what educational programs teachers will use. Some schools even jumped at the class-lesson system and declare a transition to new means of educational process organization.

2) Readiness of teachers. Presence of computers in schools could not pass unnoticed. More

and more teachers feel the necessity of applying information technologies in studies of their courses. Meeting these needs, a course of mastering and implementing a project method for teachers was developed in the Institute for Informatics Problems RAS.

3) Change of teachers' role. The process of gradually transferring knowledge from people's heads into magazines and books and then into computers which is underpay all over the world involved schools as well. Now teachers become more and more aware that they no longer represent a source of knowledge for students. Teachers' role of a source of information is substituted by the role confined to methodical organization of the process implying self-reliant acquisition of knowledge by students from various sources.

4) The economic situation. The economic situation played an important role in arising the necessity to overhaul the organizational form of using computers implemented in schools. The project collective model requires considerably lower costs for computerizing the education process. The same approach may be applied to the model of individual activities.

5) Civilized methods. Several years ago school were supplied computers according to directives of the party and the government. Now schools acquisition of computers is based upon sponsor investments. The further step toward civilization would be to apply for sponsorship not only for providing the given school with computers but also for implementing certain education projects that will bring in particular results. The transition to financing projects is getting closer. This is the way science is financed. The transition to the collective project method of organizing the use of information technologies may create advantages for schools in getting the proper financing.

4. STUDENTS

4.1. MODELS FOR APPLICATION OF INFORMATION TECHNOLOGIES IN SCHOOLS

It can hardly be expected that in the near future schools will be able to equip every working place of students with computers. It is also unlikely because neither the teachers nor designers of educational programs can offer students a constant substantial work on computers at least in certain courses except for informatics basics. It seems that the class-lesson model of using computers reached the limit of its possibilities. Hence, the task of informatization of the education process must be solved through other ways.

As one of these ways it is possible to propose to start implementing other organizational models for interaction of students with the information technologies. Let us view what options it presents. In order to do that we will have to list the mechanisms of educational interaction between students and computers and evaluate the possibility of their implementation in the framework of certain organizational models. We can map out the following models of using information technologies applicably to computers:

1) Model of studies. This model is designed for studying and mastering computer user interface and programs. An instrument or a working tool is being mastered. The model is characterized by the immediate communication with computers for a consequent implementation of actions and test for the correct reaction of software. This model plays an auxiliary role as a preparation stage providing a possibility of implementing other models for applying computers. In the overwhelming majority of cases this model is used in schools.

2) Model of existence. Programs featuring certain artificial environments via modeling (simulation) or creation of virtual reality have gained more and more significance lately. Multimedia means are used as well. Under these circumstances, the user of such a program - a student in this case - views this artificial environment as reality in which he exists within a certain period of time. The purpose of such programs may vary. Most frequently this model is used in computer games and training programs. Another fine example would be INTERNET. Some of its features make it possible to implement a collective model of existence in artificial environments. The model of existence has a paramount importance because it provides the greatest impact upon the user. This model is implemented in the conditions of direct communication of the user and the computer. The education application aspect may be represented by such "construction" games implementing macroeconomic and social models as SimCity, MotorCity, Civilization and others.

3) Model of managing one's own information. This model is implemented when as a result of work with a computer, the user accumulates certain materials that require particular attention in terms of storage, renewal organization etc. This self-reliant work requires personal memory resources. The simplest version of the model of information management is implemented when students create their own subcatalogues featuring results of their activities such as texts, charts, tables etc.

4) Model of managing technological process. This model features application of computers as an intellectual interface between the controlled process and the operator. As far as the education process is concerned, this model may be used in case of computerized control of physical and chemical tests. There are projects on managing such physical characteristics in the classroom as temperature, humidity, light etc. They may form part of the education process when dealing with such courses as physics, geography and nature studies.

5) Model of creativity. In the event that computer is mastered as an instrument, students may face a situation that requires a certain portion of creativity. Computers make it considerably easier to write essays, enables students to format the created texts providing them with polygraphic quality. Creation of computer pictures and programming may also be regarded as creativity. The process of creativity requires a special creative atmosphere which can hardly be achieved during the classes and especially in the situation when all students must do the same work.

6) Model of communication. Modern computer

networks feature the function of transferring messages among the users. These possibilities are so immense that they turned into an important element of human culture during the last years, which may not be implemented via other mechanisms of transferring messages across a distance (mail, telephone, telegraph, fax). Computer networks just like ordinary every day communication may feature educational projects containing along with the materials for educational purposes element- of motivation for students. These means also allow to execute distance education implementing the parable of a virtual classroom.

7) Model of browsing (surfing). Those students that are computer wizards usually familiarize themselves with a new computer not starting with solving the task in hand, but with finding the contents of the computer memory. They scan catalogues, starts the programs he is interested in and scans files that may be of interest for him. This scanning or browsing is a rudimentary example of the behavior that may fully be realized in INTERNET. An analogue of these activities may be represented by scanning books with a free access in the library. This model is implemented both for satisfying one's curiosity and as a method of browsing information. In this case it does not matter whether the person engaging in scanning knows what he looks for. Currently, no experience of practical application of browsing model has yet been generated. However, there is so great an interest shown toward such a possibility that we may soon expect publications of methodological materials on its application.

8) Model of retrieving information. This model may be outlined as an independent mechanism for computer interaction because in the event of a straightforward search of information other programs are employed than the ones used for implementation of the browsing model. This model may be executed in case of educational use of electronic encyclopedias and tour guides on CD-ROMs, for example, when preparing summaries or reports.

9) Model of intermediary interaction. Among many education projects there are ones that do not require direct communication between the computer and all participants of the project, although, the information retrieved from the computer considerably determines studies related activities [1]. A fine example illustrating that model may be the description of a project entitled "Holidays" that got underway in 1992-93 in the framework of an E-mail pilot project for schools in Great Britain and the CIS. Students of schools exchanged descriptions of national holidays and then picked one of the holidays celebrated in the other country for doing so in their school. After settling on a particular holiday, a detailed study of the chosen holiday took place in the school including the behavioral scenario, clothes and national cuisine. The closing event was the celebration of the chosen holiday with the further exchange of videocassettes containing a recording of it. The direct work on the computer was accomplished by a small group of students and in some schools this role was played by the teacher alone. However, the intermediary interaction of practically the entire school with their counterparts lead to a significant for the schools event. The project materials increased motivation during geography, literature, history world culture classes, because it inspired studies of both British cultural traditions and those of their own country.

All of the described models may appear useful when implementing educational activities of students employing computers. However, the modes of organizing students should conform to the applied models. Let us view organizational models of interaction between students and information technologies.

1) Class-lesson model This model is characterized by the fact that all of the working places are equipped with computers as well as that of teachers'. It is also assumed that all computers are plugged into a local network and supported by a server. The interaction with computers during the classes is organized so that all students engage in similar or same actions. The teacher's task is simplified. He presents problems, shows how to solve them and controls the process. It is fairly easy to control same tasks just like it is to comparatively evaluate the results. This organizational model provides the best implementation for the model of studies which is auxiliary with regard to the rest of them. The model of browsing would probably also fit the profile of such a computer class in the event that no concrete goals are set before the students and the process assumes the form of mastering the browsing procedure. All other models require individual actions of students thus not fitting the class-lesson system.

2) Collective project model. This model is based upon a project method well known in pedagogic. One of the major controversies of modern schools is that goals of pedagogues are different from those pursued by students. Low rating of pedagogues' goals among students does not increase their motivation and leads to a general decrease of interest taken in the studies and hence to a decrease in the level academic achievements. One of the effective methods increasing the motivation of students is creation of goals important for them and which can be achieved by obtaining particular knowledge. In this case achieving the pedagogical goals becomes a means of achieving the goals that were artificially presented to students. It appears probable enough that this famous pedagogical situation may find a second chance due to the emerging possibility of using computer based information technologies is schools. Perfecting the project method teacher concentrates on pedagogical issues and on planning changes in the educational process of character building. Employment of information technologies plays an auxiliary role in ensuring the planned changes. Since project activities implies different roles of participants, the use of computers becomes momentary and takes place to the extend of being necessary according to the distribution of roles among participants. If there are several, from six to eight project groups in the classroom one or two computers may be enough for supporting the entire work. In this case every group may use the computer differently than others. Naturally, teacher's task in such a class becomes more complex. However, because of the intensive motivation of students one may be assured that everyone is occupied with a task. Subsequently, it becomes harder to evaluate the academic achievements of every student. In order to avoid this complication, the evaluation procedures should be planned when working on the project. Apparently, depending on the contents

of projects any of the models employing information technologies may be implemented, with the possible exception being the model of studies. The collective project model may be employed when using a single computer in a school. Some of the projects may not require a computer in the classroom at all. In this case it is the education process that undergoes informatization but not *the* operation of studying the computer itself. Practical application of the collective project model requires that teachers possess new knowledge and follow the special procedure.

3) Model of individual activities. This model finds its best application when using a computer at home, however it may be replaced by an analogue represented as single computers located in a school library, for example. This organizational model allows to apply any of the models employing information technologies including the model of studies. In order to employ it, both time during the class and off the class may be used. In the event that students have a computer at home, the accent may be replaced on the homework.

The major conclusion that may be drawn from this material suggests that the class-lesson model of interaction between students and information technologies is depleted. It should be replaced by the collective project model and the individual model The main advantages of the offered models are represented in the fact that they allow to subject the education process to informatization, achieve this goal with lower costs and suit the modern school better.

5. SOCIAL, ECONOMIC AND CULTURAL ASPECTS

5.1. TECHNOLOGICAL INNOVATION IN THE SOCIAL SPACE AND INFORMATION TECHNOLOGIES

One of the major principles of the modern society development is the great degree of technological innovation in the social space [25]. The technological development level of the society determines today its capability to produce high quality competitive goods, makes the country economically powerful and socially stable, determines living standards of the overwhelming majority of our planet's population. This is exactly why a brand new type of the world market has been forming lately - a market of promising technologies where the information technologies play more and more considerable role. In other words, information technologies become such an important product of social activities as manufactured goods, products and services. A characteristic example of it would be Japan - the first country to give informatics and information technologies a priority status in their national policy of social and economic development.

The strategic role of information technologies as a factor of social and economic development in the modern society may be deemed generally acknowledged today with no room for doubts. It is determined by the following major peculiarities of information technologies that stipulate the necessity to give them the priority status both in national scientific and technical policy and the sphere of education [2].

1) Information technologies make it possible to activate and efficiently utilize national and the world information resources of the society that today represent such an important factor for the development of the civilization as mineral resources, raw materials, energy and human resources.

2) Information technologies allow to optimize (and in many cases - to automate) information processes that have occupied larger niches during the recent years in different social activities spheres It is a common knowledge that the development of the civilization assumes the direction toward informatization-oriented society in which objects and results of the work accomplished by the majority of population are not tangible values but mostly information and scientific knowledge. Already now in the developed countries a large part of working population (more than 60% in the United States) are closely linked in their activities with the processes of preparing, storing, processing and transferring different types of information and therefore, it has to develop and practically apply the proper information technologies. Thus, the rapid development of the information sphere in the society had a considerable impact upon the structure of population's occupation and requires the proper orientation of the education system. For example, the development of personal informatics means and the telecommunication system provide new options for providing jobs for handicapped at home, pensioners capable of working and women raising small children. And these are quite vital and important social problems for many countries in the world.

3) Information technologies are often important components of other types of technologies both industrial and social. In this case they implement the most vital "intellectual" functions of these technologies. Characteristic examples may be systems of automated projecting of manufactured products, flexible automated and robotized types of production, automated systems of technological process control, modeling complexes for conducting tests of complex technical systems etc.

4) Information technologies play an extremely important role today in providing information interaction between people as well as in the systems of preparing and distributing mass information. Today, in addition to the customary means of information communication (such as telephone, telegraph, radio and television) systems of electronic communications gain more popularity in different spheres of social activities. These systems may be represented by E-mail, facsimile communication of information and other types of telecommunications. These means are rapidly assimilating in the culture of our society since not only do the) create certain conveniences and save social time but also facilitate solution of many industrial, social and routine problems entailed by the globalization and integration process the world community is undergoing, expansion of national and international cultural and economic ties, migration of population and more dynamic transportation across the planet. The level of development and distribution of modern information technologies determines the extend to winch a country enters the world community space. This is one of the critical conditions for developing not only the economy but also for efficiently developing its science, culture and

education.

5) Information technologies are pivotal in the process of intellectualization of the society and development of educational and cultural systems. Practically in all of the developed countries and in many developing ones computers and television equipment, education programs on optical disks of CD-ROM types and multimedia technologies become customary attributes of not only higher education institutions but also ordinary schools that form the system of secondary and elementary education. The application of information technologies became also an efficient method for education systems, continual education as well as for qualification advancing systems and retraining of personnel. Thus, the issue of developing and distributing progressive information technologies in the society is most closely related to the problem of qualitative development of human resources and intellectualization of the society.

6) Another promising direction in the process of safe and stable development of the civilization is the development based upon knowledge. It implies that both global and regional knowledge should be rationally developed and actively knowledge that reflects the historical experience and peculiarities of development in particular countries and regions of the world [26].

In this regard it is appropriate to emphasize especially the key role if the information technologies in the processes of generating, distributing and effectively using new knowledge. Today, the traditional methods of supporting scientific research confined to basically computerization of mathematical calculations, employing methods of statistic modeling and in distributing scientific and technical information within telecommunication networks does not satisfy scientists anymore. These methods are replaced with the new ones based upon application of rapidly progressing options for means of informatics and promising information technologies.

It should be primarily noted that such methods as teleconferences, assigned scientific task forces as well as methods of complex information modeling of complicated natural processes and phenomenon that allow scientists conduct a sort of a "calculation experiment". In this event, the characteristics of the researched processes may be selected the ones that often may not be implemented given the conditions of natural modeling due to its great complexity, high cost or danger post to those conducting the experiment. This direction created and actively developed by academician A. Samarsky from RAS was widely acknowledged by both Russian and foreign scientists [27].

The second prospective direction is formed by methods of artificial intellect that assist in finding solutions to ill-formalized problems as well as problems with incomplete information and blurred initial data. In this case the logical sequence of the automatic search for the type of problems specified above reaches in its character that of metaprocedures used by the human brain [28].

The next promising direction is represented by methods of multi-dimension cognitive computer graphics that make it possible to present various mathematical formulas and principles in spacious form. With the help of them Russian scientists managed to observe several new principles even in such an abstract field as the theory of figures.

It is necessary to underline that fostering research in the field of theoretical informatics and philosophic perception with which the Russian scientists deem the role of information in the evolution process help form a new picture of the world around us, which appears considerably more informative than it was thought before [29].

5.2. INFORMATICS AND CULTURAL ISSUES

Development of means of informatics and information technologies make it possible to find new solutions to a number of pressing problems of modern culture. One of them is the problem of how to save cultural legacy of different peoples, represented by ancient books, manuscripts, pictures, photos, sound recordings, films, videos, etc. Another problem is how to provide a wide access to this data to all interested users, with no threat to their good condition in future. Both these problems can be effectively solved by creating electronic encyclopedia, reference books and data base of the works of culture, where their electronic copies are kept in high-fidelity computers and can be easily accessible to many distant net users. Necessary distribution, as well as local use of this data, for instance, for research work, studies, culture education activities, etc., are also possible.

Invention and application of digital copies of the works of culture, as well as recent development of integral multimedia technologies have become the main instruments of the fast-developing art trend - screen art. Dozens of thousands of CD-ROMs, which have already become an industry trend, popularize world's cultural masterpieces, which have been accessible only when in museum, palaces, picture galleries, art exhibitions or private collections.

Multimedia technologies let not only link the picturesque and detailed images of the works of architecture, sculpture and fine art item by item, but supplement them with diverse reference and scientific data, as well as music, movies, video, animation, etc., if needed. All this strongly influences the audience emotionally, develops its sense and interest in art and, simultaneously, lets it obtain the necessary knowledge in culture, art, human history.

Opportunities of this trend of informatics means and information technologies development are so promising that Russian culturologists have good reasons to say that a new cultural trend, i.e. screen culture [30], is being born. Most important is to ensure that this trend is fully applied in the area of humanitarian education.

It is worth mentioning that there is one more type of promising information technologies. Its appearance will provide absolutely new opportunities for the realization of human creative talents. This is the so-called creative technologies which are intended to exercise information support for human art processes with the help of computers, TV and other information equipment.

Application of these technologies is especially effective when the art process implies combinatorial tasks, searching for necessary combination of space, color and other elements of the work. This is rather typical for architects, designers, modelers, arrangers, animators, sound engineers and some

other art professions.

Creative technologies are new. Therefore their opportunities are not widely known yet. Though they will have a good future. If digital TV and sound-recording studios already exist, the specialized computer centers for the data support of other types of creative activity are the matter of the near future of information.

That is why one of the tasks of the modern education system is to properly update both teachers and students on the main opportunities, problems and peculiarities of this fast-nearing future, which gives us no time to get ready for it.

5.3. INFORMATICS AND OF NATIONAL SECURITY ISSUES

Informatics and information technologies are the necessary and rather effective means of ensuring national security, many of which are of a mostly information character [31].

Paying no particular attention to the well-known problems of military security, which is impossible without strong computer base, we will consider three basic problems, which people meet at the door of XXI century and which pose a serious threat to their future existence.

The first among these problems is the problem of environment and its greatest part - human environment. Ensuring of chemical safety of a person under modern conditions of the himself-made artificial world is becoming one of the most pressing and urgent problems of national security. The ways to find a solution to this problem are closely connected to the use of modern information technologies.

As a result of the rapid growth of chemical industry and insufficient toxicological control over production of many artificial substances and materials, dangerous to health and sometimes life, our society is now living in an undeclared chemical warfare, having no idea about this fact.

Man is surrounded by toxic substances: paints, lacquers, plant and anti-insect strays, furniture varnishes of different kinds, building structures, etc. There are thousands of them already and they keep increasing in number [32].

The problem is even more dramatic due to the fact that different toxic substances influence human body in different ways, not only according to the type and the quantity of the substance, but to the individual peculiarities of the organism as well.

Thus, today diagnosis and treatment of acute chemical intoxication are not purely medical but mostly information tasks, which solution demands the use of such means as automatic toxicological data base, expert systems for doctors-toxicologists, telecommunication networks, etc.

Another serious problem of national security, demanding the use of the latest inventions in the area of informatics, - is the fight against crime, especially Mafia. The problem of co-interacting the crime in its traditional forms, as well as in form of new types of crime against individuals and society (environmental and computer crimes) can be effectively solved only on the basis of creation and wide application of latest means of informatics and information technologies in the activities of internal affairs bodies. Personal identification, ballistic tests on weapons, tests on document and money bills authenticity, operative connections and transmission of criminal data - these are just some of the problems, which security services and police institutions have to face nowadays. Besides, the problems increase in number every day.

One more new and, probably, not enough realized problem is the necessity to ensure information security of man and society. This is a complex problem, involving such components as ensuring sufficiency, accessibility and authenticity of the data, used in society, prevention against personal information control and other no less important and complex social problems. They all need careful study in terms of information approach, as well as development and introduction of appropriate information technologies in social practice.

5.4. PROSPECTS FOR THE DEVELOPMENT OF INFORMATICS AS A SCIENCE

One of the most important conclusions of modern science is the conclusion that information and scientific knowledge are the main factors, representing not only general potential of the society, but the prospective of its further growth. In this situation it is extremely important to introduce into education system new principles of information study which is to be considered as a fundamental natural science discipline, which will study features and laws of data motion and transformation within nature and society.

Today, on the threshold of information civilization, it is inadmissible to treat informatics as a purely technical science on methods of data computer processing. This approach does not already conform to the fast-growing subjective sphere of modern informatics and its part in the process of further social development.

The above examples of the use of information technologies in the different areas of social activities and the important part of society in solution of urgent social, economic and cultural problems witness the necessity of substantial reconstruction of traditional informatics study courses under the motto, set forth by academician A. Ershov: "From computer literacy to information culture of society", which is to become an inseparable part of its culture.

This would comply with the one of the main principles of Russian modern educational policy - to ensure the leading position of educational system as opposed to other means of social, economic and cultural development of our society [32]. Top priority, given to education, is a contribution to the future of Russia.

6. TRANSPARENT TOPICS

6.1. DISTANCE EDUCATION IN RUSSIA: OBJECTIVES AND PROSPECTS

In the last two years the term "distance (or distant) education" became quite trendy. It is mentioned at every conference dealing in the least with the issues of using information technologies in education. Each author with a fair amount of self-respect

writing about the application of information technologies in education can hardly keep silent when it comes to this topic. The reason for this is quite obvious - for our huge country with the intrinsic to it pour infrastructure system and significant concentration of scientific and educational centers, the possibility of obtaining education without suspending the major activities is extremely critical. It is apparent that the existing system of extra-mural education due to a number of circumstances fails to meet the pending requirements.

The meaning of the term "distance education" is confined in the realization of the possibility to obtain education without suspending the major activities and without physical transportation to the location of the educational institution The fact that this term is broadly used reflects understanding that there is a growing necessity of emergence of such an opportunity rather than possession of techniques and methods for its implementation.

It would appropriate to say several words about the system of extra-mural education that formed in our country. It feels like the more extra-mural education resembles the standard one the better it is. The entire information interaction between teachers and students is carried out during an extensive session. Outside the limits of the session practically no programs exist. In this form, the extra-mural education will always lag behind the standard one which causes quite a negligent attitude toward it.

On the other hand, extra-mural education has a paramount importance for such a huge country like Russia and its perfecting based upon new technological options may appear quite promising. That is why, apparently there was an explosion of interest toward Distance Education. In this case everyone deems the distance education as he pleases. This includes television education, extramural programmed education, videoconference education and self-education using the means of information technologies. It is worth mentioning that the system of extra-mural education is much more rich in options than in our country which may be explained by the absence of the strict centralization which we all witnessed and participated in. That is why a certain confusion took place. If any specialist is lucky enough to familiarize himself with an existing system of extramural education that is considerably different from the one in our country, under the slogan Distance education, then with a certain degree of probability one could assume that he will take it for the distance education everyone is talking about. Especially if the system employs such technical means as computers, television or satellites. Let us try, though, to outline the most important aspect that entitled this term to exist. We propose that the distance education shall be considered the forms and methods of education that offer a possibility to exclude any direct personal contact of teachers and students regardless of the nature of the applied technical and other means. In this event, it is not the issue to obligatorily dispense with any possibility of personal contact. In each concrete cases only the methods that suit the education purposes the best should be applied. Thus, if as a result of education an issuance of a certain certificate or a diploma is implied of certain importance then undoubtedly the final stage which is graduation exams and thesis hearings shall be accomplished in personal contact. The education related to working with special equipment is also conducted at the location of this equipment. However, the preparation and theoretical stages may be implemented distantly.

Thus, the successful implementation of distance education requires the following:

- supply of the educational materials to students,
- presence of interaction with the teacher,
- ensuring collective distance work where needed.

In this context it is necessary to bear in mind that students are physically left to themselves. That is why the educational materials, tasks and the consequence of their studies and fulfilment shall be worked out more in detail than it is usually done in case of a standard education.

In essence, the real distance education takes place if there is a distant feedback. The regular mail plays the primary role in this case (historically). One can easily imagine a written exchange of information between teachers and students. Of course we are not trying to point out that each teacher has to respond to every student's letter. Terms for accomplishing particular tasks, form of material presentation, form of consulting organization (everyone knows his questions but each gets a complete set of answers) mechanisms of evaluating the submitted results shall be determined. In certain cases telephone and facsimile communications may be used. However, it should be admitted that the most prospective and convenient for distance communication is the telecommunication in the form of E-mail or teleconferences

In the events when organization of a collective work of students is required, teleconferences would be the only acceptable solution Videoconferences solve such problems as well however, currently they can hardly be widely used. Distance education based on computer (telecommunication) networks and videoconferences feature the parable of a virtual class, the possible variations of which depend on the age of students and level of education. All of them to a significant degree depend on the role assumed by the teacher or a group of teachers like in a normal class situation. I cases when the teacher educates and evaluates the contribution of students there may be different styles of interaction in the group with each member of it who possesses knowledge and skills sharing it with the others. Teacher in this context acts as an assistant.

Thus, the application of distance education methods allows to obtain (provide) a complete education at the location of residence or work without suspending major activities. Depending on the advanced character of the communication means and the proper scope of financial resources available, particular technical means may be preferred It is worth mentioning at this point that everything concerning the possibility of obtaining distance education specified above applies to teachers as well. He may also teach without suspending his major activities and do that from his home or office regardless of the location of the educational institution that provides the training. This fact is rarely paid attention although implementation of these options may be as important for teachers as it is for students.

Such options offered by the distance education as:

- collective (group) work;
- employment of distant educational materials;
- operative (in the course of education process) exchange of information between all the links

are fully demonstrated when using telecommunication. That is why they may be considered the main and systematizing feature of distance education [33-39].

We can map out at least four ways of applying distance education methods:

- for complete substitution of personal contacts;
- as an addition to personal contacts,
- as information-oriented approach toward the education process,
- when using a fully integrated method.

Full substitution

Methods of distance education are used for replacing the traditional methods of education that require personal presence or ensuring these contacts via electronic means across a distance with regard to geographically isolated regions or offering them a constant (permanent) alternative for extramural courses. A good example may be represented by the application of teleconferences for implementing distance on-line courses in the New school of social research in Manhattan. The school offers complete courses based on that technology. The traditional college atmosphere is represented at these courses the following way: traditional classes are formed as separate teleconferences, there are conferences for an electronic campus cafe for students and teachers, recreation room for students, electronic library and board of announcements. This program serves for students from any state of the US, Tokyo, Singapore or Great Britain just like it does for those from the closest to this are of New York.

Addition

The technology of distance education is also applicable as an addition to the traditional education based on personal presence. Electronic seminars may introduce a useful and motivating aspect both in standard and extra-mural education. Materials covered during the lectures may be supplemented and commented on during the teleconference. Students may ask teachers questions, require additional information for ensuring success of the entire class. Personal contacts may be continued during the simultaneous teleconferences for carrying on discussions on the raised issues or topics that were not possible to discuss during the personal meeting.

Information-oriented approach

Distance education methods are used for ensuring an education based upon information resources. In thus event different types of delivering and using information may be used. An example of such approach is the course in the Open University on information technologies. In addition to the traditional materials used in education (texts, audiocassettes, television, lectures, additional materials, course programs etc.) students are also granted access to teleconferences for such activities as exchanging information of the course, renewal of information, consulting and collective self-reliant preparation. Thus, teleconferences are one of the several alternative ways of providing education within a course. In this context, the variety of available education means meets the various needs of students.

Completely integrated method

In case of the integrated approach each means of education offers the advantages that it may add to the education. Lab works are carried out according to the traditional way. The types of work that do not require personal presence are accomplished via distance education methods which become an important and organic part of the course but not some overtime addition.

As a rule, authors writing about distance education accentuate that it is vital for Russia. This really is vital factoring in the vast size of the country, inefficiency of transportation means and "concentration" of scientific and educational centers. On the other hand, the expel Use generated in the world flowing into our country related to organization of distance education systems may be considered adequate for its practical application. Nonetheless, the actually operating models of distance education may be counted by fingers with none of them being completely Russian. Organizations specializing in distance education mainly provide Western education in Russia. The Russian national education is neither "exported" to other countries nor does it work in Russia.

The Institute for Informatics Problems of the RAS, possessing the technology of distance education and persistently offering it to organizations visibly concerned, faced unexpected and interesting circumstances. Educational institutions, as a rule, are not prepared for introducing distance education. This applies both to higher education institutions and commercial education departments of large companies. As far as we can judge, the reasons for such an altitude toward distance education are:

1. Serious obstacles in obtaining state financing supporting this type of education. Western grants support the introduction of Western courses in our country. That is why Western course are offered in Russia but not vise versa. Educational organizations as a rule, face the choice whether to seek a grant or to pay themselves Usually grants are the choice that is favored

2. Absence of technical possibilities both at the education facility and students of distant courses. This controversy is encountered when trying to introduce distance education in higher education institutions and branch systems of advancing the qualification of personnel. The technical side of this issue still remains an expensive effort. Since it actually deals with the application of computer networks, the organization minimally has to purchase computer and a modem for the teacher, become a client of a telecommunication system and make sure that students possess the proper equipment as well. In a number of cases it appears to be an irresolvable problem.

3. Teachers possess an experience of working with standard education and it is uncustomary and undesirable for them to switch to the new teaching methods.

All what was mentioned above, seems sufficient enough to understand that distance education may successfully integrate into the existing educational systems such as extra-mural and standard education, open education, education at home or without suspending major activities. However, today we can mostly speak about the distance education in subjunctive mood or in the future tense. Creation and introduction of a federal program in Russia entitled "Development of the uniform system of distance education in Russia" has to upgrade distance education to the category of practical activities.

7. ABOUT PROSPECTIVE STRUCTURE OF EDUCATIONAL COURSE "FUNDAMENTALS OF INFORMATICS"

The general prospective structure of the educational course "Fundamentals of informatics" is offered for the system of secondary and higher education in Russia. This structure is built upon a problematic module principle and therefor is quite flexible. It is designed that the contents of this course should contribute to practically ensuring the leading role of education in the process of intellectual development of the Russian society. For this purpose, a section of the course entitled "Theoretical informatics" was expanded and a new section called "Social informatics" was introduced, in which social aspects of the society informatization process are reviewed.

7.1. MODERN CONCEPT OF THE SUBJECT SPHERE STRUCTURE OF INFORMATICS

In Russia's National report entitled "Policy in the sphere of education and new information technologies" which will be presented in July, 1996 at the Second International congress "Education and informatics", shows a structure scheme illustrating the modern concept of the subject sphere structure of informatics (Table 1). This scheme according to authors of the report, shall lay the foundation of the modern course c "Fundamentals of informatics" that is to replace the traditional course in the Russian education system called "Basics of informatics and computers".

The offered course is undoubtedly an advancing step as opposed to the traditional one. The very title of this course "Fundamentals of informatics" already orients pedagogues and students at studying informatics as a fundamental scientific discipline and not solely as a course aimed at obtaining elementary computer literacy. It seems that this is a very critical structural shift in orienting the Russian education system applicably to this subject sphere.

The course contains three major sections which are "Theoretical informatics", "Means of informatization and "Information technologies". The section "Theoretical informatics" includes only studies of mathematical and information models and algorithms as well as methods of designing and projecting information systems and technologies. Naturally, this dot's not make up for the entire number of problems intrinsic to this vital section of the course which shall contribute to formulating a modern world perception among students. It seems to be the **first serious remark** on the contents of the proposed course.

Another serious remark is that the content **of the course practically completely fails to cover the issues of information support** of informatization means which of course is unacceptable

The problem of structuring in section "Information technologies" does not seem quite appropriate either, for there is no distinct boundary between the versatile (base) and problem-oriented technologies.

And finally, the course does not deal with the issues related to the studies of social and economic aspects of society informatization at all, which are exclusively vital and are more and more brought up to the surface by the very development of the modern society. That is why such important notions as "information resources", "information infrastructure" and "information environment of the society as well as its "information potential" and "information safety" will remain ill-understood by the students that will successfully master the offered basic course of informatics. All of it takes place in the conditions when the global process of society informatization is increasingly affecting its social and economic structures and the role and position of people in the society.

It seems necessary that this weak point of the offered course is corrected as soon as possible.

7.2. PROSPECTIVE STRUCTURE OF THE SUBJECT SPHERE IN EDUCATIONAL COURSE "FUNDAMENTALS OF INFORMATICS"

Paragraph 7.3 describes the general prospective structure of the subject sphere in educational course "Fundamentals of informatics" in which all the remarks concerning its contents are factored in as it seems.

The course contains three major sections which are "Theoretical informatics", "Technical informatics" and "Social informatics" each of which contains several problem modules representing components of the educational program.

The section entitled "Theoretical informatics" contains six such modules: "Philosophic fundamentals of informatics", "Basics of general information theory", "Basics of computer semantics", "Fundamentals of information modeling", "Information intellectual systems" and "Information and knowledge".

The listed titles of problem modules as well as the essence of issues described in them proves that this section primarily aims at forming a modern scientific world perception among students in which information is regarded as a fundamental semantic feature of nature and the information processes - as critical intellectual components of the functioning processes of any technical, social and natural systems including processes of perceiving the world by humans.

Apart from this philosophic task, this section contains issues related to studies of the modern scientific methodology in informatics and primarily theoretical basics of information modeling. It stipulates studies of statistic methods, methods of conducting "computing experiments" (according to A. A. Samarsky) as well as methods of solving ill-formalized problems and problems with incomplete or blurred initial data.

The second section of the course - "Technical informatics combines four problem modules: "Technical means of informatization", "Program means of informatization", "Information support of informatization" and "information technologies"

Contents of this section covers basically all problems that are proposed for including into the basic course of informatics in Russia's National report (Table 1). In addition, it specific, an important problem module entitled "Information support of informatization", and the problem module called "Information technologies" sets forth their more distinct division into versatile and problem-oriented.

The third section of the course called "Social informatics" contains four problem modules which are: "Information resources", "Information potential of society", "Information society" and "Man in information society". Their titles and the contents of the issues described in them proves that the major objective of this course is to render the students a broad perception of the information-oriented character of the modern society development process as well as arising from it of problems and methods of solving them based upon the information approach and prospective information technologies.

Studying this section is extremely important for universities and humanitarian higher education institutions as well as in the system of advancing qualification of state officials and those occupying administrative positions.

7.3. STRUCTURE OF THE SUBJECT SPHERE IN PROSPECTIVE EDUCATIONAL COURSE "FUNDAMENTALS OF INFORMATICS"

Section 1. Theoretical informatics

1.1. Philosophic fundamentals of informatics

• Concept of information as semantic feature of matter. A triad of substance-energy-information.

• Information and evolution in living and non-living nature.

1.2. Basics of general information theory

• Methods of measuring information. Micro- and macroinformation.

• Information and self organization. Synergetics of information processes. Information approach.

1.3. Basics of computer semantics

• Information and knowledge. Semantic aspects of intellectual processes.

• Semantic concept of information systems.

1.4. Fundamentals of information modeling

• Stochastic methods in informatics.

• Computing experiment as a new methodology of scientific research.

1.5. Intellectual information systems

• Artificial intellect information systems. Methods of rendering knowledge.

• Methods of expanding poorly formalized problems in indefinite conditions.

1.6. Information and knowledge

• Knowledge and creativity as information processes. Creative information systems in science and culture.

• Social intellect. Basics of social cognitology.

Section 2. Technical informatics

2.1. Technical means of informatization

• Means of data processing: PCs, workstations, input/output devices, computation complexes and systems, computer networks.

• Means of telecommunication: technical means and links and computer telecommunication systems, audio and video systems, telematic systems.

2.2. Program means of informatization

• System program means: operation systems and environments, systems and languages of programming, user languages, systems of user interface, service nutshells.

• Means of implementing versatile (base) information technologies: text and graphics processors, processors of electronic tables, SUBD, means of object, rocess and system modeling.

• Means of automation of calculations, SAPR, GAP, ASNI, means of solving information and analytical problems and problems of organized administration.

2.3. Means of information support

• Information languages and formats of data and knowledge presentation, dictionaries, classifiers.. thesauruses.

• Means of information protection from elimination and unauthorized access.

2.4. Information technologies

• Versatile (base) information technologies of: integration and collective use of various information resources, their "electronization". Technologies of text processing, that of video and audio information, multimedia technologies.

• Problem-oriented technologies of: training, diagnostics, administration, projecting, modeling.

Section 3. Social informatics

3.1. Information resources

• Methods of formation and quality evaluation of information resources, their structure and topology. National and regional resources.

• Information resources as a factor of social economic and cultural development of society based upon knowledge.

3.2. Information potential

• Information technology. Methods of activation of information resources.

• Information infrastructure and social information environment. Information culture.

3.3. Information society

• Principles and problems of development and evolution of information society Major features of information society. Peculiarities of the transitional period.

• Informatization as a global process. Its impact upon social structures of society. The issue of information safety.

3.4. Man in information society

• New options for character building in information society. Problems of democratization in information society and ways of their solution.

• Information culture and information safety of identity.

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Table 1.

Subject sphere structure of informatics - modern concept

FUNDAMENTALS OF INFORMATICS				
THEORETICAL INFORMATICS				Mathematical and information models, algorithms. Methods of designing and projecting information systems and technologies
MEANS OF INFOR-MATIZA-TION	technical	data processing		PCs. Work stations. Computing systems. Input and output devices
		data transfer		Computer networks. Complexes. Technical means of communication and computer telecommunication systems, audio and video systems, multimedia
	program	system		Program means of intercomputer links (systems of teleaccess), computing and information environments Operation systems. Systems and languages of programming User languages, systems of user interface, service nutshells
		implementation of technologies	*versatile*	Text and graphics processors Database administration systems Processors of electronic tables Means of modeling objects, processes, systems
			profession-oriented	Publishing systems Profession-oriented systems of implementing technologies of calculation automation, projecting, data processing (accounting, planing administration, analysis, statistics etc.) Systems of artificial intellect (databases, expert, diagnostic, training systems etc.)
INFORMATION TECHNOLOGIES				Of input/output, collection, storage, transfer and processing of data Preparation of textual and graphical documents, technical documentation Programming, projecting, modeling, training, diagnostics. administration (of objects, processes, systems).

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UNITED NATIONS EDUCATIONAL,
SCIENTIFIC AND CULTURAL ORGANIZATION

EDUCATION and INFORMATICS

EDUCATIONAL POLICIES and NEW TECHNOLOGIES

PROCEEDINGS
OF THE SECOND INTERNATIONAL
CONGRESS

VOLUME II

NATIONAL REPORTS

UNESCO INSTITUTE
FOR INFORMATION TECHNOLOGIES
IN EDUCATION

PREFACE

TO THE 2nd VOLUME OF THE PROCEEDINGS OF THE 2nd UNESCO INTERNATIONAL CONGRESS

EDUCATION AND INFORMATICS

EDUCATIONAL POLICIES and NEW TECHNOLOGIES

We bring to the notice of specialists and all interested persons the 2nd volume of the Proceedings of the 2nd UNESCO International Congress "Education and Informatics" held in Moscow on July 1-5, 1996. The volume contains texts of national reports presented at the request of the UNESCO Secretariat by the official education system control bodies from 32 countries. Most of these reports have been submitted to the Congress before its onset, printed and distributed among the Congress participants as the working materials.

The contributed national reports are in full agreement with the objectives of the Moscow Congress. They represent examples of collaborative experience and joint use of limited resources, examine national tendencies and experience in introduction of information and communication technologies into education systems, set forth peculiarities of national policies pursued by various countries in the education sphere, and suggest recommendations concerning international cooperation.

Significant differences in the content of national reports seem to be quite natural because all countries are now at different stages of developing education systems and using new information technologies in education.

As with preparation of other volumes of the Congress Proceedings for publication, we met in this case with a wide variety of approaches to the problems discussed at the Congress - in ideas, terminology, style and completeness of presentation of particular sections and topics. Based on common principles of forming the Congress Proceedings, the compilers and editors of this volume seek to retain, where possible, original texts and avoided in most papers editorial corrections and especially changes in the content. At the same time, some lingual nuances are possible in the issue of national reports in three official Congress languages - English, French, and Russian, which were difficult to avoid with the best will in the world.

The editors would be grateful to authors and readers for corrections and suggestions. Your references will help to continue discussions started at the Moscow Congress, to approach to the unification of terminology and notions used in this area, and to enhance exchange of information on the topics discussed at the Congress.

The present state of the art of using information and communication technologies in education systems of various countries will serve as a good reference material in the activity of the UNESCO Institute of Information Technologies in Education (IITE) set up in Russia in line with recommendations of the Moscow Congress.

Analysis, selection, and preparation for the issue of this volume were accomplished by the IITE and the International Center of Systems

Analysis of Higher Education and Science Problems (the UNESCO associated center). Readers' references, comments and suggestions will be accepted with thanks by the Editorial Board.

They should be sent to the Center's Address: 117918, Moscow, GSP-1, Mal. Kaluzhskaya ul. 1, General Director of the Center, Academician of the Russian Education Academy, Manushin Eduard Anatol'evich.

PRESIDENT OF THE RUSSIAN ORGANIZING COMMITTEE FOR THE 2nd INTERNATIONAL CONGRESS "EDUCATION AND INFORMATICS",

MINISTER OF GENERAL AND PROFESSIONAL EDUCATION OF THE RUSSIAN FEDERATION,

V. G. KINELEV

NATIONAL REPORT OF AUSTRIA

INFORMATION TECHNOLOGY IN THE AUSTRIAN EDUCATIONAL SYSTEM - THE STATE OF THE ART AND BEYOND

1. INTRODUCTORY REMARKS

Both modern societies in the industrialised world and developing countries are moving towards the so-called information age which is symbolised by the transition from an industrial society to an information-processing society. Information and telecommunication technology plays a vital role in economic, commercial, social and also classroom activities nowadays. The informatization of society seems to take place as a "cultural mutation" affecting not only life styles around the world (Vitalari, 1990), but also our way of thinking (Turkle, 1984). It is a matter of fact that the New Information and Communication Technologies (usually abbreviated as NICT), in particular the computer, have already found their way into schools considered as revolutionary in many aspects (see OECD/CERI, 1986 and 1987; OECD, 1988 and 1989).

Seymour Papert [1] philosophised in his keynote address at the international conference "Children in the information age" in Sofia (19-23 May 1987):

"So we are entering the computer future, but what will it be like? What sort of a world will it be? There's no shortage of experts, futurists, and prophets who are ready to tell us - only they don't agree. The Utopians promise us a new millennium, a wonderful world in which the computer will solve all our problems. The computer critics warn us of the dehumanizing effect of too much exposure to machinery, and of disruption of employment in the workplace and the economy". (Papert, 1987, p. 3/4)

Governments in almost all developed countries have introduced computers into the educational system, meanwhile *"an increasing number of parents are feeling more and more guilty if they do not buy a computer for their children"* - as Jacques Hebenstreit sarcastically pointed out at the 8th international European Conference on Computers in Education (24-29 July 1988) in Lausanne (Hebenstreit, 1988, p. 4). What is now (1996) available to schools would have been unthinkable ten years ago. And while the technology advance in the field of microcomputer and new transmission technology continues - and is even accelerated by the convergence of several technologies [2] including satellite technology to produce even more powerful uses - educationalists and politicians have to accept that the demands for investing in educational hardware and software will go on. Even one of the greatest critics of computers, namely Joseph Weizenbaum admitted at the UNESCO -Congress "Education and Informatics: Strengthening International Co-operation" in Paris (12-21 April 1989) that

"another reason given for installing a lot of computers in schools, ..., is that computers are everywhere and that it is very important for children to learn about computers because the world in which they grow will be full of computers. Almost every job will be somehow laced with computers and so they had better know about them". (Weizenbaum, 1989, p. 7)

On all sides, thus, the computer has been invading our lives, changing our human relations and our relationship with the world. There is no doubt that whether or not we use computers in our jobs or in private life the main thing is to become familiar with and acquire a knowledge of computing. In the information society of today a familiarisation with computers has become a fundamental need of the citizen. The growing significance of information technology was also taken into account in the Austrian educational system (EDP/Informatics 1991; Fischer H.F. (ed.), 1988; Reiter A./Rieder A. (eds.), 1990;) that will be outlined in the following chapter.

2. PROFILE OF THE AUSTRIAN (NON UNIVERSITY) EDUCATION SYSTEM

The sector of pre-primary education consists of crčches for the very young, day nurseries for one and two year old, and kindergarten for children between the ages of three and six and is not compulsory. As a rule children start with compulsory education at the age of six, attending primary school (Volksschule) for four years, if physically or mentally retarded a special school (Sonderschule). After the fourth year of school children either go to the four-year main general secondary school (Hauptschule) with streamings in German, Mathematics and Foreign language (predominantly English) or the four-year first stage of a higher general secondary school (allgemeinbildende höhere Schule, AHS). The syllabi of Hauptschule and AHS differ very little, transfers of pupils on a comparable standard of knowledge are possible. In the ninth year of compulsory schooling choices must be made again. Pupils from the Hauptschule often opt for the pre-vocational year (Polytechnischer Lehrgang) before entering apprentice training colleges. These colleges are specialised institutions for vocational or craft qualifications. An alternative route to vocational qualifications from the ninth year onwards up to five years offer the intermediate and higher technical and vocational colleges (berufsbildende mittlere und höhere Schulen, BMHS). They train students for skilled industrial, commercial, business and agricultural occupations and can also qualify them after having passed the final matriculation examinations (Reifeprüfung) for university tertiary admission. Tertiary education is the aim of the three categories of higher general secondary school (Gymnasium, Realgymnasium and wirtschaftskundliches Realgymnasium) with Reifeprüfung which takes the form of written examinations or project assignment and orals for university entrance. Alternative two-year non-university tertiary technical and vocational (Kolleg) courses (leading to qualifications equivalent to those of the BMHS), specialised technical courses (Speziallehrgang), teacher training colleges (Padagogische Akademie) or specialised university (Fachhochschule) studies as additional tertiary options for AHS graduates and BHS graduates.

Sources for Students: Anticipated Outcomes and Unexpected Challenges, in: MC Dougall A. and Dowling C. (eds.) [1990], Computers in Education, North Holland, Elsevier Science Publishers B.V., pp. 19 - 23.

The institutes of education, organised in four departments (compulsory general, apprentice training college, higher general secondary, intermediate/higher technical and vocational college) carry out the vast majority of in-service training for all teachers. An important sector of education and training in Austria is adult education offered by special adult education departments at higher technical and vocational colleges, at universities, federal adult education centres and "popular universities" (Volkshochschulen).

Education system

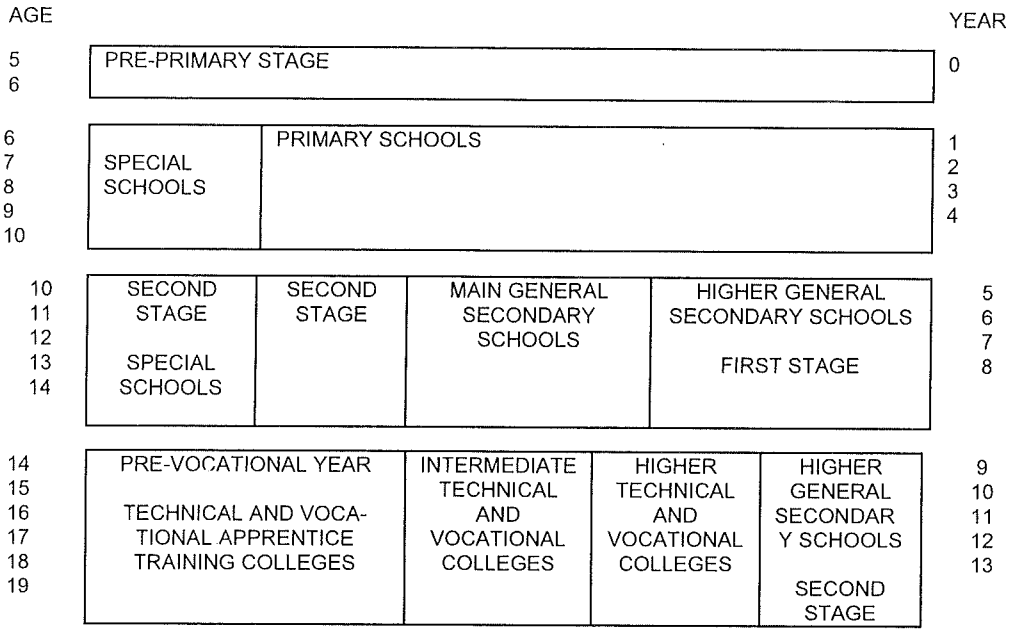

Table of the Education system in Austria (BMUK 1993, Dep. of Educational Economics and Statistics)

3. EDP/INFORMATICS IN THE AUSTRIAN EDUCATIONAL SYSTEM

The first preliminary attempts at incorporating electronic data processing into school curricula took place towards the end of the 'sixties and, in the following years, it became more and more widespread at the individual types of school (see also Kerner, 1994).

The development of EDP/informatics in Austrian education was closely moulded on its classic approaches; The machine orientation of the late 'sixties was replaced in the 'seventies by the algorithm-orientated model of thought, which promoted the application of programming languages. Since the middle of the 'eighties it is the user-orientated approach that has been put to the fore in many cases in EDP/informatics. This approach sees man and society in a reciprocal relationship with the new technologies and emphasises the aspect of computers as a working tool. Today, the main concern of information technology education in Austria is to acquaint each pupil with the new information and communication technologies (NICT) in the course of his or her general education in such a way that they are able to use them in a purposeful way. In this process, they are to be shown the opportunities and the limitations of the NICT; groundless fears are to be dispelled in the same time as blind faith in technology is to be countered.

Basic education in information technology for all pupils in the 7th and 8th forms is continued in the 9th form at general high-level schools with the subject informatics and complemented at medium and high-level vocational schools with profession and application-orientated EDP knowledge. To help comply with the specialised job profiles that have emerged in EDP and informatics, vocational education offers a five-year education course at high-level secondary schools for electronic data processing and organisation as well as the subject informatics, which is firmly established at several universities.

3.1 BASIC EDUCATION IN INFORMATION TECHNOLOGY

At the start of the 1990/91 school year basic education in information and communications technology (informations- und kommunikationstechnische Grundbildung, ITG) was introduced for pupils in the 7th and 8th forms. All pupils, boys and girls, had now direct access to the new technologies by the age of 13. The so-called "Integration Solution" was chosen as the means of anchoring this basic education. It includes teaching educational elements of informatics within the framework of existing school disciplines.
(see Reiter, 1990, p. 130)

This integration not only complies with the holistic approach to information and communication technologies but also contributes towards reaching the objectives of basic education in information technology, namely:

- Pupils are to gather their own experience with the new technologies in general and the computer in particular and in so doing acquire basic skills and abilities
- They should be capable of analysing with a critical mind the experience acquired in the past and of situating it in a broader context
- The newly acquired knowledge of information and communication technologies should first and foremost be of a general nature; specialist knowledge is not a priority
- An essential element of ITG is to take into account the opportunities and the limitations of the new technologies, their effect on the individual person and the development within society as a whole.

In practice the Integration Concept provides for an introductory phase in the 3rd and 4th class of the "Hauptschule" [compulsory junior secondary general school] and the "AHS" [high-level general secondary school] (7th and 8th forms), with thorough preliminary information in the 7th form and a project phase in the 8th form. Computers are used according to the specific nature- of the subject matter in the subjects German, English, mathematics and geometric drawing.

This basis education places special emphasis on affording boys and girls a like the same opportunities of access to the new information and communication technologies, irrespective of sex. In this connection it has to be taken into account that existing prejudices, which would have it that females are less gifted for technology than males, have in many instances already taken hold of EDP (Clarke V.A., 1990: Sanders J., 1990; Schulz-Zander R., 1990; Brown 1995). For this reason the Federal Ministry of Education and the Arts has outlined an area of research on the social aspects of access to computers and on the matter of interactions in the classroom itself. An independent task force is working on drawing up proposals for ways in which to perceive and dismantle the sex-related obstacles that hinder access to information and communication technologies.

3.2 HARDWARE AND SOFTWARE FACILITIES AT GENERAL SCHOOLS

To implement the Integration Concept a second classroom with 15 AT computers (14 286-microprocessor based pupil workplaces /1 teacher workplace on a 386-basis, VGA monitor...) and laser and/or matrix printer(s) had been set up at 189 state AHS by the 1990/91 school year. Most of the state AHS schools have opted in favour of a network variant (Novell network), which offers a number of advantages for instruction. A videotext workplace is also part of the basic AHS equipment. By the 1990/91 school year the 1,200 "Hauptschulen" [compulsory junior secondary general schools] had acquired between 6 and 8 computers with the same features per school location.

In terms of software a basic package comprising word processing, spreadsheet and CAD (Computer-Aided-Design) programs has been compiled for the general secondary schools to be used in German, English, mathematics and geomet-

ric drawing. This basic equipment also includes an integrated package. In the school year 1992/93 the equipment standard at AHS schools has been partly replaced and extended with PCs with CD-ROM-drives and soundcard specially geared for the subjects of physics, chemistry, music and sculptural education. Compulsory junior secondary schools are also aiming to expand their present facilities.

3.3 INFORMATICS AT THE "POLYTECHNISCHER LEHRGANG"

The purpose of the "Polytechnischer Lehrgang" is to prepare pupils for their professional careers upon completion of the "Hauptschule" or (seldom) the first cycle of the AHS. Here again, special emphasis is placed on informatics. Since the 1989/90 school year pupils at the "Polytechnischer Lehrgang" are also given instruction in informatics as part of one of the seminars of their choice (the choice consisting of social studies and biology, economics, natural science/technology and agricultural science). Informatics as a subject of instruction is also part of the alternative compulsory subjects such as bookkeeping or typing, and is also taught as an optional subject with one to two hours a week.

3.4. INFORMATICS AT THE SECOND CYCLE OF THE AHS

With the coming into effect of the reformed second cycle of the AHS during the 1989/90 school year, informatics as an existing practical subject became a two-year compulsory subject. Instruction is aimed essentially at teaching the uses of application software and at working out structured problem solutions taking into account the general laws on which information processing is based. The social aspects of HDP uses are also looked into. In the 6th, 7th and 8th classes of the AHS, informatics is available as an elective compulsory subject and as an optional subject. In this way existing knowledge and skills can be improved and additional knowledge gained. In many cases instruction is project-orientated.

3.5. EDP AT MEDIUM AND HIGH-LEVEL VOCATIONAL SCHOOLS

Practical considerations are the main priority for EDP education at the vocational schools. At the technical and trade schools for instance, CAD instruction is a priority subject along with the compulsory subject "EDP and applied EDP" while at medium and high-level business schools the use of EDP in the commercial area is a focal point of instruction.

At the high-level vocational schools for humane studies (secondary schools for domestic science, tourism as well as fashion and clothing techniques), EDP is incorporated as a main point of emphasis in the subjects "accounting", "stenotyping and word processing" and as practical subjects in practical company courses at the secondary schools for tourism and catering or the practical application of the newly-developed data technologies for the textile industry: CAD, computer-aided cutting design and cut-layer optimisation.

At the high-level secondary schools for agriculture and forestry, EDP instruction aims to familiarise pupils with the function, organisation and purpose-orientated use of EDP installations.

The subject-specific use of EDP in medium and high-level vocational education in Austria is rounded off by syllabus adaptations aimed at strengthening, also at vocational schools, the instruction in EDP knowledge and handling that is necessary for the vocation concerned.

3.6 INFORMATION TECHNOLOGY FOR THE EDUCATION OF HANDICAPPED CHILDREN

Priority is given that all children in Austria should get the same opportunities to apply information technology. Handicapped and disabled pupils should be prepared for the private and professional use of computer-assisted learning and communication aids. There is the increasing use of the computer as a communication aid for helping children with a severe sensory impairment or a motor disability, (see Reiterer/Tjoa/Wagner, 1989)

In addition there are also school pilot projects aimed at giving a fundamental education in information technology, taking into account the individual abilities and development of the handicapped child (Busby/Wagner/Zagler, 1994).

3.7 TRAINING, ADVANCED TRAINING AND FURTHER TRAINING

In the course of their studies at teacher training colleges future teachers of elementary schools, compulsory junior secondary general schools and special schools are given an insight into the new information technologies; they learn how to use them in practice and how to draw up useful application possibilities in class. The optional subject "informatics" is available for those wanting to acquire an additional qualification.

The specific EDP/information training requirements for teachers at vocational schools who do not have university or college education are provided by the vocational teacher training colleges. Most of the advanced teacher in-service training for high-level general schools and the vocational medium and high-level schools takes place at the institutes of education. At EDP/informatics courses lasting several semesters they continue to provide teacher training until a sufficient number of teachers with university informatics education are available. Work is still in progress on drawing up a general regulation for university education in informatics for candidates to the teaching profession. Certain universities offer the possibility of acquiring the qualification to integrate computer instruction in the teacher's specific subject.

4. COMPUTERS IN THE DAILY LIFE OF AUSTRIAN SCHOOLCHILDREN

At the start of 1991 a scientific study entitled "Die Spaß-Maschine - Der Computer im Alltag österreichischer Schüler/innen" ("Fun Machines - Computers in the Daily Lives of Austrian Schoolchildren") was submitted by the sociologist Dr Walburga Gáspár-Ruppert, which offered interesting insights into the attitude of youths of both sexes to computers. Her findings have shown that for the majority of schoolchildren of both sexes, computers are primarily an interesting and, compared with other instruments, extremely flexible "toy-cum-tool". While the interesting aspect is further strengthened by informatics lessons at school, in most cases the initial contact with computers usually takes place before tuition is given at school.

The study also revealed that the fact of installing a computer in a child's room is by no means a way for concerned parents to keep their child happy at all costs; indeed, in nearly all of the cases it was the children themselves who asked for the computers to satisfy their curiosity and their craving for "novelties".

Noticeable differences in the attitude objectives in relation to age are due to a large extent to the fact that among the lower age groups the novelty of the computer results in a more intensive involvement with it. The main incentives for schoolchildren, children and youths are curiosity, play and risk-free trial and error. Sometimes there are also instances where children experience a sensation of power as a result of "dominating" a machine.

A direct consequence of "instrumental competence" is the prestige that appears within a group of friends whenever a child or youth becomes expert at handling computers. However, it has been shown that the appeal of computers wanes the more it is integrated in the daily lives of young people. As instrumental competence increases with age and as activities adapt more and more to future careers, computers lose their function as toys or games to become professional tools, which in general are no longer fun. According to the study conducted by Dr Gáspár -Ruppert this is primarily a pragmatic decision on the part of the adult-to-be and not a quality inherent to the computer.

The sex-related differences were also identifiable in the survey. However, they cannot be attributed to the fact that girls are less interested in or not as competent with computers "by nature". Rather, family conditions play an essential role in shaping their behavioural patterns. Girls are as uninhibited and as unprejudiced as boys in their attitude towards computers provided their interest and their curiosity (which are as pronounced in girls as they are in boys), are stimulated and promoted accordingly. It could well be a sign of frustration if girls lose interest quicker than boys. In this case it can only mean that clearly less is done to satisfy the requirements of girls. Possibly another factor is that girls clearly attribute less importance to computers for their future professional activities than boys. The material collected with the questionnaires does not support the assumption that involvement with computers at school and at home will give rise to a generation of "compulsive programmers".

Nor are there any indications that computer technology is causing a loss of social competence; on the contrary, by virtue of its toy or game character, it can even promote and considerably strengthen contacts between children of the same age. A possible withdrawal from social relationships might occur in the case of socially and/or psychologically impaired children; however, the appropriate data is not available at present to substantiate any such claims.

The usually effortless processes of habituation and adaptation, among schoolchildren and children in general should not however conceal the fact that there might be repercussions in the longer term that are not even assessable at present. For this reason it is essential that the possible consequences and effects of using computers be discussed and processed, as is intended by the school curricula. Whenever possible it is not just the social aspect as a whole - as stipulated by the curricula - but also the psychical and psycho-social area that should be integrated. Under these prerequisites the teaching body should in future devote closer and also special attention to the clear difference in behavioural patterns among boys of the lower age groups; certainly it would seem that parents have not yet been able to acquire a sufficient degree of competence to be able to assume tasks such as these, which imply a very intensive involvement with computer technology.

5. PERSPECTIVES OF THE FUTURE: MULTIMEDIA AND TELECOMMUNICATIONS

In the Working Document "Multimedia Educational Software: First elements for reflexion", published in Sept. 1995, the European Commission (EC) states:

"The true convergence of telecommunications, television and computer technology, thanks to a widespread digitisation of data, is ushering in a new era, that of multimedia telematics ... Being aware of such promising perspectives, the European Council has confirmed 1995 that education and training must be considered as priority domains for information and communication technology." (EC, p. 9)

A main challenge for education aside communicating culture, disseminating knowledge and transmitting information is to prepare young people with the technological skills for demands of the fu-

ture. It has become necessary to promote awareness, understanding and use of information and communication technologies both in regard to learning and teaching and for the future employability of the citizens:

"The future of Europeans - and of their jobs - depends on education and training methods being suitably adapted to new requirements as regards qualifications and the new technological, economic, social or cultural environment of the information society. This adaptation will be facilitated by the introduction and use of interactive multimedia products and services in education or training activities." (EC, p. 21)

Under these perspectives the EC demands that by the year 2000:

- every primary and secondary school should have at least a room of multimedia microcomputers allowing access to remote educational services;
- every university should have access to high speed networks needed for exchanging multimedia educational materials in training activities;
- every firm should be served locally by a centre for multimedia educational resources, an "open university for industry", every town hall, library or Chamber of Commerce should offer free of charge the means of access to telematics tools and services so that all citizens can benefit from information, education and training facilities. (see EC, 1995, p. 6)

Undoubtedly Information Technology (IT) will go on transforming the educational system, by "supporting the learning process at all educational levels and in all curricular areas" as Allan Martin (1995, p. 646) pointed out at the World Conference on Computers in Education (WCCE) in Birmingham (23-27 July 1995). IT has created various instructional possibilities for education. Teachers and learners benefit meanwhile from a broad spectrum of information tools (databases, spreadsheets, DTP, word processing, programming, computer graphics, simulations, input devices etc.) More powerful hard and software combined with rapid advances in multimedia [3]) and communication are providing further potential resources.

Ten years ago the educational systems put computers to the classrooms, recent initiatives concern the implementing of networking. Susan Merrit noted at WCCE 95 the following:

"The telecommunications revolution is about to profoundly change our lives, and is just beginning. It will necessarily affect our schools and perhaps our rooms. In terms of computer applications in the education telecommunications is the most significant development beyond the standard productivity tools which are word processing, spreadsheets, and databases." (Merrit 1995, p. 484)

As a representative of the EC Luis Rodriguez-Roselló described in his keynote-address at the IFIP WG 3.4 Working Conference "Computer Mediated Education" in Soest, Germany (12-16 July 1993) the future scenario of telecommunications:

"Telecommunications will equally make possible new forms of networked training such as linking peers to carry out co-operative learning at a distance by sharing powerful information processing or creating different configurations of groups of tutors and learners by means of advanced interactive telecommunication services giving raise to what we may call the "virtual classroom." (Rodriguez-Rosello 1993, p. 6)

But Multimedia and networking are new to schools and teaching in general, sometimes they are not directly applicable to teaching and learning because of being far removed from the realities of classrooms. To be aware of the technological developments that have an impact on education across a wide range of curriculum subjects pilot experiments on the use of multimedia educational products and projects on networking of schools to promote virtual mobility and exchange of information and experience have to be established and continued. We also need qualitative research that proves the effectiveness of the newest technologies and their integration into the classrooms, the faith that technology will work well is not enough. Pupils and students have to learn first-hand how a computer with a modem and a telephone connection can lead them to a wealth of resources and information far beyond the schools walls and they may even participate in distance learning courses via satellite later.

[3] Martin Hoogeveen doubted the benevolent effects of an overoptimistic multimedia paradigm at ED Media 95 in Graz (17-21 June 1995): "The multimedia paradigm is a dominant conviction that adding multimedia functionality to information systems (ISs) leads to improved information and knowledge transfer to people." (Hoogeveen, 1995. p. 348)

5.1 THE INTERNET AS COMMUNICATIONS MEDIUM FOR TEACHERS AND LEARNERS

The Internet (see Eastment, 1996; Lake, 1995; NCET, 1996) has become one of the most fascinating resources for telecommunications by linking together former separate networks and using a common communication protocol called TCP/IP (Transmission Control Protocol/Internet Protocol). Estimations suggested that there were some 35 million users in 1995 in the world and its use is still increasing. Even though it is not managed by any particular organisation it gives people access to a wide range of material and information. To be able to access it in the cheapest form a computer, a modem connected to the telephone-line and a service provider is necessary. Apart from the registration fee there is the cost of the telephone calls and the (monthly) charge from the service provider. The growing number of people with Internet e-mail addresses indicate its potential as a communications medium. Users of the Internet have access to

- electronic mail
- bulletin boards and computer conferencing systems
- on-line databases (data files)
- catalogues and illustrated guides from museums, art galleries, libraries etc.
- free software (public domain)
- newspapers and books
- graphics, etc.

But the Internet *"is more than an information delivery system-it is also an intellectual environment within which we are beginning to create "places"... it is a place that is not yet here, hut is quickly becoming a world of places.* "(Lake, 1995, p. 25) Since a couple of years the *"Internet has been undergoing a fundamental change that is allowing users to access*

multimedia materials such as digitised images, sound and animation. Ease of access has also been enhanced... users simply click highlighted hypertext links on the World Wide Web." (Bull et al., 1995, p. 59) The keywords are Hypertext and Hypermedia being essential components of the so-called World Wide Web (WWW). Eastment defines hypertext as *"a system which allows you to click on a word or picture to jump to another part of the document... Once you have connected to a site, you jump to further information by merely clicking on icons... "* (Eastment, 1995, p. 13/14) Hypermedia has become the current buzzword in educational technology:

"A hypermedia environment is the user interface that allows to work with different elements as a whole: text, graphics, images, sounds, simulation software, external hardware, data bases, computer networks, etc. on the base of the specific application. The results of this approach are increased interactively and simplification of the use. Hypermedia technology is important not only for educational applications, because it may prove to become, in the near future, a powerful tool for managing information of all kinds". (Parodi/Ponta, 1993, p. 175)

A WWW page is a multimedia document created by HTML (Hyper Text Markup Language) that contains text, images, sound and even animation and movies. It can be viewed with a browser such as Netscape or Mosaic. In future word processors, telecommunication programs and operating systems will offer support for viewing Web pages that will become as ubiquitous as f. i. electrical service. Using the WWW learners are offered to navigate through, select, assess, manipulate and evaluate information and develop their own skills and network literacy. Educators can easily create their own resources by setting up collaborative projects and displaying their results on their Web page and sharing them with a "global audience". The Web allows immediate access to a world-wide information community and *"is a virtual meeting place to exchange information with distant partners who were previously inaccessible",* Caroline McCullen notes in an article in the ISTE Journal of Educational Technology Practise and Policy of Nov. 1995, summarising:

"Using the WWW, teachers can develop collaborative projects with international partners, compare data with classes in other parts of the world, share the results on their own home page and get feedback from the global community on the Internet. The WWW makes the virtual classroom a reality." (McCullen, 1995, p.10)

5.2 PEDAGOGICAL RECOMMENDATIONS FOR HYPERMEDIA

Cognitive search has shown that learning in general is driven by the student's intrinsic need to make sense - learning is a natural activity. L.A. Rhodes explains that:

"From birth on, humans seek meaning-then try simultaneously to understand both the world and themselves. They take information in from their interactions with the surrounding environment, conned it to what they already know, and construct new knowledge and skills. These new skills are then tested through continuing interactions. Each interaction increases the individual's capacity to act intelligently in solving problems." (Rhodes 1995, p. 36)

The act of "doing" being essential for a new learning paradigm in the context with hypermedia [4]) develops many other learning skills and evolves a significant amount of intrinsic satisfaction on the part of the active participant. Pientti Hietala from the university of Tampere reported at the IFIP WG 3.4 Working Conference on Computer Mediated Education in Soest in 1993:

"Hypermedia is an exciting new avenue to pursue in the use of computers to empower learning and leaching. Possibilities not even dreamed of before can now be examined through this new concept, but it also requires a special hardware and special kind of pedagogy...The utilisation of this new equipment has to be based on the learner's active and creative engagement, not just passively watching video clips or guided tours chosen by somebody else. The sooner the learner herself is able to have her hands on the hypermedia, the better." (Hietala, 199.\ p. 169)

The pedagogical reasons are given by the cognitive learning theory:

"The findings ... seem to call for a more active and creative role for the learner which is also the message from the contemporary cognitive learning theory... This theory emphasises three primary principles. First, learning is a process of knowledge construction as opposed to knowledge absorption. Second, learning is knowledge-dependent, i.e. people inevitably use existing knowledge upon which to build new knowledge. And third, learning is highly tuned to the situation in which it takes place." (Ibd., 1993, p. 164)

Under these circumstances the role of the teacher will also change. A. W. Bates reported at the IFIP TC3 third Teleteaching Conference in Trondheim (20-25 August 1993) the new approaches of learning and teaching by telecommunications:

"Teacher ... will increasingly be advisors, and managers and facilitators of learning, rather than providers of information. Access to information will be primarily through telecommunications. The teachers' role will concentrate more on developing skills, and in particular skills of navigating knowledge sources, and skills of processing and analysing information." (Bates, 1993, p. 3)

[4] The term "hypermedia" includes also off-line multimedia (educational) products as CD-ROMs T. J. van Weert argued at the 13th World Computer Congress in Hamburg (28 August-2 September 1994) in the same direction:

"The use of open learning and technological support systems will mean that some or much learning will be outside the teachers sphere of influence. The teacher becomes a learning guide or a mentor for the students, co-operating with pupils in a learning experience." (van Weert, 1994. p. 624)

During the last two years several pilot projects on networking of schools have been established by the Federal Ministry of Education and Cultural Affairs in Austria. Many teachers who want to add telecommunications skills to their repertoire of teaching tools today are first introduced to the Internet via a simple modem and electronic mail software. But few schools have the luxury of a computer room where all the computers have Internet access. So only teachers or a small group of pupils/students

under supervision of teachers have access. It should also be mentioned, as Eastment reports, that *"often a good deal of class time can be spent simply staring at the screen waiting for information"* (Eastment, 1995, p. 20) when using a conventional telephone line (you wait minutes until a photograph is downloaded) and not the still expensive digital and fast ISDN-lines. The real Information highway will become reality with broadband (fibre optic) connections usable also by the educational system.

6. COMPUTER BASED TRAINING-INITIATIVE AS CASE-STUDY

In order to evaluate the potential of the new educational technologies several pilot projects were established ranging from the "Austrian School Net" (with links to the Internet) via "Portable Computers in the classroom" to the production of "Multimedia Educational Software". As example the initiative "Mobile Computing" at a higher technical vocational school (HTL) in Vienna will be briefly presented.

Within a period of 18 months two classes of a 4th grade (18 years of age) of a HTL were equipped with notebooks (TravelMate 4000) with CD-ROM-dockingstations (SCSI-Interface, sound-card etc.) for multimedia applications in a ratio one portable per one student. During this so called pre-project phase a LAN was built connecting each working place with a router offering access to the Internet. As additional but necessary measure appropriate courseware was selected and purchased by the project-team. The crucial points of the project are the following:

- Availability of portable computers for curricula support;
- Use of multimedia educational software;
- Evaluation of the efficiency of computer based teaching and learning;
- Revising of valid standards of interactive courseware;
- Acquisition of knowledge through electronic networks.

After the creation of the infrastructure the schedule implies the start of the regular project with the objective of integrating newest information technology into the curricula in the school year 1996/97. The following main expectations put forward as working hypotheses are to be verified:

Is portability "a catalyst for cross-curricular Information Technology permeation" as Allan Martin reported a WCCE 95 referring to a project between June 1993 and 1994 in Leeds (Martin 1995, p. 645 ff.): *"One aspect appreciated by both teachers and pupils was the manoeuvrability of the machines... Not only could the portables be moved in and out the classroom; these could also be disposed within the classroom as the teacher wished. This offered teachers flexibility and subordination of the hardware to the learning objectives and organisational requirements of the lesson. "* (Martin, 1995, p. 650/651)

Does the new learning paradigm predicted by cognitive science and manifested by hypermedia bring improved information and knowledge to pupils? *("Knowledge as a result of the process of knowing, which can only occur as the learner actively constructs what he or she knows, using information in this process "* as Harris, 1995, p. 58, defines)

Does ubiquity in the information age by means of telecommunications enables schools, teachers and learners to share the virtual community that Howard Rheingold compares like that: *"It's a bit like a neighbourhood pub or coffee shop. It's like a salon, where I can participate in a hundred ongoing conversations with people who don't care what I look like or sound like, but who do care how I think and communicate. "* (Rheingold, 1993, p.66)

7. CONCLUSION

The so-called new information and communications technologies (NICT) have been introduced into the Austrian educational system in a broad context in the past decade. Since Austria has become a member of the European Community the integration of multimedia and telecommunications is considered as a major qualification aspect to be taken into account by schools for teaching and learning purposes in regard to the future labour market. A dominant role in this context play the Internet as herald of the information highway and off-line-multimedia educational products (hypermedia). The shortly outlined project initiative at a higher vocational technical school in Vienna by implementing CBT together with mobile computing using portables and direct access to the Internet gives an example of the future scenarios in Austrian schools. The aim is to establish further pilot projects on networking to promote virtual mobility and on the production of multimedia courseware applicable for the curricula.

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[1]

Seymour Papert created the programming - language LOGO which has been used in a variety of educational research projects related to children's learning, and the learning of programming in particular. It should be noted that even if LOGO had been grouped as a crucial theme of the sessions at the 1985, 1990 and 1995 IFIP World Conference on Computers in Education the interest in the LOGO environment seems to be decreasing. The ability to write simple computer programmes is now accorded less importance as standard software packages have become widely available.

[2]

The newest technologies in the field of multimedia and telecommunications (e.g. interactive video, interactive compact disc, CD-ROM, two-way cable and satellite communication, view data and others) offer enormous possibilities to teachers and pupils: in regard to CD-ROM see Baumbach, J.D. [1990], CD-ROM Information

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NATIONAL REPORT OF BANGLADESH

EDUCATION AND INFORMATICS: BANGLADESH PERSPECTIVE

The impact of the Information Technology and the computer on the life and civilisation of nation is very great. Its contribution towards the expansion of knowledge, education and research is surprising. Its revolution has also touched Bangladesh mildly. The Atomic Energy Commission of Bangladesh introduced the system in 1964 with the installation of the IBM 1620 computer. Gradually, the use of computers spread to some important research centres. Universities and administration bodies. Computer Science as an academic course was first introduced in the Universities, then in the colleges and recently in the schools. Short courses/training are also offered by the Government agencies and by private commercial firms. A number of Hardware and Software firms have been developed recently. Bangladesh Television, Radio and Telegraph and Telephone Boards are also contributing towards the generation and dissemination of information on various aspects of education and research. Although general consciousness has developed recently regarding the benefits and uses of computers in the search for knowledge and education, some major limiting factors like lack of specific national policy, shortage of funds, absence of necessary training centres, skilled IT manpower and inadequate information infrastructure are limiting the progress for welcoming the new inventions in the Information Technology. Please find as follows the brief description of the status of Bangladesh in the field of the New Information Technology (NIT). Some recommendations are also given along with the identification of the problems we are facing.

NEW INFORMATION TECHNOLOGY IN OUR EDUCATIONAL SYSTEM

1. Primary level

No course has yet been introduced in the primary level syllabus, i.e. from class I to class VIII.

2. Secondary level

Computer science has been made as an optional subject and a small number of candidates will appear in the Secondary School Certificate (S.S.C) examination in 1996. Moreover, computer science has been made as a compulsory paper of the S.S.C. Vocational course under the Technical Education Board. The Government has also decided to provide 317 Government schools with computers this year.

3. Higher Secondary level and Degree Pass Course

The Government has introduced computer science as an elective subject in the Higher Secondary Certificate (H.S.C.) class and also in the Degree (Pass) class in 1993. The Government has decided to install computer with modem in 136 colleges in the year 1996. NTRAMS, an institution under the Ministry of Education, has also opened a computer course as a paper (part of the course) of Business Management at the H.S.C. level.

4. Higher Education

Computer science has been introduced in the Bachelor's level in various Universities (Government and Private) and in an Engineering University:

- Dhaka University - B.Sc. (Hons) and M.Sc. (3+1=4 years);
- Rajshahi University - B.Sc. (Hons) and M.Sc. (3+1=4 years);
- Islamic University - B.Sc. (Hons) - 3 years recently introduced;
- Shahjalal, Syllnet University - B.Sc. (Hons) in Electronics and Computer Science (4 years) introduced in 1990;
- Khulna University - B.Sc. (Hons) introduced in 1989;
- Jahangirnagar University - One paper in the Hons course;
- National University ' B.Sc. (Hons) in computer science, 3 years, introduced in 1993.
- Two Private Universities recently have introduced a B.Sc. (Hons) in Computer Science with 4 years' duration;
- Open University introducing Diploma Course in Computer Application -1.5 years' duration;
- Teacher's Training College has incorporated computer Science in the B.Ed. course;
- NTRAMS, an agency of the Ministry of Education, provides short course in computer operation;
- Bhuyan Academy and Microland, both are conducting B.Sc. (Hons) in Computer Studies with 3 years' duration under London University;
- Bangladesh University of Engineering and Technology (BUET) introduced B.Sc. (Engineering) in computer science with 4 years' duration, introduced in 1989.

About 700 students in all are enrolled in the 1st year B.Sc. (Hons) B.Sc. Engineering course in different Universities/ Engineering Universities in Bangladesh in the current year. It indicates a good rise from the previous year's record (i.e. 475 students).

TRAINING FACILITIES

a. Computer Training

A number of Government, Semi-Government and private institutions and firms are providing training facilities. Bangladesh Computer Council (BCC) is the most important computer training centre in the country. Other centres are: BBS (Bangladesh Bureau of Statistics); NTRAMS, TTTC (Technical Teachers' Training College), BUET, D.U. (Dhaka University), Ministry of Youth and Sports, Ministry of Establishment, Bangladesh Bureau of Educational Information and Statistics (BANBEIS) and Public Administration Training Centre (PATC).

As many as 600 private firms are rendering training services in. the form of computer literacy, awareness programmes, programming and system design.

On the whole, training facilities are most inadequate in relation to our rising demand for computers. . It is very much felt here that training requires to be imparted not only to the computer operators and developers but also to the information users like the Secretaries, Directors and Executives.

The importance of training to the technically skilled persons like programmers and system analysts is not perhaps properly recognised by our administrators, as a result of which an insignificant amount is spent here for training.

b. Present Status of the Information Users in the Education Sector

It is observed that some of the top ranking and middle-level officers and executives of the Ministry/Directors and autonomous bodies engaged in educational pursuits have some training in the computer science and information technology, while others have little knowledge and experience in the current progress of the technology and computer science.

Inadequacy of training or absence of modern training compels them to be ignorant about the recent development in information technology and this may lead them to the wrong decisions at a given time. One gloomy picture in office management depicts that in most of the cases, senior officials are equipped with costly computers of the latest model, but they have neither ever used these devices nor have they any training or time to utilise their services. This is nothing but a sheer wastage of hard earned resources. Provision for Computer Appreciation Training on the part of the top administrators/Directors/Executives may be an appropriate solution for this issue since they have hardly any time for operating/developing or programming through the computer. Again, the middle level officers who may serve the Department for a longer period and who can afford some time for computer work may be trained adequately and properly in computer science. Such executives should be retrained from time to time to cope with the changing environment.

LEVEL OF COMPUTER HARDWARE AND SOFTWARE PROVISIONS

About 5 private firms are assembling micro computers. About 50 private firms are working for software development out of which 10 firms are well-established in the line. Increasing the number of firms need to be encouraged and patronised by the Government in the form of tax concessions and tax holidays. It is noteworthy to mention here that 35% taxis imposed on the import of computer and parts which is discouraging the development of the industry in the country.

POLICY TOWARDS STANDARDISATION

Uniform standardisation is lacking in the installation of hardware and the development of software due to lack of specific policy guidelines and dearth of expertise amount decision makers.

INFORMATION INFRASTRUCTURE

A. Broadcast Technologies in Education

(i) Radio and TV

The Bangladesh Radio and Bangladesh Television (BTV) broadcast are disseminate news (local and foreign) and speeches and organise educational guidelines, advice, lessons and instructions on regular/daily/weekly/ periodical basis on the following socio-economic and environmental topics: Population education (concept, planning and control), nutrition and health education, prevention of diseases (AID, HIV, etc.), academic courses on national and major international languages, special classes for Open University students and also for B.Ed. students, computer science and also provide guidelines, information and technologies involved in various branches of agriculture like cultivation, plantation, forestry, fishery, prevention of environmental pollution and also topics covering development of fine arts. It is viewed by many experts that our BTV and Radio programmes should henceforth be made in such an efficient and effective manner that it suits the current needs of present and future generations and be more capable of keeping pace with the Interment age.

(ii) YCR, VCP and Diss

The number of VCR (18,089), VCP (3,344) and Diss (1.660) is still not sufficient for such a populous country (about 12 crore).

B. Telephone Services

The telephone service in general does not appear to be satisfactory up to expectation, although BTTD is working to expand and improve its services. At present, 331,210 telephone lines are in operation out of which 147,500 are Digital phones. Three telephones are meant for one thousand person currently, which is much low compared to Indonesia, Philippines and Thailand (13, 17 and 47 telephone per thousand respectively). The BTTB's aim is to reach to the following targets (i) at the end of 1996: 503,840 connections including 317,100 digital phones, (ii) By 2000 year .8 million in all. The number of mobile phone is increasing rapidly. The present installation fees are probably discouraging from users' standpoint. These are: for Analog TK. 10,000 and for Digital TK. 20.000 when our per capita income is $ 230.

C. Processing Technology

Computers

Availability of computers in the country at present are as follows: Main Frame 15, Mid-Range 40, PC 50,000.

(i) Computer Literature

In order to popularise the computer science in the country, the Bangladesh Computer Society is functioning very sincerely. A number of monthly journals and periodicals are in circulation in the market (e.g computer Jagat, Computing, Computer Technology and Electronics, Shikhya Barta) and information like type and use of computers, make, origin, modern development of technology, Internet, etc. are being disseminated with a view to making our young readers and information users well-conversant with the modern development and changing environment.

(ii) Data Bank

Five organisations/agencies including University Grants Commission and Planning Commission have jointly developed a Data Bank in order to interchange information among themselves through network. The training of the concerned officers is progressing satisfactorily.

(iii) Database Development

The Bangladesh Bureau of Educational Information and Statistics (BANBEIS) has successfully developed Database of 350 thousand teachers and non-teaching staff and also 22 thousand educational institutions. Moreover, it has also developed teachers' profile of 232 Government Colleges and 9,500 of Ebtedayee Madrasah (religious institutions).

(iv) Computerisation of S.S.C. & H.S.C. Examinations

For the last two year's Secondary School Certificate (S.S.C) and Higher Secondary Certificate (H.S.C) Examinations of 4 Secondary Education Boards are being computerised where about one million examinees appeared.

Internet

Bangladesh is going to Internet very soon. Some obstacles seem to create barriers at the national level in respect of having the advantage of Internet, though it is not expected. Lack of initiative on the part of the Government in general and lack of capacity of the Bangladesh Telegraph and Telephone Board (BTTB) appears to be the major source for the absence of this important technology here. Nevertheless, some awareness has been developed among the citizens specially the younger generation and a number of enterprising private firms. Under the initiative of the University professors and private firms and professionals the Internet Week has recently been observed in order to raise consciousness among the younger generation and information users. Under the private initiative, 256 E-Mail connections are going to be made soon which are envisaged to connect educational institutions, research orsanisations at different levels. It will have access to the Internet.

FACTORS LIMITING PROGRESS IN THE ADOPTION OF NEW TECHNOLOGIES IN EDUCATION

(i) Financial constraints of the Government and other private organisation is perhaps the most important bottleneck.

(ii) Inadequacy of the infrastructural facilities is another major bottleneck hindering the progress of this industry.

Total electric supply is very much insufficient which is again disturbed by frequent voltage fluctuation and load shedding.

Telephone services and lines are still costly, inadequate, defective and irregular.

The total number of computers as noted below is most inadequate for the country as indicated earlier.

License fees are small for Radio owners but seem to be high for TV and VCP owners (e.g. TK 200 for Black and White TV, TK 400 for coloured TV and 500 for VCP).

(iii) Lack of well educated populace, skilled IT manpower and inadequacy of training facilities in the country are some of the most important factors limiting progress in the adoption of new technologies in the country.

(iv) Apprehension of the employees and labour union that they may face unemployment due to the introduction of computers.

(v) Lack of the Government commitment in respect of introduction of the Information Technology and its expansion within and outside the country is another major limiting factor.

PARTICIPATION INTERNATIONAL NIT PROGRAMMES

Bangladesh has already gained much through participation in the following Participation International NIT Programmes. We welcome very much to participate in such seminars/congress:

- GIIC (Global Information Infrastructure Commission);
- IIP (Inter Governmental Informatics Programme);
- RINSCA (Regional Informatics Networks for South and Central Asia).

Recommendations:

*1. **National Commitment**: Government commitment in the development of Information Technology should be considered as a prerequisite wherever necessary.*

*2. **Education and Training**: Provisions should be made for building up a well-educated populace.Provisions should be made for building up an efficient work, force including the operators, developers and users in general.Adequate training facilities be provided to ensure regular flow of skilled manpower and to equip them with the changing environment and new technologies.Provisions should be made for foreign training, study tours and attachment programmes in the relevant fields.*

*3. **Participation in International Seminars**: Government should take initiative to send their delegates to all the relevant international regional seminars/congress in order to exchange concepts and experiences.*

4.Development and patronisation of research work at national and international level is highly desired.

5. International cooperation for the development of Information Technology should be very much welcomed.

*6. **Infrastructure**: Adequate number of infrastructure facilities be provided with the national and international resources and cooperation.*

*7. **Financing:** Necessary financial assistance of the advanced countries, donor agencies, and well established computer companies will be very much welcomed and appreciated by the developing countries like Bangladesh.*

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NATIONAL REPORT OF BELARUS

INTRODUCTION

Today information is one of the most important strategic resources of a society's development. It caused the inflow of tidy investments in the creation of information systems and technologies. So, it became obvious, that the further society's development is widely determined by the level of its informing citizens in the field of their professional activity.

The acquiring of sovereignty by the Republic of Belarus and its economy transition to the market principles challenged the changing of the traditional principles of the society's organisation. This has touched the system of information supply of educational and scientific and research fields. In the conditions of the open economy, higher educational institutions, academic and branch institutions have to agree the level of their developments with the world standards. There has appeared the need for a new system of information services, based on the up-to-date means and new information technologies. This system should cover all the aspects of scientific and research activity and educational process and provide diverse information for consumers.

The former Soviet Union Republic of Byelorusssia was one of the leaders in the development and production of software and hardware, especially in the field of universal computers of the integrated system (ISC), personal computers, system and applied software. However, during the period of making the Belarus nationhood and its entering the new economic relationships after the USSR dissolution the situation had radically changed. Belarus sank in the wave of imported technique of various quality, there has emerged the regional producers of it. Our specialists skills and knowledge became useless.

However, regarding our experience in the field of information technologies introduction in different fields of activity, the advantageous geographical location of Belarus, high intellectual resources of education and scientific systems specialists, we can talk about the advantageous perspectives of information infrastructure creation and development in the field of education and in the Republic on the whole.

1. THE STRUCTURE OF THE NATIONAL EDUCATIONAL SYSTEM

The process of forming and development of the education system in the Belarus Republic is implemented according to the constitutional demands and guaranties in the field of education, providing equal opportunities for its acquiring, the integrity of the educational system and succession of all the educational stages.

The structure of the national educational system is based on the Constitution of the Belarus Republic, laws "About the education in the Belarus Republic", "About languages", "About national and cultural minorities", "About child's rights" and other normative documents, adopted during the recent years and regulating its activity. The structure is based on the principle of continuos education and training, including the following documents: pre-school education; general education; vocational education; family education; self-education.

According to Article 14 of the law "About the education in the Belarus Republic", all national and non-governmental educational institutions, situated on the territory of the Republic, belong to the national system of education of the Belarus Republic, which includes:

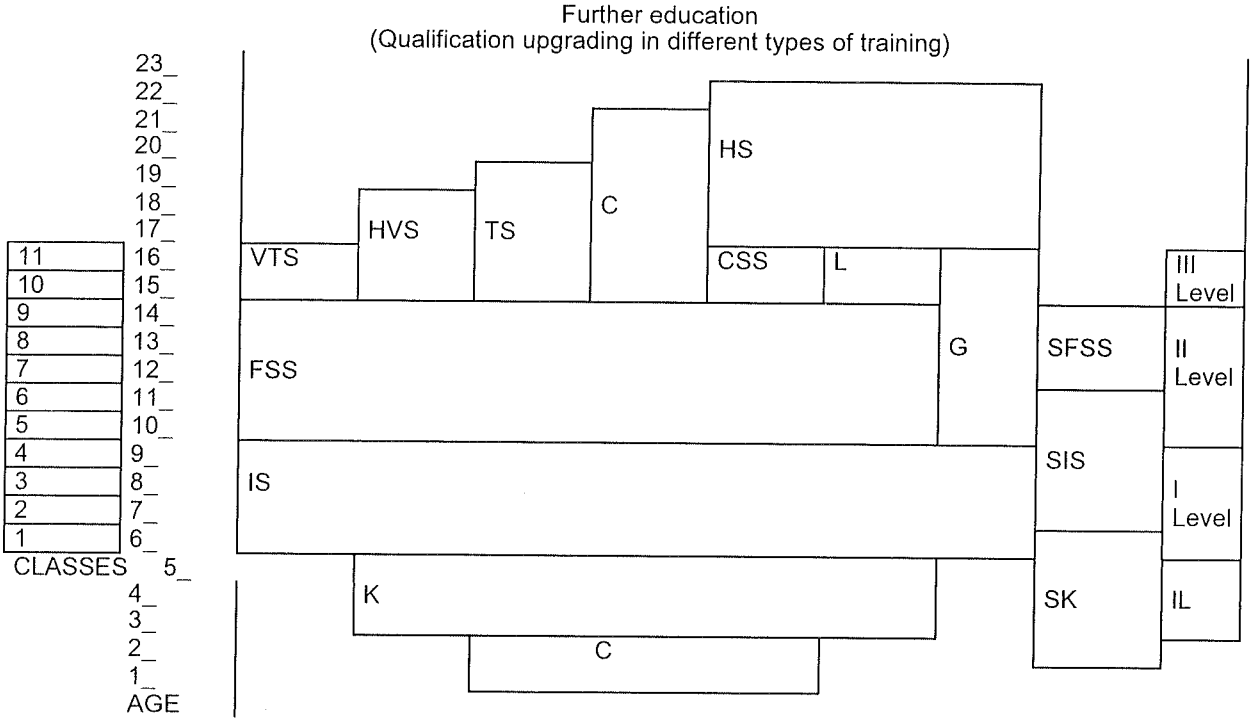
1) pre-school education;
2)general secondary education;
3) extra-mural forms of education;
4) vocational and technical education;
5) special secondary education;
6) higher education;
7) scientific and scientifically pedagogical training;
8) personnel qualification improvement and in-service training;
9) public self-education.

The educational system of the Belarus Republic includes various types of educational and educative institutions: children's pre-school (kindergartens, creches) and out-of-school institutions; general educational (fundamental and secondary schools, gymnasiums, lyceums); special institutions and boarding schools (children's homes, boarding schools, reformatories for minor delinquents, etc.); professional and technical schools and higher professional and technical colleges; secondary special (schools, technical schools, colleges) and higher educational institutions (specialised higher educational institutions, universities and academies); scientific and research institutes and institutes for personnel qualification upgrading and in-service training; the bodies of the educational system management (Ministry of education, the educational administration and departments of the Executive Committees of the Regional Soviets and submitting educational and methodological organisations.

The continuous nature of the educational system, its structure, stages of teaching and types of the educational institutions are demonstrated of the Scheme 1:

Scheme 1

Structure of education in the Belarus Republic



- IL - Initial Level;
- C -Creche;
- K - Kindergarten;
- SK - Special Kindergarten;
- IS - Initial School;
- SIS - Special Initial School;
- FSS - Fundamental Secondary School;
- SFSS - Special Fundamental Secondary School;
- G - Gymnasium;
- VTS - Vocational and Technical School;
- HVS - Higher Vocational School;
- TS - Technical School;
- C - College;
- CSS - Complete Secondary School:
- L - Lyceum;
- HS - Higher School (Universities, Academies, Special Higher Educational Institutions)

THE SYSTEM OF HIGHER EDUCATION IN THE BELARUS REPUBLIC

At the beginning of the 1995/96 school year the System of higher education in the Belarus Republic consisted of 39 state higher educational institutions (HEI), Management Academe under the President of the Belarus Republic and 20 non-governmental HEI:

The number of students

	The number of HEI	The number of their students
State HEI	40	174 189
Non-state HEI	20	23 192
Total	60	197 381

Academical staff:

Staff, total	15 153
including females	6 252
including doctors of science	843
including females	101
candidates of science	7 104
including females	2 312

THE SYSTEM OF SPECIAL SECONDARY EDUCATION IN THE BELARUS REPUBLIC

At the beginning of the 1995/96 school year the system of special secondary education in the Belarus Republic consisted of 146 state special educational institutions (SSEI), including 77 technical schools, 18 colleges and 51 schools. Besides, there are 3 non-governmental SSEI.

The number of students:

	The number of SSEI	The number of students
Govrnmental SSEI	146	121 560
Non-governmental SSEI	3	812
Total	149	122 372

SSEI staff:

Staff, total	10 838
Teachers on the staff	8 414
including females	5 768

THE SYSTEM OF SECONDARY EDUCATION IN THE BELARUS REPUBLIC

At the beginning of the 1995/96 school year the system of secondary education in the Belarus Republic consisted of 4808 schools of general education, 98 special schools and boarding schools for the children with mental or physical deficiency, 25 sanatorium boarding schools, 82 evening schools and 242 professional and technical schools, subordinate to the Ministry of Education and Science. Besides, there're 15 schools and 10 vocational and technical colleges, subordinate to other Ministries and institutions.

	The number of educational institutions	The number of their students	The number of teachers
Day-time schools	4808	1 538 068	126 489
Evening schools	82	20 911	788
Special schools	98	20 095	2 666
Vocational and technical schools	252	130 083	14 064

According to the acting law, the control after the education in the Belarus Republic is realised by the body of state administration (legislation - Supreme Soviet (the Parliament) of the Republic, laws execution - the Cabinet of Ministers) as well as the regional control administration.

The Ministry of Science and Education of the Belarus Republic has the control over the submitting higher and secondary special educational institutions, scientific and educational and methodological organisation, institutes of qualification upgrading, republican departments and organisations. It carries out the general organisational and methodological control after the activity of the educational departments and administrations of the regional Executive Soviets of People's Deputies, which are in charge of children's pre-school and out-of-school institutions, schools of general education, vocational and technical and pedagogical schools and colleges.

At the begging of 1996 there were 4 576 pre-school and 3318 different out-of-school institutions in the Belarus Republic.

2. THE REFORM CONCEPT OF THE SECONDARY SCHOOL OF GENERAL EDUCATION

A) THE FOUNDATION FOR THE REFORMS IMPLEMENTATION

The analysis of the general education school development in the Belarus Republic and the experience of its reforming in the 50-80s revealed its main drawbacks:

- the general education school orientation on students preparing to enter a HEI, and not to breed the citizen, which is the traditional aim of general education schools and it result in:
- the considerable students' overload, especially in the second half of the 80-s (the students of the high grades have pending 40 hours per week, while within the previous years the mean norm was 30-32 hours), the absence of a fixed minimum, necessary for the life activity and compulsory for every student comprehension.

The significant increasing of student's load

conditioned the decision to refuse the idea of the overall secondary education and to accept to the conceptions of compulsory nine-years education. However, graduating fundamental school (9-years) doesn't mean acquiring the complete course of education, therefore it can not be considered as the condition for socialisation, which is its main difference from 8-years course. In the 60s 8-years course executed the similar functions. Besides, the 15-years old graduate from the fundamental school is not prepared physically, physiologically, socially and morally neither for self-sufficient activity, nor for making important decisions.

In the conditions of reforming the entire society on the whole, it turns out, that out of the educational institution graduate doesn't meet any support of his or her right to work and social defence.

However, the necessity to conduct the reform of general educational school is related not only with the sharp acceleration of the society's development, which consequent is the need for constant improvement of the general educational training and its corresponding with the world standards. The roots of the suggested reform are laying much more deeper. The home school can satisfy the demands of the new child only with the condition of solving the problems, preventing the development of the system of secondary education.

First of all, it is the necessity to overcame the internal contradictions, proper to Soviet school of general education.

Second, there is the necessity to bring to the logical end the Soviet school reform, carried out during the recent years.

The complex solution of the pointed problems provides the conditions for the individual's self-realisation, for the development of his or her creative abilities, for the increasing the level and the quality of training, for the transition to a new content and modern technologies of education.

B) THE MAIN FEATURES OF EDUCATIONAL INSTITUTIONS

According to the developing Conception, the national system of education in the Belarus Republic will consist of the following issues:

Fundamental (basic) school education

Kindergarten (age - 3-6 years)

the aim of it is to develop the inborn child's abilities with due regard of his individual and age features through his or her involving into the simplest spheres of social life. Usually, attending kindergarten at the age of six is compulsory.

Initial school (1-4 forms, age 6-10 years)

it is oriented at the further development of child's physical, intellectual and moral abilities, his or her studding the integrated educational programmes of literacy basis, necessary for learning the sciences' and arts' bases, during the period of his education in fundamental (basic) school. Teaching the program of the first form may be held either in kindergarten, or at school.

Fundamental (basic) secondary school (5-10 forms, age - 10-16 years)

it is oriented at children's preparing for their life activity (and not for entering the HEI) and for their acquiring the logically complete fundamental secondary education, which allows them to make their own decision of the way of the further educational, social, moral and vocational becoming. The basic secondary education provides thorough knowledge and humanitarian set of education, the necessary applied level of knowledge and skills, creative development of intellectual, physical and moral forces, which condition individual's development.

The implementation of the objective is realised through student's digestion of the basic component of secondary education. In 7-8 forms there is an opportunity to introduce different levels of training (specialised studding certain subjects). Education in 9-10 forms comprises profile training (natural sciences, humanitarians, polytechnics profile, arts and sports).

The successful finishing the 10th form and passing the state certification give a right for obtaining the school-leaving certificate and for continuing free education on the competition basis in a vocational and technical college, or in a SSEI, or in a lyceum.

Pre-HEI training

Vocational and technical colleges (initial vocational school)

- provides an opportunity to acquire a qualification, necessary for a certain professional activity, or in case of extension the period of education to 2-3 years students can take the courses of additional training of general education, preparing them to enter an HEI.

Colleges, technical schools (special secondary school)

- during the period of 3-4 years they provide the opportunity of acquiring a medium-level qualification, as well as the right to enter an HEI.

Lyceums, lyceum classes

- during the period of 2 years they provide general educational training, aimed at the further entering HEIs or technical schools and colleges.

There are supposed to be five types of lyceums: of general education, humanitarian, of natural sciences, aesthetic, polytechnics.

The successful finishing lyceum education provides an opportunity to obtain the document, giving a right to enter an HEI (college, technical school).

Higher vocational school (higher colleges, institutes, academies, universities)

- they organise training, different in content, forms and periods of education and provide specialists training in three levels: Bachelor, Diplomaed specialist, Master.

C) THE STAGES OF THE REFORM IMPLEMENTATION

1st stage: years 1996-1997 - the elaboration of the Conception and adoption of the National Programme of Reforming the Educational System; working out the scientific and methodological and normative and legal bases for the reform; definition of the content of education, development of the new curriculum and syllabuses.

2nd stage: years 1997-1999 - the carrying out

of scientific and pedagogical examination of the new syllabuses and curriculum; organisation of experimental grounds for their testing.

3rd stage: years 1998-1999 - the introduction of a new curriculum in the 1st and the 5th forms of secondary schools of general educational in a few regions and cities.

4th stage: years 1998-2005 - the development and introduction of the new textbooks, teachers' pre- and in-service training.

5th stage: years 1999-2001 - gradual introduction of a new curriculum of the 1st and 5th forms of secondary school of general education. Its implementation depends on certain features and the level of fitness of concrete educational institutions and regions.

6th stage: years 1998-2005 - the creation of a updated network of educational institutions: vocational colleges, technical schools, lyceums.

7th stage: years 1998-2005 - the reform of higher education in the Republic, the introduction of the new content of education in HEI.

3. BASIC TRENDS IN INFORMATION TECHNOLOGIES INTRODUCTION

The basic trends of information technologies introduction into the educational system of Belarus are the following:

- using computer as a tool for teaching and the resource of information;
- using computer in managing the educational and scientific systems;
- the development of the means of communication in order to provide an access to the world information resources.

There is a number of groups of specialists and single developers, who are busy with scientific development in the field of information technologies implementation in education in Belarus. Their work is oriented at the creation of tool systems for the preparing educating and controlling systems, their complete software, modelling systems, educative games, etc. It's worth to mention, that most widely there are developed the software on natural sciences (physics, radio electronics) and foreign languages courses. Under the Ministry of Education there is a fund of software. The basic aim of the fund is to carry out the examination of the developments in the field of information technologies and their introduction in educational process.

4. INFORMATION TECHNOLOGIES IN THE SYSTEM OF SECONDARY EDUCATION

The creation of the national system of teaching the basis of information technologies application started in 1985, in the framework of the federal programme. First of all it was based on the introduction of the new subject "The bases of informatics and computers" in the existed curriculum.

The lack of the school teachers of the new subject caused the involvement of the teachers with the different level of informatics knowledge, various fundamental education and working experience. Within the period of two years (1985 - 1986) on the base of universities and pedagogical institutes there was organised the mass pre- and in-service training. In 1985 pedagogical institutes started to train teachers of informatics.

During the first six years the school subject of informatics developed in the republics of the former USSR in common directions and by the common programmes. The school course of informatics pursued the following objectives:

- the forming of student's notions about computer information technologies and their role in society's development;
- providing students with the simplest skills of using computer information technologies.

The achievement of the educational aims in the course *The bases of informatics and computers* was stipulated by learning the programming languages and their application in the solution of computing problems. The passed years witnessed the considerable progress, made in providing students with the skills of programming, and as the result was the successful participation of the Belarus students in the different Olympiads on informatics.

The development of computer hardware and software revealed the necessity of changing the content and the structure of informatics teaching at school.

The analysis of the teaching experience of the course *The bases of informatics and computers*, of computer hardware and software resources, of society's needs revealed in its turn the necessity of the division the process of students digestion the basis of computer literacy at school:

1. VIII -IX forms - the basic course, providing the minimum of student's general educational skills and knowledge.
2. X-XI forms - the specialised students training in informatics, different in its volume and content, depending on student's interests and school

resources.

In order to innovate the content of the course, in 1993-1994 there was developed and introduced the programme of the new basic course, called *Informatics.* The objectives of the new course ware almost the same, but the means of their achievement had radically changed. The content basis of the course consisted not of the programming languages, but of the universal programmes for information processing: text processing, computer graphics, DBMS, spreadsheets, etc.

The programme strengthened a general educational aspect of subject. The basic notions of the course are *computer, information, data processing, algorithm, model.* In 1994-1995 there ware published new textbooks for the course. Now, the specialists are working out the complete methodological set.

In 1995 there were developed the programmes of the specialised courses on informatics for the students of the 9th-10th forms with the extended training in informatics, in mathematics, physics and economy. There was started the preparation for the work with these programmes.

Nowadays, those who are involved in the process of secondary information technologies introduction in education, are solving the following problems:

- the equipment of the fundamental schools of general education (nine years schools) with computer hardware (today, the level of school equipment makes up only 6 % of the demanding level);
- teachers training for fundamental schools;
- the equipment of the specialised schools with up-to-date computer hardware and software;

At present, the situation with information technologies application in the educational system is determined by the three following factors:

- hardware;
- software;
- a professional level of the specialists in information technologies application in the field of education.

Nowadays, computers are used at school to form the basis of informational culture, to form students' skills of the practical work with computer and applied software. 84 % of the available computers allow to realise a basic course of informatics in practice. However, we should obviously take into consideration the fact that computers are more and more often applied as an educational tool in the process of learning the general educational and specialised subjects. And in this context, the capacity of the today available computers, installed in a mass school, is not sufficient. In this connection, educational institutions and organisations are oriented at the application of the IBM-compatible computers.

5. INFORMATION TECHNOLOGIES APPLICATION IN HIGHER SCHOOL

Higher school hardware is based on IBM-compatible computers. The modern multimedia computers are still rare nowadays. However, the software meets the level of the latest world developments.

The mass character of any technical innovation introduction in education depends on the evaluation of its three parameters:

- application effectiveness (reduction of time for studding, increasing of the efficiency of education, the reduction of irrational student's mental work activity);
- convenience of application (the reduction of student's work volume, the low level of special background, the innovation reliability in the educational process, correspondence with the aims of education);
- availability (the availability of purchasing and servicing).

In the present conditions the mass character of information technologies introduction in the system of education of the Republic first of all is restrained by the low level of availability, related to the present financial support of the educational system. The lack of the technical support stipulated the poverty of the other parameters (effectiveness and convenience), though it is also connected with psychological aspects: teachers are not ready to use information technologies.

The perspectives of information technologies application in the Republican system of education are first of all related to the increasing of the financial support of this process, to the propaganda of information technologies through the distribution of the information about the latest developments in this field, to the intra-Republican co-ordination of the home developments and international co-operation, to the organisation of teachers in-service training.

In 1995 the quarter scientific and methodological magazine *Information Technologies introduction in Education* started to issue in order to propagate the progress, made in the field of information technologies in the Republican system of education and science.

The number of educational institutions and organisations are involved in the experiments on information technologies introduction in educational process, scientific researches, the management system of education. The specialists of the Belarus State University (BSU) are now intensively working on the creation of an automated control system (ACS) of an HEI on the base of local and remote networks of personal computers. At present there is a computer network, functioning in BSU, which links

40 users and a network training classroom. Within this network the following subsystems of BSU ACS are exploited: *Matriculant, Students, Stipend, Staff, Salary, Fixed Assets , Control over the execution of the orders and directions,* etc. Data bases on servers contain information about every student of the university (including all marks, got during the period of education), teachers and academical staff, fixed assets, which are on the balance of BSU, etc. The subsystems *Matriculant - Students - Stipend* provide the non-paper technology of data processing about the students of the university since the moment of their entering BSU. The working stations are installed in every Dean's and in the Rector's offices. They are used for data processing and updating. The participants of the international workshop *Higher Education in Belarus: international co-operation and development,* held in Minsk in March 1995, where met the representatives of the leading HEI of the republic, pointed out that BSU ACS doesn't have any analogy in the Republic in the complicity of data bases and in the width of covering such an number of different aspects of a university's activity.

BSU consider the introduction of information technologies in librarian system to be one of the most significant directions in the modern computer technologies introduction. It is the field, where BSU has the long and active co-operation with the Moscow State University (MSU). At present the data bases of the library catalogues of MSU and BSU are functioning in the BSU computer network. This fact gains the special meaning in the conditions, when acquiring information and literature, issued in Russia was obstructed because of some reasons, generally of the financial character. Besides, the users of the university network have the access to the data base of the French Institute of Scientific and Technical Information (INIST), which contains the information on more than 4500 periodicals from all over the world. This data base was obtained by the university in the framework of the project, realised within the programme TEMPUS in co-operation with the Joule Vern Picardy University (France).

The University considers that the strategy of information technologies introduction in HEI on the modern stage should be departamental local networks integration into an integral information network, providing its users access to Internet, as well as their access to the bibliographic data bases of the university and other educational institutions. That is the aim of the developing project of the such a network creation on the base of the optical fibre communication lines, permitting to link separate departments of the university.

6. INFORMATION TECHNOLOGIES IN THE SYSTEM OF EDUCATION MANAGEMENT

In 1992 began the implementation of the project of information technologies introduction in the system of education management in the system of the Ministry of Education and Science of the Belarus Republic. This project is realised according to the Resolution of the Collegium of the Ministry of Education of 30 September, 1992, ? 10-n. The head organisation of the project implementation was fixed the Computing and Analytical Centre of the Ministry of Education and Science - the head organisation of the branch in charge of problems of the development and introduction of information technologies in the educational process, scientific researches and control system. The main results of its activity are the following: the development of the base project for the information technologies introduction in the education management system, as well as the development and installation of a local network in the Ministry machine. Now the following projects are realised: *Telecommunication, Documents turnover, Finances control, Statistics.*

The result of the carried out activity was the acquiring and systematisation of the information on the structure of education management system in the Belarus Republic. This information includes organisational structure, information flows, the functional model of the educational system. There was elaborated the programme set called *Document turnover.* the complex was created for the automation of the works, related to controlling document turnover, including document registration, the searching for a document, the route of transportation, control after execution, access control.

The result of the carried out activity in the framework of the project *Statistics* was the development of the complex software for the automation of processing data on the state statistic accounting, acquired from the regional educational departments and submitting educational institutions and organisations. It allowed to increase the efficiency of acquired data processing and of the taken management decisions.

7. COMMUNICATION TECHNOLOGIES DEVELOPMENT IN THE EDUCATIONAL SYSTEM OF THE BELARUS REPUBLIC

Computer telecommunications are the natural continuation of integration trends in the development of informational systems. The combination of computer techniques and means of communication emerge the new computer function - they become a means permitting to widen the scope of the information space of a given organisation, to expand the opportunities of the information interaction up to the scope of a city, region, republic and, finally, to provide entering the world information space.

In this case a personal computer user finds himself involved into a powerful telecommunication infrastructure, he or she becomes an element of a global computer network. The networks of this kind link, through the up-to-date means of communication (individual and switched telephone lines, telegraph network, radio, satellite communication, etc.), tens and hundreds of users, information resources, centres of data processing, separated from each other by thousands of kilometres. The global networks are covering schools and governmental establishments, public organisations and research centres, commercial companies and universities, etc.

The global networks are covering almost every country in the world, every sphere of one's activity. They don't have any boundaries and any censorship. Most of the networks are connected between themselves creating a global integral information space. The subscribers of a global computer network gains access to the world market of information services. The modern information market can be conditionally divided into several correlative areas.

1. INFORMATION.

Here, different types of information are represented. The sector of scientific and technical and special information comprises: bibliographic and reference information in every field of fundamental and applied sciences, education, culture and other fields of human activity; access to the originals through libraries and specialised services; provision of the opportunity to acquire text data, full size copies, micro-movies and origins, using inter-librarian subscriptions; professional information and special data for teachers, physicians, engineers, etc.

The sector of consumer's information comprises news and mass media information, references, encyclopaedias, mass character and entertaining information, oriented at home consumption instead of business one: regional news, weather forecast , transport time-tables, etc.

2. ELECTRONIC COMMUNICATIONS

The two systems of human interaction - individual and business - should be marked out on the market of electronic communications. First of all it is e-mail, providing quick transmitting and receiving different types of data (text and graphic information, software, data base fragments, etc.). It gives an opportunity to automate almost every operation of processing individual and business correspondence. E-mail laid down the foundations for the so-called teleconferences: mutual exchange of topical information between users - teleconference participants. The means of electronic communication permit to issue electronic newspapers and journals, to organise electronic advertisement desks and bulletins, clearing houses for publicly accessible software, etc.

The structures of all computer networks are similar and represent a system, formed by terminals, units and communicational environment (channels and communication lines). Network structure is implemented with regard of the discipline of connections and topology (geometrical structure).

The computers of national and international units, interacted into one network, offer their users the following services:

- access to remote data bases, programme libraries and applied processes;
- collective usage of the computing resources of network unit computers;
- massages exchange in the interactive regime;
- e-mail services.

At present, a lot of global networks and informational centres are functioning on the Belarus territory. They have different organisation and technique. The most significant among them are:

BelPAK - The state network for data transmission. It has the national status. It is based on the application of the protocol X.25. This network, as the other analogical national networks for data transmission in other countries, offers a powerful technical foundation and a wide range of universal services.

EUnet/Relcom - A commercial international network, offering the services of e-mail, teleconferences, access to Internet, Usenet, etc.

GlasNet - A public non-commercial international network, offering, first of all, e-mail services.

Sovarm Teleport - A powerful commercial network, offering rather expensive services of access to Internet and other networks, which are kept in with protocol X.25.

CITEC - A commercial information system. In fact, it represents the enhanced electronic

advertisement desk BBS.

BASNET - The network of the Belarus Academy of Science. Besides servicing the Academy's organisations and institutes, it offers the services of e-mail and access to international networks.

At present, the mentioned networks do not offer the full size direct exit to global networks of Internet. This exit is realised ether through e-mail, which doesn't provide an opportunity to use the on-line regime in the work with information systems, or through protocol X.25, which emerges some technical problems, reduces throughput and increases the price.

One of the most developed computer networks of the Belarus Republic is the non-commercial network UNIBEL. It integrates the leading educational and scientific organisations of the Republic, offers the wide range of correspondingly cheap services. The main aim of UNIBEL is to provide access to the global community of Internet networks for the organisations of social sphere on the non-commercial base.

UNIBE network is a part of common scientific and research computer network (SRCN) of the Belarus Republic. The general system principles of it are the following:

1. SRCN should represent a complex of information and computing networks of the establishments, institutes and organisations, working in the field of education, science and culture. The complex should be based on the abidance of the common system of protocols and rules. The rules and protocols should be based in their turn on the world standards and should define the order of information creation, processing, storing and transmitting, as well as the order of using computing resources.

2. SRCN should be created on the base of supporting networks of different ministries and institutions of the Belarus Republic, on the preferential conditions for the budget organisation of communication channels.

3. SRCN should be organised on the condition of the maximum application of resources of the existing institutional networks.

4. There should be provided co-ordination of the projects, aimed at the creation of local systems and means of data transmission. These projects are the part of the national programme of information technologies introduction in the Republic.

5. In order to acquire access to international computer networks, and consequently to the information of different data bases, there is a necessity to strengthen the co-operation with such well-known organisations, as Executive Secretariat of CIS (Minsk), DFN (Germany), NASK (Poland), NORDUnet (Norway), SSC (Sweden), OSI (USA).

The creation of UNIBEL network pursues the following objectives:

- the overcoming the disconnection between universities, institutes, scientific centres, laboratories, groups of researchers and separate scientists, teachers and students. To provide them with the opportunity of free informational exchange;
- the solution of the problems related to the dissemination of new ideas, scientific results and publications in the field of education;
- the following general technical policy in the field of information technologies introduction in the educational system of the republic. It will allow to increase the efficiency of using the resource of an educational institution and of the concrete worker of education and science. It will provide the opportunity to use efficiently the national informational resources of the Republic;
- dissemination of information technologies; education and popularisation of computer telecommunications in the field of education.

The further stage in the development of the UNIBEL network is supposed to provide the full access to the services of the Belarus national network of data transmission BelPAK and of the other networks, created on the application of the protocol X.25. It is expected to provide the access to the complete set of the services of the protocols X.400 and X.500 and the other ones and of the standards of the pattern model of open system interconnection (OSI).

The development of the UNIBEL network is implemented in the following directions:

- the closer co-operation with the network of the administrative control system after the educational system of the Republic; the creation of an integral republic network on their base;
- promoting long term information programmes, first of all on the base of attaching to the network the largest libraries, archives, centres of scientific and technical information and the expert service of the Republic;
- the development of the connections and realisation of mutual programmes with scientific and research organisations (branch and academical);
- gradual attaching to the network the system of secondary special education and secondary schools, non-state educational institutions;
- attaching (the direct and through BelPAK) governmental and public organisations, funds, etc.;
- the organisation on the base of the central unit of the Centre for specialists training and an inter-HEI research laboratory of network technologies.

Today, the number of foreign organisations and funds are promoting the creation and the development of the educational and scientific network of the Republic. The Institute of the Open Society (USA) gave Belarus a grant for the creation of an optical fibre ring around Minsk - MINSK INTERNET PROJECT. The implementation of this project provides our educational institutions and scientific organisations with the full access to the global computer network Internet.

There was gained a grant from UNESCO for the attachment to the computer network of the educational departments of the Regional Executive Committees of the Belarus republic. Our activity was promoted by NATO Scientific Committee of the informational filling of the creating network.

The creation of a real information infrastructure has only started in the Belarus Republic. However, people realise that, that information is an extremely valuable and perspective commodity, and the information market is one of the most dynamic and roomy. Nowadays, many governmental, commercial, scientific and public organisations are promoting

their activity in the field of computer communications and information technologies on the whole.

Regarding the considerable scientific and technical, educational and industrial resource of the republic, Belarus has real chances for the soon entering the world information space and becoming the competent member of the world community of global computer networks of Internet. In order to achieve the objectives, Belarus should increase the efficiency of the educational process through the wide application of information technologies.

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NATIONAL REPORT OF BOTSWANA

EDUCATIONAL POLICIES AND NEW TECHNOLOGIES: THE CASE OF BOTSWANA

1. INTRODUCTION

Computers are becoming more and more common in all aspects of life. They are simply tools that help to be more productive. More and more jobs require applicants to be familiar with computers. As this new technology of computers has become so pervasive and thus more prevalent in everyday life and in the workplace, use of computer has gained in importance over the computer itself. Botswana like other countries has recognised the need to increas the technological background of its people to complete better in world markets. The new Education Policy is based on the general goals as stated in the Revised National Policy, which are to prepare Botswana for the transition from a traditional Anglo-based economy to the industrial economy to which the country aspires. The industrial worldwide economy is driven by Information Technology, which uses computer technology to process, analyze and communicate information in an increasingly efficient and effective way. Thus the contemporary society must be computer aware and likewise and workforce to make the best use of Information Technology. Computer technology, when used in education, encourages the development of problem solving, analytical and research skills. The revised National Policy on Education of 1994 has therefore made a call for the inclusion of a computer awareness programme as a requirement in all Community Junior Secondary Schools.

Botswana tertiary institutions are also commited to the provision of computer awareness courses for their students.

The introduction of the programme within the basic Education Structure ensures a basic level of computer competence for most, and in the long run, all young people throughout Botswana. Tomorrow's world of information Technology is one where information handing skills will be needed to improve the standarts of learning and living. The world is becoming connected electronically by the Internet world wide network through which we can all share information. The computer Awareness programme aims to incorparate section on Telecommunication later, when the time is ripe to enable young Botswana to use this giant network to communicate with the rest of the world.

2. REVISED NATIONAL POLICY ON EDUCATION

The development of the Computer Awareness Programme for the Junior Community Secondary Schoools was prompted by the recommendations made by the Revised National Policy on Education og1994. The process of the syllabus development was started with a consultancy which looked into the logics to be considered in the development and implementation of the programme. The consultancy consulted widely and reached out to a variety of stakeholders.

This is a new programme which is designed to inroduce pupils to the use of computers as tools which help to increase productivity by automating a lot of tasks undertaking in the world of work. Unlike a typewriter document, the computer generated document can be corrected without having it retyped, and this increases productivity. The intent of the programme is not to produce computer experts out of the students, but to give them computer literate. The programme will give them the basic skills to enable them to pursue computers studies without being intimidated by the computer.

The computer awareness programme is not a stand alone programme, but has to be infused into the other subjects in the school curriculum. It should be divided into global topics or modules as follows.

Computer skills

Productivity tools:

- word processing spread sheets
- databases
- graphics will have to be taught prior to the use of productivity tools.

The basic skills i. e. computer skills and keyboarding skills have to be created in order to accommodate this part of the Computer Awareness programme. The productivity tools will then be taught and used within other subject areas. These cannot be taught during specified times but they are best learned through practice over a period of time. The aims of the Nine Year Basic Education Programme are commited to the integration of computer skills as exemplified in the part that follows.

3. AIMS OF THE TEN-YEAR BASIC EDUCATION PROGRAMME

On completion of the Ten-year Basic Education Programme students should have:

1. *Developed compentency and confidence in the application of computational skills in order to solve day- to-day problems.
2. Developed an understanding of business,

everyday commercial transactons, and entrepreneurial skills.

3.Developed critical thinking, problem-solving ability, individual initiative, interpersonal and inquiry skills.

4. Developed desirable attitudes towards different types of work and the ability to assess personal achievement and capabilities realistically in pursuit of appropriate career/employment opportunities/possibilities and or further education.

5. Acquired knowledge, skills and attitudes in food production and industrial arts for self-reliance and self sufficiency.

6. *Developed awareness, and or literacy and understanding of the signififcance of computers in the world of work.

7. Acquired knowledge and understanding of their environment and the need for sustaining utilisation of natural resources.

8. Developed desirable attitudes/behavioral patterns in interacting with the environment in a manner that is protective, preserving and nurturing.

9. Acquired knowledge and understanding of society, appreciation of their culture including languages, traditions, songs, ceremonies, customs, social norms and a sense of citizenship.

10. Developed the ability to express themselves clearly in English, in Setswana and a third language both orally and in writting, using them as a tool for further learning and employment.

11. Acquired the basic science knowledge and knowledge of the laws governing the natural world;

12. Acquired a good knowledge, practice of moral standards and helth practices that will prepare them for responsible family and comunity life.

13. Developed their own special interest, talants and skills whether these be dexterity, phisical strength, intellectual ability, and/or artistic gifts.

14. *Acquired and appreciation of technology and technological skills including basic skills in handling tools and materials.

15. Gained the necessary knowledge and ability to interact with and learn about their community, the government of their country and the world around them.

*Note: The asterisks show the items associated with computer awareness.

4. OTHER RECENT DEVELOPMENTS

Recently a Task Force has been appointed whose main aim is to develop the syllabus that is to be used for computer awareness programme. The Macintosh Computer has been identified as the most appropriate computer to be used for the awareness programme. Four zones were established to provide maintenance as shown in Figure 4.1.

Table 4. 1

Established Zones for the Provision of Maintenance

Zone	Areas	Response Time
One	Gaborone and around	4 hours
Two	Lobatse, Molepolole	12 hours
Three	Mahalapye	24 hours
Four	Maun, Kasane, etc.	Bring in

To keep pace with the Information Technology explosion, the University of Botswana has developed awareness courses so as to provide its students with the required skills. The Faculties of Social Science and Humanities offer compulsory computer awareness courses to all their students.The Faculty of Education and Teacher Training institution likewise, are considering to fall in the same footing with the other Faculties of the University in providing their students with computer awareness courses. All these developments regarding the provision of computer awareness as both the secondary and tertiary levels is gradually gaining support from the Government of Botswana as indicated by recent policies.

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NATIONAL REPORT OF BULGARIA

I. CURRENT STATE OF TEACHING INFORMATICS AT SCHOOL

In 1981 the production of 8-bit Apple compatible personal computers was given a start. At the end of 1984 the Government took a priority decision to create conditions for training the youth in working with computer-based equipment. Following the State policy a new compulsory subject - Informatics - was introduced in the upper grades of the high school, vocational schools and high technical schools since the school year 1986/87.

Those three factors reflected the urgent social needs and speeded up the process of immersion of computers and information technologies in the Bulgarian Educational System. Although, these were necessary, they were not sufficient conditions for running the hardly-known and specific in kind Training in Informatics. Normal and effective realization of the educational processes leading to acquiring and using the computer and the information technologies in the social practice requires the presence of a system of mutually related didactic factors. Until 1986 no didactic system that could be widely used in the Bulgarian schools, existed for teaching of Informatics.

Despite the lack of experience (both Bulgarian and foreign), the Ministry of Education introduced Informatics as a compulsory school subject from the school year 1986/87 within the following restrictive conditions:

1. Informatics was introduced as a general compulsory subject. It started from the second term in the 10th grade (second year of the vocational and high technical schools) with two hours per week (for the total of 34 hours) and continued in the 11th grade (third year of the vocational and high technical schools) again with a two hours a week. The total number of hours allocated for Informatics in the curriculum was 98.

2. Schools were equipped with at least ten 8-bit Apple compatible personal computers, while not all of them with peripherals (disk drives).

3. The programming language was BASIC, and the Operational System was DOS 3.3

With the available technical, software and methodical facilities existing by that time in schools, the three developed and implemented variants of subject contents were restricted to studying the following topics:

1. Introduction in Informatics.
2. Principal structure of the computer and the computer system.
3. Algorithms and ways of expressing them.
4. Introduction in programming.
5. Drawing geometric figures and shapes and animation.
6. Data. Type of data.
7. Data Structures
8. Basic informational activities and algorithms for inputting, outputting, actualizing, processing, finding and sorting.
9. Stages of problem solving by means of computers.
10. Utilization of the computer and the information technologies for problem solving through computers.

During the first stage (1986 - 1991), the introduction of the subject contents is related to the computers and the information technologies and was motivated, introduced and acquired mainly in the process of solving a suitably chosen (by the authors the actual text-books by that time) system of specific problems.

The existing conditions, the ideas of the authors and the chosen educational strategy led to a groundless domination of programming in teaching in Informatics during the first stage of its introduction in the Bulgarian school.

It is known that the study contents reflects the level and needs of the economical, social-political, cultural and scientific - technical level of society. The deep social and political changes and the economic crisis in Bulgaria in the beginning of the nineties, affected the educational system.

Though slowly, the attitude and the aspirations of society towards education were changed. A tendency is observed towards decline of society' interest in education, that are expressed in the following:

- reduction of the relative share of funds, allocated for education from the national budget
- lack of motivation and common attitude of the youth towards the general and vocational training.

In the conditions of an economic crisis the educational system is gradually being re-oriented and reset in accordance to the changes taking place in the society:

1. Symptoms of decentralization have appeared, expressed in the emergence of private schools.

2. Since 1992 a new curriculum has been adopted, according to which part of the study time (number of hours per week) is used in conformity with students' interests and the priorities of the specific school.

As far as organization is concerned, the variable part of training is accomplished in classes through:

- compulsory elective preparation;
- profile training;
- free-elective training.

In the comprehensive schools in the 9th and the 10th grades the subject "Technologies" is studied. The subject contents is specified locally in accordance to the profiled technological trends, chosen by the relevant school.

3. The Ministry of Education, Science and Technology promotes a tendency for decreasing the relative share and level of the theoretical component of subject contents in the comprehensive schools

and increasing of potential possibilities of the study contents for acquiring skills, abilities and methods of learning.

The new curriculum dramatically changed the approach of allocation and use of teaching hours in Bulgarian schools.

The following is regulated for each grade in the curriculum:

1. Compulsory subjects and their weekly horarium. The number of these subjects and study hours defines the General Compulsory Training (GCT) for the students from the specific grade.

2. The number of hours per week, used obligatory for expanded study of one or a couple of disciplines. These are the hours for "compulsory elective training" (CET). The number of hours per week for the GCT plus the number of hours for CET specify the compulsory study time per week.

3. The number of hours per week, that can be used for additional training range. These are the hours for "free-elective training" (FET). In order to carry out a FET, groups of students (occasionally from different classes) with similar interests should be formed. The FET is not compulsory by nature and is carried out when supplementary funding is available.

4. The number of study weeks.

5. Scheme of allocation and usage of the study hours in GCT, CET and FET.

The CET appears in the curriculum with 2 hours per week in the 9th grade. In the upper grades the hours for CET are gradually increased.

IMPLEMENTATION OF THE TRAINING IN INFORMATICS

The new curriculum and the tendencies for development of the secondary education, launched by the Ministry of Education, Science and Technology offer possibilities for a differentiated introducing of subject contents, related to computers, Informatics, and its implementation in the various forms of education, existing in the schools:

1. Non-profiled education in general secondary and high schools.

1.1. Informatics is part of the GCT. It is studied in the 11th and 12th grades with 2 hours per week. Practically though, training in the subject in the 12th grade is not common, as most general secondary schools do not offer 12th grade. Compulsory secondary education is completed in grade 11.

1.2. Part of the hours for CET can be used for training in Informatics. The number of hours and subject contents are specified locally for the school and the different groups in accordance to:

- equipment (hardware and software) in the computer classroom;
- teachers qualification;
- students' interests and potentials;
- orientation of the school.

1.3. In the frames of the GCT in the 9th and 10th grades the school subject "Technologies" is studied with the total horarium of 140 hours and under the following specific conditions:

- availability of at least seven 16-byte (or more powerful) personal computers;
- suitable software;
- qualified teachers;
- willingness of the students and the school authorities.

The study time defined for the subject could be used for acquiring some concrete information technologies knowledge in word processing, data base, spreadsheets, etc. at the relevant textual or graphical interface. Training is done on a modular principle, in study programmes approved by the Ministry of Education.

2. Profiled training in general comprehensive secondary and high schools

In the form of profiled training students choose (in 9th grade) and study (since 9th to 11th or 12th grade) extensively three school subjects, called the first, the second and the third profiling subjects. The name of the profile and its course are specified by the first profiling subject. In 9 - 11th (12th) grade hours for the CET are distributed according to a certain scheme between the three profiling subjects. Thus the number of hours for the GCT in the profiling subjects is increased and conditions for their extended and intensified study are provided.

When graduating high school, school-leaving examinations (matriculation) in two profiling subjects are taken.

2.1. Studying Informatics as a profiling subject

In this case training in Informatics and its implementation is carried out in:

- GCT in Technologies (Information Technologies) in 9th and 10th grades, in a total horarium of approximately 140 hours;
- the hours for profiled training in Informatics, that are formed from the GCT Informatics plus a part of the hours for CET in 11th and 12th grades.

2.2. Studying Informatics in a profiled training, when no profiled subject is chosen.

In this case Informatics is studied only in the frames of the GCT, with two hours per week in the 11th and 12th grades. Practically, training in the subject in 12th grade is not common, as most general secondary schools do not offer 12th grade. Compulsory secondary education is completed in grade 11.

3. Training in Informatics in vocational and high technical schools

3.1. The compulsory general-educational training in vocational and high technical schools does not include training in Informatics.

3.2. The vocational training in some types of high-technical schools includes training in Computer Science and/or Informatics and its implementation. For example:

- all students in high technical schools in economics and high technical schools in trading study the subject "Informatics and computers" for the total of 140 study hours. Some specialties in these schools - "Machine processing of information" and "Business and administration" study Informatics and computers extensively or in other school subjects;
- vocational training in high technical schools in electronics includes the following subjects - "Programming" (approximately 140 hours), "Microprocessor-based equipment" (approximately 120 hours) and "Software applications packages" (approximately 70 hours).

3.3. Part of the study hours (classes) for CET (compulsory elective training) in the vocational and the high-technical schools can be used for studying and acquiring computer hardware, Informatics and Information Technologies. Training takes place where there is hardware, software, a teacher and most important - willingness in the students.

Equipment

1. In the period 1986 - 1989 computer classrooms were set up in almost all secondary and high schools in Bulgaria. They were equipped with 8-byte Apple compatible personal computers, but not all of them had floppy-disk drives.

2. In the period 1988 - 1992 some schools changed their equipment entirely (through self-funding or centralized purchasing) with home-made personal computers "Pravetz 16" (IBM XT compatible).

3. In the recent years the Ministry of Education has allocated almost nothing for the modernization and upgrading of the computer equipment. Schools are supplied with computers through self-funding, following an initiative of their own. The restricted sums given at their disposal force the schools to buy mainly particular, usually second-hand units. That is why a significant part of the computer classrooms were equipped with hardware and software that is different in kind and type, which makes specification of study contents and the actual training with up-to-date tools and means quite difficult and rather frustrating.

4. During the last 2 - 3 years some Bulgarian schools were supplied with high-quality up-to-date software at preferential conditions or as donations from world-known software companies, the Open Society Fund, or through International Educational Programmes.

4.1. Twenty-five computer classrooms and one Centre for Teachers' Qualification are equipped with 7 - 8 Macintosh computers (mainly LC II and LC III models). They are using the Bulgarian version of System 7. Basic education is carried out with the integral package Claris Works.

4.2. In May 1994 started the fulfillment of the contract "Educational Initiative of IBM for Bulgaria", signed between the Ministry of Education, IBM and Open Society Fund. Under the patronage of that very contract IBM practically granted 240 personal computers to Bulgarian schools as follows:

- 28 pieces IBM/APTIVA/486/DX/66
- 196 work-stations IBM/APTIVA/486/SX/25

This equipment supplied 27 modern computer classrooms in schools and one Centre for Teachers' Qualification. Open Society Fund completed the equipment in the classrooms by multimedia accessories, laser jets, modems and last versions of software. The Fund, the schools and the Ministry of Education allocated funds for the special training of teachers, working on the initiative.

In conclusion, it can be pointed out that by the end of 1995 almost all secondary and high schools in Bulgaria had their computer classrooms. Unfortunately most of the hardware and the software is old-fashioned and worn out now. This can be seen from the approximate data given below:

- 70% of computers in the classrooms are 8-byte, Apple compatible, with, or without disk drives;
- 21% are IBM XT compatible;
- 4% are IBM AT 286 or compatible;
- 3% are IBM 386 and IBM 486 or compatible;
- 2% are Macintosh computers, mainly LC II and LC III models.

Subject Content

The subject content in Informatics is determined in each concrete school, class or group, according to the curriculum, the interests of the students (identified through the choice of compulsory electives or free electives), the equipment and software available and the expertise of the teachers in the school. The wide range of factors influencing teacher and student activities in the classroom call for variety in choosing the subject content. The concrete topics, their scope and depth, and the structuring of the subject content is done by the teacher on a modular basis. Teaching the different modules follows syllabuses designed and approved by the Ministry of Education, which act as broad frameworks.

1. Subject content within the core curriculum.

1.1. When the school has provided only 8 byte PCs (with or without floppy discs), the subject content in Informatics is being introduced in the process of solving appropriate sets of tasks (or problems) and generally covers the following themes:

- introduction in Informatics;
- algorithms, basic algorithm structures and ways of describing them;
- introduction in programming (Basic or versions of Logo in Bulgarian are explored);
- Database. Type of data. Symbols, logic and numeric types of data. Compound types of data - one-size bulk (Basic) or linear lists (Logo);
- Basic algorithms for input, output, accumulation, search and sorting information;
- Drawing out geometry figures. Moving simple geometry objects;
- Applications - DOS, electronic sheets or word processors.

The following software is in use in schools:

- File study system - a didactic tool for introducing and learning topics related to creating, editing and data processing saved on files;
- Programmme study environment in informatics - it is an adapted programming environment which imitates the basic opportunities available with MS DOS, study text editor and symbol editor.

1.2. When the school provides 7 16-bit PCs at least (or more powerful than this type), learning Informatics is organized in two stages:

- theory - within a school term;
- applications - word processing, electronic sheets, database, graphic design, etc.

Bulgarian versions of widespread and used software are used - Word, Lotus 1, 2, 3, DBase, etc.

2. When Informatics is among the subjects in the group for extended study, about 60% of the time (over 180 teaching hours) is set for compulsory study of the following topics:

1. Structure and basic elements of the

computer. Classifying. Historical ,information.

2. Arithmetical and logical basis of computers. Countable systems. Representation of information in computer memory.

3. Algorithms. Properties. Ways of describing. Programming languages.

4. Operational systems. mS DOS;

5. Algorithms and programmes (PASCAL).

5.1. Outlines of PASCAl.

5.2. Simple data types.

5.3. Basic algorithmic structures.

5.4. Compound data types.

5.4.1.Array. Basic algorithms.

5.4.2. Records. Basic algorithms.

5.5. Procedures and functions.

5.6. Recursion.

5.7. Problem solving with the aid of computers.

5.8. Files. File types. Basic operations. Algorithms for working with files.

About 40% of the teaching hours is devoted to introducing and learning the subject content, determined in the schools. The topics to choose from vary within:

1. Application of Informatics in mathematics - using the Plane Geometry System GEOMLAND.

2. Programme packages - word processing, electronic sheets, database, computer graphics, etc. under DOS and /or Windows.

3. Numeric methods. Close equation problem solving. Close functions.

4. Combinatory algorithms.

5. Dynamic data structures - lists, stacks, tails, dual trees. Basic algorithms. Applications.

II.COMPUTER SCIENCE IN THE SECONDARY SCHOOLS - TODAY!

1. INTRODUCTION

Whenever we treat and discuss the future of teaching Informatics in the secondary school, no doubt we have first to pose the problems and to report the results obtained in this field today. That is why our report is concentrated on those problems, approaches and methods used at present which will be applied to teaching Informatics in the secondary school in future as well.

The implementation of computer technologies in modern society is unthinkable without well educated people in this field and no doubt this sort of education should start in the secondary school. Some of the basic notions of computer science and computer applications are studied in Bulgarian secondary schools in the Informatics classes.

Those who study Informatics as a subject according to the curricula offered by the Ministry of Education, namely ({1,2}, {3,4}, {5,6}, {11,12}, {13,14}) are supposed at graduating from the secondary school to have acquired knowledge on:

- computer hardware, principles of computer operation and some computer applications;

- some types of software and the ways of using a certain operating system in order to write and execute simple programs and programming systems;

- the main methods of coding and representing data, some data types and data structures, the principal management structures. In addition, pupils are expected to be skilful in creating algorithms and programs for solving some unsophisticated problems.

2. USING MODULES AS A METHOD OF TEACHING INFORMATICS IN THE SECONDARY SCHOOL AND AN INTRODUCTION TO THEIR IMPLEMENTATION

The process of introducing Informatics as a school subject in secondary school in 1986/87 was accompanied by some problems which we could summarise as follows {15}:

- As a "new" subject, Informatics had to "be inserted" in the high school curriculum among the other, well established subjects, which naturally resulted in decreasing the number of classes in some of them. Some of the experts in the Ministry of Science and Education adopted a negative attitude towards the new subject which led to a multiple shifting of the place of the classes in Informatics in the curriculum from one grade to another and to a crucial decrease in their total number. That inevitably resulted in destabilising the attitude of most teachers, primarily mathematicians. The latter insisted on classical teaching of Mathematics pleading the new Textbooks and School Aids to be introduced in other school grades within another syllabus.

Also we cannot assume that "blurring " Informatics knowledge into Mathematics classes is a successful attempt. As an argument we can point out that not all Mathematics teachers have the qualification needed to teach Informatics as well and for this reason we could hardly expect any achievements in teaching Informatics in this way.

- The available computer technique (both in quantity and quality) does not prerequisite a general and unified Informatics teaching, even when the education is integrated. This impression could hardly be influenced substantially by the recent changes in equipping some schools with new computer classes. One of the possible ways to solve the problems caused by the great diversity in teachers' qualification, in the computer technique available as well as the very lack of computers in some schools, is to teach Informatics at two levels, namely:

- *first level* - all pupils graduating from the secondary school should acquire an obligatory minimum of Informatics knowledge;

- *second level* at which the knowledge acquired by the first one is upgraded by including additional knowledge which may vary in topics and in volume depending on the desired professional qualification of pupils and on the hardware and software available. The teaching materials supporting such an education could also be created according to the module principle. The idea of module approach is a prerequisite for differentiating Informatics teaching

with the obligatory minimum as its lowest boundary and with a free upper boundary which may vary according to the desires of pupils and the hardware and software available.

The changes of the syllabus for specialised and non-specialised education in the secondary school introduced recently have shown in practice how Informatics might be taught in different ways.

The textbook "Informatics II" {6} is an attempt to illustrate the real implementation of this idea; it comprises some modules {7}, {8}, {9}, etc. oriented to practice. Next follow the basic parameters of three of them. The modules given are TEXTPROCESSING, SPREADSHEETS and DATABASES and they comprise three modern, popular and simple (as far as the hardware required is concerned), programming systems, namely WORD, LOTUS 1-2-3 and dBase III+ in their Bulgarian versions. The modules are unified in structure and reveal both the basic and the specific facilities of the systems under consideration. Also some practical examples have been given so as to illustrate how these systems can be implemented for solving real problems. Each topic ends with a Topic Summary. Next follow the main topics of the modules:

Textprocessing

I. Introduction to Textprocessing Systems
1. Computer Texts
2. Starting with MText
3. MText Commands
4. First Computer Text and Text Writing and Correcting
5. First Steps to Formatting Texts
6. Text Printing

II. Specific Facilities of Textprocessing Systems
7. Screens, Windows and Operations with Them
8. Table Creating and Editing
9. Calculating Expressions; Text Sorting and Searching
10. Formatting through Masks

III. Implementation of Textprocessing Systems
11. Staff File of a Company
12. Mail Automation of a Company

Spreadsheets

I. 1. Introduction to Spreadsheets Management Systems
2. Starting with MPlan
3. Creating Spreadsheets
4. Editing Spreadsheets
5. Fields and Operations with them. Addressing
6. Additional Information about Calculations in MPlan

II. Some Specific Facilities of Spreadsheets
7. Displaying Spreadsheets Data
8. Business Graphics in MPlan
9. Databases and Spreadsheets
10. MPlan mosaic ... or Something else about MPlan main Commands

III. Implementation of Spreadsheets
11. One Hundred Levs Today is More Than One Hundred Levs Tomorrow
12. Each Loan is Paid Back with Interest

Databases

I. Introduction to Database Management Systems
1. Databases
2. Relational Systems
3. Starting with dBASE
4. Creating a Main File
5. Up-dating a Database
6. Using Restrictions at Processing a Database

II. Some Specific Facilities of DBMS (Database Management Systems)
7. Sorting and Indexing Files
8. Operations with Two Main Files
9. Introduction to Programming in dBASE
10. Management Structures in dBASE

III. Implementation of DBMS
11. A Card-Index of Addresses and Telephone Numbers
12. Stock Control of a Store for Building Materials

3. INFORMATICS AS A SCHOOL-LEAVING EXAMINATION SUBJECT

The problems mentioned above have already been solved and standardised for the cases when Informatics is studied as a chosen obligatory or specialised subject. The Ministry of Education approved a syllabus for that type of education in 1993 and in May 1994 a Textbook was approved by anonymous competition {10}.

Principal ideas observed when writing the textbook

The classes of Informatics envisaged are 216, distributed as follows:

- classes for new lessons about 70
- exercises in class about 40
- drills and practice in a computer classroom about 90
- tests about 5
- revision about 10

a) Structure of the textbook.

The textbook consists of Introduction, where some historical notes are given, four Sections and a concluding part. Each Section covers several topics comprising one or more lessons. Wherever possible lessons begin with some examples or problems. Thus an introduction to the root of each topic is made. The basic headings of each topic are:

- autotests;
- questions and answers;
- topic summary

The autotests comprise one or more problems enabling students to test what they have learnt by themselves. Thus some additional problems whose solutions are given at the end of each topic are added to the lessons.

b) Why PASCAL is chosen as a programming language in the textbook?

PASCAL is a universal programming language. The first idea of its author, Professor N. Wirt, has been to use this language as an educational one. The passed twenty years have shown that he was right. During that period PASCAL has proved not only to be the most taught programming language but also the one most often used in different programming systems. Probably this is due to the fact that it is:

- a programming language with a wide scope of problems which can be solved through it;

- a structural programming language;
- a module programming language;
- a standardised programming language ;
- a language supplied with relevant media for programming on almost all models of large computers, mini- and microcomputers.

c) Didactic features of the textbook.

The main guiding principles at creating the different methodological units of the textbook have been systematisation, consecutiveness, scientific rigour, simplicity, visuality. New notions are introduced relying on pupils' intuition and wherever necessary they are formally defined as well. Topics are ordered so as to enable the implementation of the following three parallel types of activities:

- teaching new lessons;
- class exercises;
- practice in a computer classroom.

d) Brief content of the textbook.

The History of a Dream which Became Reality - instead of an Introduction

1. Mathematical Foundations of Computers;
Numerical Systems;
Predicate Algebra
Algorithms
2. Computer Systems
Structure of Computers
Operating Systems
Programming Media and Applied Systems
3. Introduction to Programming
Structure of a PASCAL Program
Numerical Data Types
Use of Standard Subroutines
Conditional Operator. Boolean Data Type
Loops
Character Data Type. Multiple Choice
Simple Types: Completion and Generalisation
4. Subroutines and ...Data Types:
Functions
Procedures
Arrays and Character Strings
Computer Graphics and PASCAL Programs
Recursive Definitions and Programs
Records
Files
How Fast Can Computer Programs be Run? - Instead of Conclusion

School-leaving examination in informatics.

Pupils will sit for a school-leaving examination in Informatics this year. Naturally they feel excited and embarrassed. What will a school-leaving examination topic in Informatics look like? Though there exist a number of opinions in this field, the problem is not clarified yet. Let us even add another one.

The school-leaving exam in Informatics will consist of two parts called conventionally theoretical and practical.

The theoretical part will be a written exam consisting of a test and a problem. The problem will be formulated so that its solution should be written as a PASCAL program. The topic for the written exam will be one and the same for all graduates and it will be given by the Ministry of Education, Science and Technologies.

The practical part of the exam will be absolutely independent of the theoretical one. It will aim at testing the actual skills of pupils to implement a certain applied system, for example, a textprocessing system, spreadsheets, a DBMS, a computer graphics system, etc. The use of different hardware and software in high schools will hamper the formulation of a unique practical topic at first. Teachers might be given the opportunity to prepare these practical topics in the form of exam tickets. If the number of computers in a school is not sufficient, the practical part of the school-leaving examination might be carried out in several consecutive days but it should precede the written examination and only pupils who have passed it would be admitted to the theoretical one.

Next follow some problems which might be items of a test included in a topic for a secondary school-leaving examination. More detailed information about tests in PASCAL can be found in the journal "*Mathematics and Informatics*, 1994 {see 16}. In 1995 on the pages of the same journal under a new heading called Info Secondary School Leaving Exam will be published some exemplary topics for such an exam.

Three hot points.

1. No more than 10% of the high schools in the country possess 16-bit PCs. Then, can we talk about Computer Free Informatics in the secondary school in Bulgaria at all? Does not this percentage mean that studying Informatics without computers in the secondary school is still a hot problem?

Note: The authors of this paper make a distinction between the notions of "Computer Free Informatics" and "Studying Informatics without Computers"

2. Are the 11th and the 12th grades the most appropriate ones for studying Informatics? How could we introduce new technologies in schools if future teachers do not face the problems of Theoretical and Applied Informatics while being school or university students?

3. The obligatory minimum of Informatics to be covered by pupils in the non-specialised schools is not formally determined yet. This is an essential obstacle for teachers and especially for pupils who would like to sit for a secondary school-graduating examination in Informatics. There are such pupils.

WHAT ABOUT TOMORROW?

Informatics as a school subject is entirely dependent of computer (hardware and software) technique available in high schools. That is why no essential changes are expected in the near future. But since the necessity of implementing information technologies is undoubtedly growing, then the position of Informatics in the secondary school will be strengthened. And if we have to answer the question "*What shall we do tomorrow*", the reply inevitably will be: *Tomorrow we are going to implement what we experiment today in secondary school and in training future teachers in Informatics.*

III. INTEGRATING INFORMATION TECHNOLOGIES IN THE HIGH SCHOOL CURRICULUM

I. DEFINITION OF THE NOTION OF INFORMATION TECHNOLOGIES

The term *information technologies* is comparatively new. It became popular in the 80s and in the early 90s in connection with the rapid development of microelectronics and the implementation of personal computers in administration, economics, technology, etc.

In general, the term *information technologies* is used to denote the set of technical devices, tools, methods, knowledge and skills required for data processing.

Thus defined, the scope of the notion of information technologies is very wide. Since we are interested in the specific purposes and problems of education in the high school, further on information technologies would mean computer-based information technologies in the high school defined as follows:

Technologies related to developing and/or using software products and systems for computer-based automation of the main information processes (compiling, processing, displaying and distributing data).

This definition is used to narrow the scope of information technologies to those used in the secondary high school and it enables us to determine some educational criteria.

Next follow some corollaries of these definitions:

1. Technologies directly connected with hardware and its elements are excluded from the high school syllabuses (they are not supposed to be studied in high school).

2. Primarily ready-made software products are to be studied, in the secondary high school since we suppose that most pupils should be well qualified users of computers and some often used software packages such as textprocessing systems, spreadsheets, DBMS, etc. In this case information technologies appear to be an object of studying in high school and they are not treated as a tool through which this process is optimized (as a tool for optimizing this process)

3. Except as an object of studying, some information technologies can be treated as a tool for optimizing the learning process in some school subjects.

4. The scope of studying information technologies in high school is reduced to those which presuppose an extensive use of computers (the computer-based ones). Thus the basic idea of studying information technologies in the high school is concentrated on training pupils to be skillful in working on computers, i.e. to become well-qualified computer users, who on the one hand, can operate with the most often used representatives of software packages and on the other hand, are capable to learn by themselves how to use some new software products.

Is such an education necessary for pupils in high school?

In my opinion - yes, because nowadays, the use of computers in the above-mentioned manner becomes an element of mass culture typical for the end of the 20th century (due to the implementation of PCs) and it is no more (it is far from being any more) an occupation of special groups of experts.

That is why from now on the problem will be not whether to study computer-based information technologies but what and how should be studied - topics, their volume, methods, organization of the learning process, etc.

II. SOME POSSIBLE SOLUTIONS FOR ORGANIZING THE EDUCATION IN INFORMATION TECHNOLOGIES

The possible ways of organizing the study of information technologies in high school are two - either through integrating them into the school subject of Informatics or by separating them in another subject.

In the second case the study of Informatics should include some fundamental knowledge in information technologies as well, but at a more principal, conceptional level, while education in the other subject should focus on implementations and applications.

What is the present situation in the high school?

Informatics is studied as a school subject in the 11th grade of the high school twice a week. The syllabus envisages pupils to acquire knowledge on some fundamental notions of Informatics and some information activities and processes; on algorithms and their representation; on some essential constructions of a given high level programming language and to use them to write some elementary programs. Also, in addition, pupils are supposed to get some idea about the essence and the functions of the operating systems and the description of the functions and structures of the main types of software products such as textprocessing systems, spreadsheets, data bases, data base management systems (DBMS), etc.

Evidently, pupils could hardly acquire any stable practical skills for operating with software products with such a curriculum and for such a period of time and probably that should not be the main purpose of studying Informatics in the high school.

Starting from 1993/1994 the curriculum envisages studying information technologies as a school subject twice a week in the 9th and 10th grade of high school.

A special guide for studying information

technologies in high school was worked out in 1994/1995.

In conformity with this guide and with the general guide for the organization of work in high school in 1994/1995, each school could choose the concrete trends and technologies to be covered by the school subject of information technologies. Thus information technologies could be one of the probable choices and some syllabuses for them had been worked out.

Does such an approach to the organization of education give any advantages?

In my opinion, yes, because it is up to each school to judge and choose to study information technologies. But they should meet some requirements concerning the number and model of computers available, the qualification of staff, etc. At present asking all the schools to study information technologies as an obligation might fail because of their inadequate conditions in school computer studies.

III. GOALS, ORGANIZATION AND SYLLABUS OF THE EDUCATION IN INFORMATION TECHNOLOGIES

The main goals of education in information technologies are as follows:

1. To enable pupils to acquire knowledge and skills needed for using computer systems and ready-made software products in different fields of economical and social life.

2. To help pupils in the high schools for natural sciences and Mathematics to extend and deepen their knowledge by applying some special information technologies to studying other school and special subjects.

3. To stimulate pupils in the specialized classes in Mathematics in combination with those in Informatics to get knowledge in programming and to use modern programming media in creating applied software products.

A main organizational approach to fulfilling the above-mentioned aims is the creation and development of separate modular syllabuses in information technologies to be approved by the Ministry of Education and each school might combine them in one or two-year course in information technologies, according to its profile, or through including them in the extracurricular or optional subjects.

Education in information technologies should be based on the names of concrete information technologies and types of syllabuses, approved by the Ministry of Education. Education in other syllabuses or other information technologies may be accomplished only in extracurricular or optional classes but only if the school meets the relevant computer and staff requirements.

The principle of the obligatory minimum of required computers and teachers is observed when permitting education in a certain information technology and these requirements are described in the relevant syllabus so as to avoid education where no adequate base is available.

Education on each module terminates with pupils' course reports which aim at testing their knowledge and skills acquired on the respective software product.

Types of syllabuses had been worked out for the following modules in 1994/1995.

Names of the information technologies for which there are syllabuses	
1. Operating Systems with Text Interface	36 classes
2. Textprocessing	36 - " -
3. Spreadsheets	36 - " -
4. Databases	36 - " -
5. Computer Graphics	36 - " -
6. Information Technologies for Research in Mathematics (for mathematical investigations)	at least 36 - " - minimum

A module of 72 classes or a combination of two modules of 36 classes, chosen by the teacher form the syllabus for a school year.

It is planned to work out syllabuses on: programming techniques; numerical methods; operating systems with graph interface; network and multi-user operating systems; pre-printing systems; graph processing; multimedia; information technologies in education, etc.

The planned variety of concrete information technologies aims at enabling schools which have the equipment and teachers needed to make their choice according to the profile of the school and pupils' desires.

IV. SURVEY ON SOME OTHER EDUCATIONAL PROJECTS AND MODELS

I would like to review the work of the two centres for training teachers founded in conformity with two different agreements.

These centres are located in the Department of Information Technologies at the Faculty of Mathematics and Informatics at the University of Sofia.

In 1993 a Centre for Training Teachers to work on Macintosh was founded according to an agreement among the Ministry of Education, the Department of Mathematics and Informatics at the University of Sofia and the company "Bulgarian Business Systems" in connection with equipping some with Apple-Macintosh computers.

In the summer of 1995 an IBM Centre for Training Teachers was founded in cooperation with IBM Bulgaria and the Fund Open Society under the terms of the contract "Educational initiative of IBM in Bulgaria".

The goals, the work and the perspectives of the IBM Centre are treated in details in the report of Mrs. Iliana Nikolova. I would like to add that the Ministry

of Education considers that the activity of these two centres and especially the work on "Educational Initiative of IBM in Bulgaria" might be a good chance of experimenting with some models of organization and interaction in the field of School Informatics and the application of information technologies to studying other school subjects in some schools, namely: developing and experimenting some syllabuses and educational projects, creating a system for permanent training of teachers, on their working places as well - through modern systems of communications, connecting the schools they work in and the educational centres.

If, in this two-year period of work with the agreement with IBM, some useful school projects and models of organization occur, they could be submitted to the Ministry of Education for approval and further implementation in high school.

At present a project for implementing the well known system "GEOMLAND" in the High Schools for Mathematics and Informatics and in some other specialized classes has been worked out. In the beginning ten High Schools for Mathematics and Informatics and some specialized classes in different schools in the country would participate in the experiment.

In conclusion, I would like to point out that further study and use ofinformation technologies in the learning process would inevitably develop with the growth of their applications to different fields of economic and social life. This perspective and the equipment of schools with modern computers and tools would result in some more efficient changes of the organizing the process of education in the high school related to widening the scope of studying and using information technologies in the high school.

IV. STUDYING INFORMATICS IN THE MATHEMATICAL SCHOOLS IN BULGARIA

In 1970 several schools specializing in Mathematics - the so-called Mathematical schools- could be found in Bulgaria. Informatics was started, being taught together with an increased number of lessons in Mathematics. At that time courses of Numerical Methods and Programming were presented. At the end of the 1970s computer laboratories using computers type IBM-360 were present in some of these schools. In 1983 the pupils in the Mathematical schools were given the opportunity to specialise in Computer science as "Operator-programmers for computers".

It is known that teaching Informatics depends to a large part on the computer equipment. In this connection the present study focuses on teaching Informatics in the Mathematical school in Plovdiv which has traditions in this sphere. This school is known to be outstanding with:

- its own computer laboratory, the first of its type in Bulgaria established in 1975;
- its computer laboratory on the basic of APPLE-computers first found in the country in 1982;
- its teachers - authors of textbooks and curriculum in Informatics for the secondary schools, etc.

At the present time the Mathematical school in Plovdiv has 4 computer laboratories with 68 IBM PC computers, 1 laboratory with MACINTOSH computers, 1 laboratory with BBC computers and a lab in Robotics. Informatics is studied every year in this school - from the first-preparatory class to the end. In the first four years of education the pupils have two Informatics lessons a week.

The program includes:

- Introduction on Using a Computer;
- Introduction to Operating Systems;
- Introduction to Text Processing;
- Introduction to Working with a Spreadsheet;
- Introduction to Robotics;
- Introduction to Programming in BASIC and PASCAL.

In the final year of education the emphasis is on the professional training of the pupils as Operator-Programmers for computers. This training includes 470 teaching hours. The working plan for school terms and subjects is as follows:

Professional Training	I Term	II Term	Lessons
School Weeks	17	15	
1.Theoretical Training:			
1.1. Programming and Algorithmic Languages	5	3	130
1.2. Operating Systems	2	1	49
1.3. System and Applied Software	-	5	75
2. Practical Exercises:			
2.1. Programming and Algorithmic Languages.	2	2	64
2.2. Operating Systems.	2	1	49
2.3. System and Applied Software	-	3	45
3. School practice			60
Total:			472

Thematic Plan: "Programming and Algorithmic Languages":

Name of the Theme	Lessons: Total Number	
	New knowledge	Exercises
I. Introduction to Programming		
1. Historical data. Algorithms and programmes. Programming languages. Classification. Metalanguages. Solving problems with the help of a computer.	3	-
2. Basic objects in the programming languages-identificators, variables, expressions, arrays, functions.	3	1
3. Operators in the Programming Languages. Sub-programmes. Structure of the programmes.	4	1
II. Algorithmic Language Pascal		
1. Introduction to the Pascal language-historical data, alphabet, key words, integer and real numbers, strings. Structure of the programmes in Pascal, classification of the operators. "Turbo Pascal 7.0" system.	8	2
2. Data types in Pascal.	3	2
3. Constants, types and variables.	4	2
4. Standard functions.	5	3
5. Expressions.	5	5
6. Input and Output in Pascal.	5	5
7. Driving Operators-IF .. THEN .. ELSE, CASE, FOR, DO..WHILE etc.	15	8
8. Procedures and functions.	15	8
9. Records, Files, Sets.	15	10
10. Additional functions of the "Turbo-Pascal" System 7.0.	15	10
III. Programming Technology		
1. Programming style.	4	1
2. Program design.	10	2
3. Program verification.	8	2
4. Program documentation.	8	2

The basic textbook used is: *Informatics with Pascal*, Pavel Azalov, Fanny Zlatarova, Sofia, 1994.

Thematical plan "Operating System" (OS)

Name of the Theme	Lessons: Total Number	
	New knowledge	Exercises
I. Introduction to the OS		
1. Operating systems-role, importance, types.	2	-
2. Stages of development of the OS.	1	1
3. Basic functions of the OS.	4	2
II. Functions of the operating system MS DOS		
1. Starting MS DOS.	1	2
2. File system.	2	4
3. Command classification.	1	1
4. Command description:		
4.1. Commands for working with directories.	3	3
4.2. Commands for working with files.	3	5
4.3. Commands for working with disks.	3	4
4.4. Other commands.	3	3
5. BAT Files.	3	3
6. Service Programmes.	3	2
III. Other Operating Systems		
1. Operating System VMS.		
1.1. General information.	1	-
1.2. File system.	3	1

1.3. Terminals. Command characters.	-	2
1.4. Starting VMS.	1	2
1.5. A general format of the commands.	1	-
1.6. Basic commands.	5	2
1.7. Exit of the system.	-	1
1.8. File editing.	1	1
1.9. Basic work schemes.	1	1
2. Operating system Apple DOS		
2.1. Basic commands.	2	2
2.2. Sequential files.	2	2
2.3. Direct files.	3	3
2.4. Other functions.	2	2

The basic textbook used is *Operating Systems for 11th Class*, A. Hachikyan, A. Rachnev, K.. Garov, Sofia, 1990.

Thematic plan: "System and Applied Software"

Name of the Theme	Lessons: Total Number	
	New knowledge	Exercises
1. Mathematical and Logical bases of the computers-number systems, logical operations and functions, realisation and application of the logical functions, logical schemes.	8	4
2. Representation of the information in the computer memory and operations with it.	15	4
3. ASSEMBLER for IBM PC.	15	10
4. Applied Software.		
4.1. Working with Database. Working with "WORKS" package.	15	10
4.2. Text processing. Text processor WORD.	12	10
4.3. Spreadsheets. Working with the spreadsheet LOTUS.	10	7

At the end of the school year the pupils work out and defend their projects in Informatics.

The extracurricular work in Informatics is very-spread in the Mathematical Schools. Talented pupils are organised in study groups. A system for working with talented pupils in the Mathematical School in Plovdiv has been functioning for 20 years. Here is a thematic plan for working with talented pupils in Informatics.

Thematic plan for working with talented pupils in Informatics

Name of the Theme	Lessons: Total Number	
	New knowledge	Exercises
1. Numeric problems-arithmetic of the real numbers, computing of formulas. Fibonacci, Bernoulli and Stirling numbers.	8	8
2. Arrays, matrix algebra, sorting and searching, polynomials.	10	10
3. Geometry and Programming.	10	10
4. Data structures-stacks, decks, tables, hashing methods.	15	15
5. Elements from the theory of the Graphs.	20	20
6. Combinatorial algorithms.	15	15
7. Methods for constructing algorithms.	25	25
8. Algorithms and games.	15	15
9. Numerical methods.	25	25
10. The Theory of Coding. Fano, Shenon, Huffman codes.	15	15

Besides the participation in the Olympiads in Informatics every talented pupil works upon a particular problem in Informatics and prepares a report. Here we offer a list of such reports which gained prizes at national conferences and competitions.

"*MDL-System for Processing Mathematical Objects*"- a system for input, support and processing of the mathematical objects. The programmes are written in Turbo C and Scheme Lisp.

"*OOEP-Object-Oriented Extension of Pascal*"- that is a language extension of Pascal by means which show the main characteristic features of object-oriented languages. The programmes are written in Turbo C.

"*A Program System for Modelling 3-*

Dimensional Objects." - a graphic system for modelling 3-dimensional objects.

"*An Information System for Computer Service of Bridge-Tournaments*"-this system was used at the European youth championship in 1989 in Plovdiv.

"*Interpretator Lisp-8 for Computers APPLE-8*".

"*Program Model of the Post Machine and its Application in the Lessons in Informatics.*"

"*A Package of Programmes for Computer Teaching in Mathematics,Biology, Chemistry.*"

"*Program System for Working with Polynomials*"

The analysis of the results of our pupils shows that the Mathematical Schools train young people who can successfully use the modern Information Technologies.

V. THE STATE-OF-THE-ART IN INFORMATICS EDUCATION IN THE BULGARIAN SCHOOLS AS PROVIDED BY THE IEA COMPED SURVEY

INTRODUCTION

Teaching informatics at school has a long history and tradition in Bulgaria. The first steps were made in the late sixties when some optional informatics courses were taught for secondary school students in mathematics and in vocational schools. In 1979 the Research Group on Education (RGE) under the Bulgarian Academy of Sciences and the Ministry of Education started an experimental teaching of informatics in twenty seven schools both at elementary and secondary school level. Informatics has been taught as a compulsory school subject for all secondary schools in Bulgaria since 1986. The procedure for introducing computers into the secondary schools, the relevant stages, objectives and tasks, were part of a Program for the implementation of computer technology, was worked out and approved by the Higher Council for Education at the Ministry of Education in Bulgaria in 1985. Since then a large number of computers have been delivered to schools, a compulsory course on informatics has been introduced in all secondary schools, several informatics textbooks have been published, a great number of teachers have passed computer education courses, many scientists and university teachers have done valuable research in the field of computers in education. However no significant research on present situation in using computers in education has been undertaken in Bulgaria so far. The International Association for the Evaluation of Educational Achievements (IEA) Computer in Education (Comped) Study, Stage 2, gave us an opportunity to draw up a realistic picture about application of information technologies in Bulgarian schools and to compare it with the situation in the other participating countries.

1. SOME GENERAL FINDINGS OF COMPED STUDY

The study showed that the integration of computers in classroom practice is being impeded by obstacles of which the most important are [1]:

- lack of good educational software;
- restricted access to computers at schools;
- teachers do not receive enough support and do not have the necessary training for computers to play a meaningful role in the classroom.

The IEA has drawn a number of conclusions from the study:

a) Having a computer at school does not mean in itself that it will be used regularly in the classroom. The effective integration of computers into lessons demands more time and targeted activities, such as the provision of information on the added value of integrated use of computers, software development and training. It can already be concluded that progress will be slower than originally anticipated when computers were first introduced into schools.

b) It is essential that teachers receive full training and support and that more hardware and software is available.

c) For students who do not have a computer at home, the school is an important provider of equal opportunities to learn about information technology.

National educational systems will have to work hard to keep pace with the social changes caused by further digitalisation of information flows. There has been a striking increase in the availability of computers at school in recent years but the computer is still marginally used as a tool for teaching and learning.

Schools, parents, and policy makers should be aware of the differences in knowledge and attitudes between boys and girls towards using computers. Lack of familiarity and experience with computers could be socially disadvantageous for girls.

Any participating country could benefit a lot by analysing the data available according to its concrete needs so that to answer many questions related to computer education. Some findings based on the analysis of Comped data made by the International Co-ordinating Centre [3] and by the Bulgarian Comped research team follow.

2. ACCESS TO HARDWARE AND SOFTWARE

Lower Secondary Schools

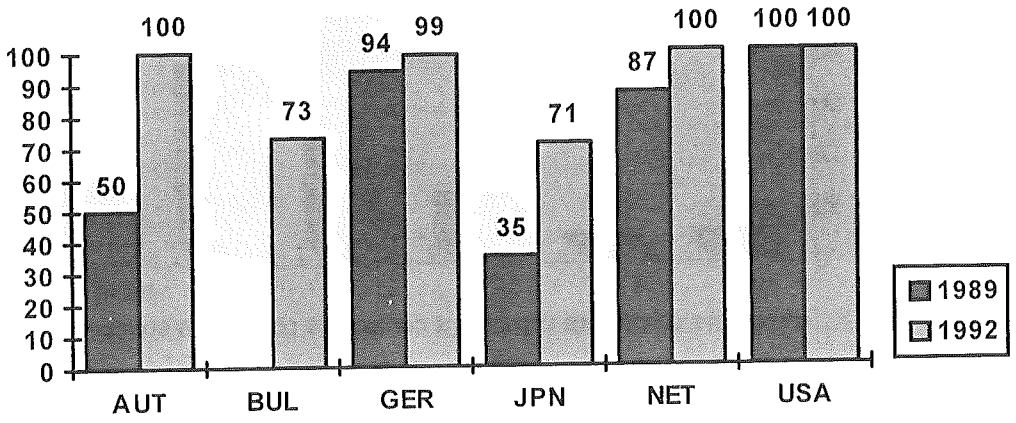


Figure 1

Upper Secondary Schools

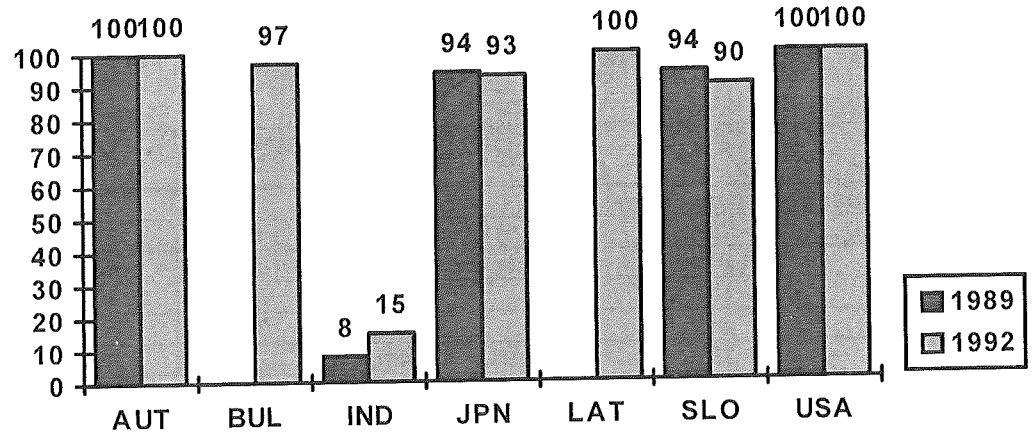


Figure 1 (cont.)

Lower Secondary Schools

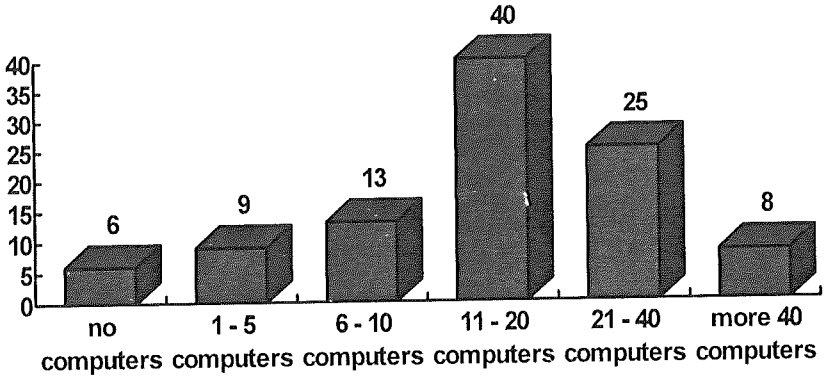


Figure 2.

Upper Secondary Schools

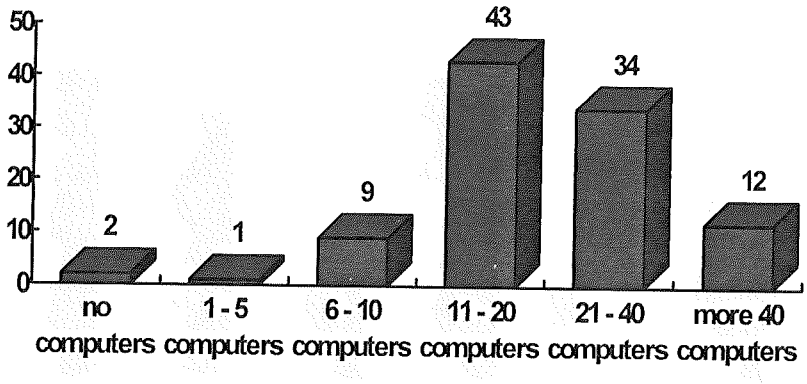


Figure 3.

As it could be seen from Fig. 1 the percentages of Bulgarian schools having computers in use for instructional purposes by the end of 1992 are: 73 % at LSS and 97% at USS. Only in Austria, the USA, and the Netherlands (at LSS) and in Austria, the USA and Latvia (at USS) all schools are supplied with computers. Fig.2 and Fig.3 show that most of the schools both in LSS and USS have more than 10 computers available and can rely on a well equiped computer laboratory. The median number of computers at computer using schools in Bulgaria is 17 in LSS and 18 in USS.

Table 1

Country	School + Outside	Only School	Only Outside	Not	At Home	Hours
Lower Secondary Schools						
AUT	62	28	6	4	43	5.2
BUL	15	24	14	47	5	4.9
GER	59	18	16	7	58	7.0
GRE*	55	41	1	4	31	5.5
JPN	13	19	24	44	21	1.9
NET	60	17	16	6	57	4.0
USA	74	21	2	3	51	2.1
Upper Secondary Schools						
AUT	62	26	7	7	53	4.7
BUL	18	61	2	20	6	5.6
IND	2	6	3	89	1	4.4
JPN	23	26	16	35	27	2.3
LAT	27	53	3	17	11	6.6
SLO	40	29	12	19	28	4.2
USA	77	19	1	3	51	2.2

Notes:*Students in computer using schools only.

All data mentioned above give the impression that the Bulgarian schools are very well supplied with computers. However in order to find out the real access of students to computers we could analyse Table 1 which shows that many of the Bulgarian students (e.g. 61% at USS and) rely only on using computers at school while a great number of the students do not have access to computers at all, e.g. 47% in LSS and 20% in USS. Another indication of the real access of students to computers is the availability of computers at home. Only 5% of the students in LSS and 6% in USS in Bulgaria report that they use computers at home. According to this indicator Bulgaria is far behind the well developed countries. It is behind the other Central and Eastern European countries participating COMPED - about 28% of the students in Slovenia and 11% of students in Latvia in USS report of using computers in school. The reported high number of computers in LSS are mainly due the fact that a lot of the Bulgarian schools are so called Unified Secondary Schools and they comprise students from 1st to 12th grade,

i.e. these schools cover both LSS and USS level and the students there share the same equipment. Great problem for our schools is the quality of the school computers. As it can be seen from Fig. 4 and Fig. 5 about 30% of LSS and 39% of USS report that they have more than 6 computers out of order. The percentages of computers with 16 bit processors offers a good indication for the extent to which the schools keep the quality of their equipment close to the recent technological developments. According to this indicator (see Fig.6) Bulgaria is at the last place among all participating countries - the mean percent of 16 bit computers is only 3% for LSS and 4% for USS. The quality and variety of computer peripherals are also quite low in the Bulgarian schools. Very few schools have local area networks and the access to Internet or Bitnet is still (almost) impossible. The majority of the computer teachers report that they face problems like: "insufficient peripherals available" (58% in LSS and 62% in USS), "difficulty with maintenance" (66% in LSS and 74% in USS), "limitations of computers" (64% in LSS and 70% in USS), etc.

Lower Secondary Schools

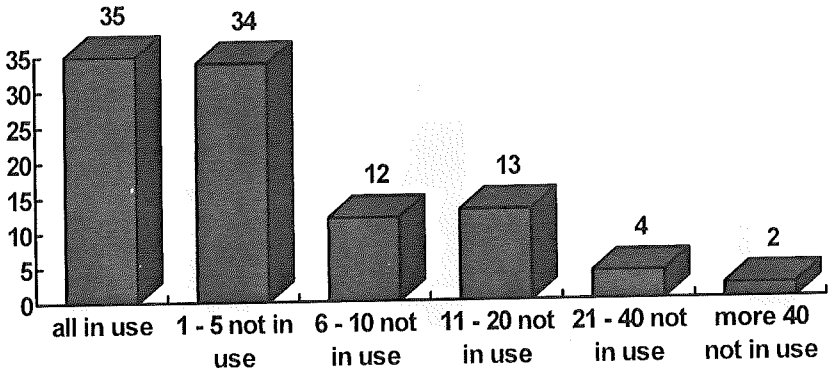


Figure 4.

Upper Secondary Schools

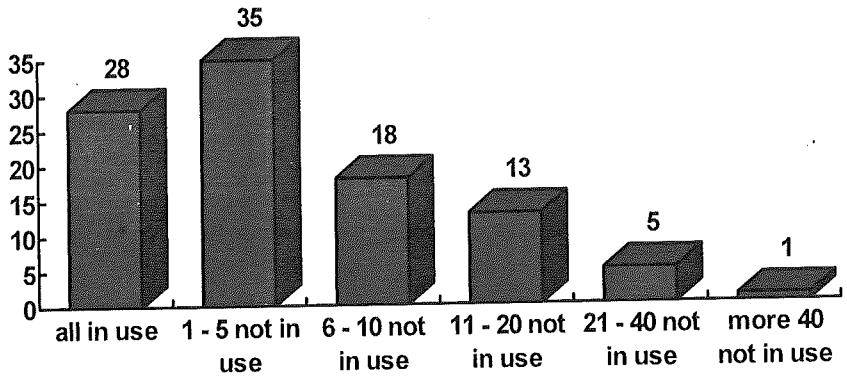
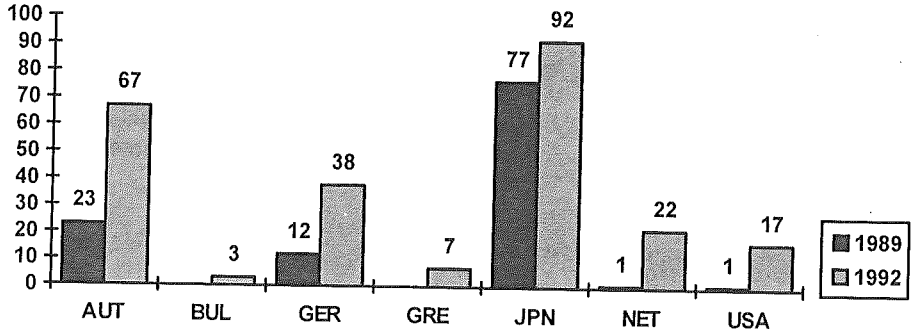


Figure 5.

Lower Secondary Schools



Upper Secondary Schools

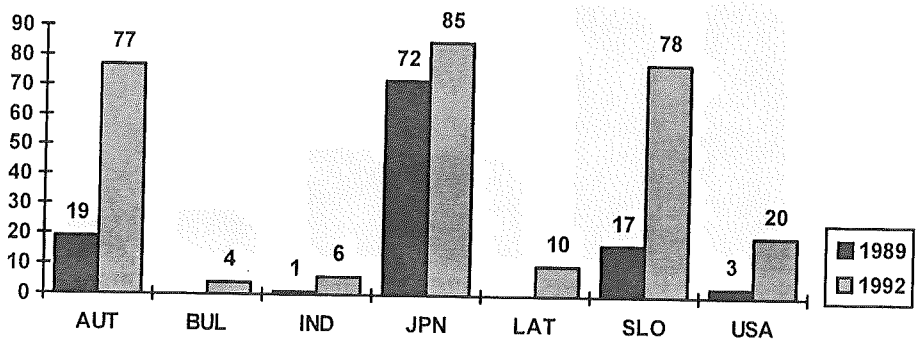


Figure 6.

Although the availability of educational software is reported to be relatively high in Bulgaria compared to other participating countries, 64% of the computer co-ordinators in LSS and 67% - in USS find that "insufficient instructional software" is among the major problems. According to our personal impression and the interviews with school teachers the amount of legal software used at schools is not much and after the Low for Copyright and Author's Rights has been approved by the Parliament the situation is expected to be dramatically changed to worse. The quality of the educational software available or which is possible to be run on the school computers is also very poor and this software is usually written by teachers or by students.

Some conclusions for introducing computers in education in Bulgaria can be drawn:

- there are not enough funds for computer education;
- there are not enough peripheral devices;
- there are many difficulties in hardware support;
- computers are not powerful enough (mainly 8-bit)
- the teachers do not have enough time for computer lesson preparation;
- the teachers face great difficulties in integrating information technologies into other school subjects;
- there is not enough educational software.

A new national computer in education programme should be launched in order to help schools keep the quality of their equipment, software and education close to the recent developments in that field..

3. HOW ARE COMPUTERS USED AT SCHOOL

The information concerning application of computers at school should be interpreted in the context of why schools started to use computers [3]. The reason most frequently mentioned by school principals was: *To give students experience with computers that they will need in the future.* Another reason: *To keep curriculum and methods up-to-date.* was ranked at the second place. Many school principals in Bulgaria (78% in LSS and 84% in USS) consider computers as tools for improving quality and effectiveness of education. This purpose implies a very deep integration of computers in all school subjects and activities. However Table 2 (p.33) shows that computers are used mostly for computer education (*learning about computers*) and a real integration in the other school subjects (*learning with computers*) is still expected in the future. We can also infer that the level of integration of computers little depends on the number and quality of hardware and software available - the students in both well developed and developing countries report that they rarely use computers in mathematics, science, mother tongue, and social studies.

Table 2.

	Lower Secondary Schools							Upper Secondary Schools						
	AU	BUL	GE	GR	JPN	NET	USA	AU	BUL	IND	JPN	LAT	SLO	USA
A.	90	52	78	96	49	78	95	87	81	40	52	80	73	96
B.	71	52	81	71	10	86	67	84	84	51	73	86	90	83
C.	7	13	15	9	2	7	7	2	5	20	2	4	3	6
D.	2	5	M	8	2	M	2	1	4	13	5	2	3	4
E.	5	6	9	8	1	7	9	0	4	8	1	2	0	9
F.	1	M	M	7	1	12	3	0	3	8	1	0	0	2

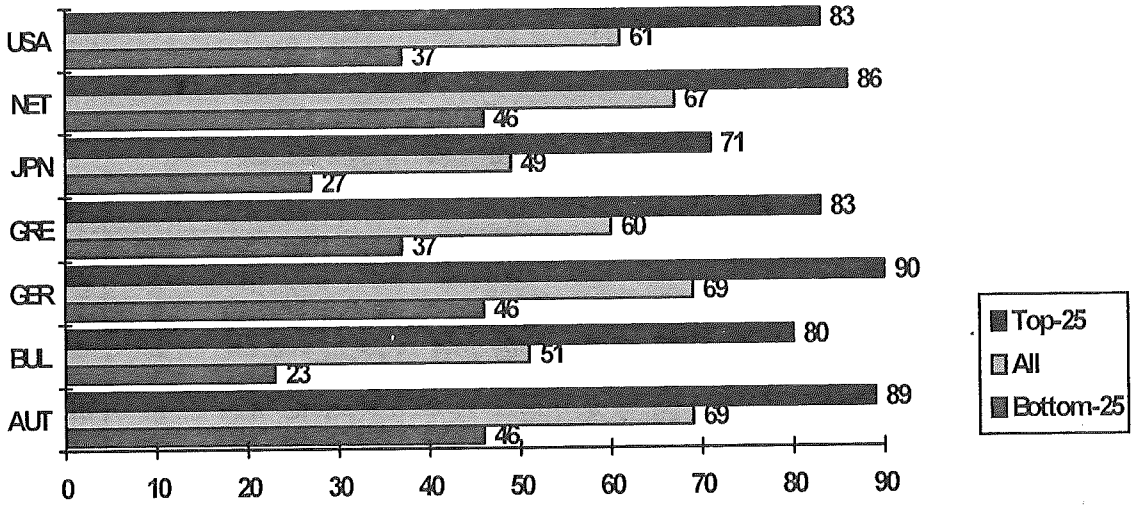
Notes: M = number of valid cases too small (< 250)
or too many missing cases (> 20 %)
The original wording of the computer use/subjects is:
A. Computer used;
B. Computer Education;
C. Mathematics;
D.Science;
E. Mother tongue;
F. Social studies.

In order to clarify the extent of application of different types of educational software the computer teachers were asked to indicate how often they use any of them. It can be seen from Table vvv and Table Www that the *favourite* type of software is tutorial or drill and practice. Application software packages like word-processors, data bases, spreadsheets, simulation, etc. are used rarely by the Bulgarian teachers. For instance about 90% of teachers at both LSS and USS never used spreadsheets, about 90% at USS and 80% at USS never used simulation software, more than 70% at LSS and 50% at USS never used word-processors, about 90% at LSS and 75% at USS never used data bases. Educational software packages for statistics, authoring, item banks, communication, multimedia, etc. are almost unknown at schools. Most of the computer teachers use BASIC as a programming language and about 40% of the teachers at USS report that they use it every period.

The statistics provided above shows a non optimistic picture for computer application in the Bulgarian schools. There is an urgent need of a new national programme for integrating new information technologies in school.

4. STUDENTS' KNOWLEDGE ABOUT COMPUTERS

Lower Secondary Schools



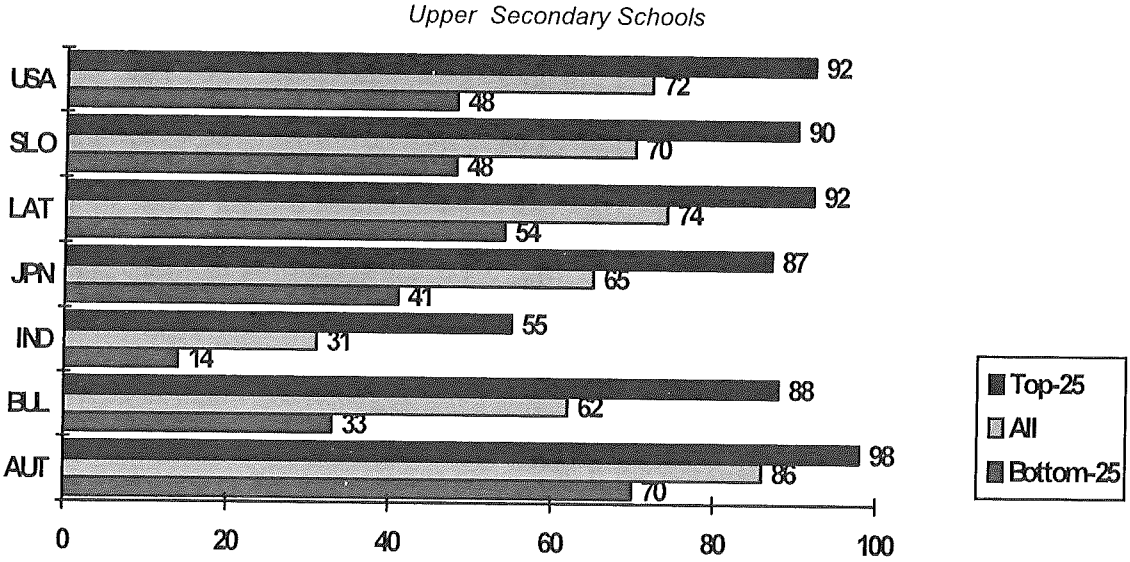


Figure 7.

The level of students knowledge and skills was measured by so called Functional Information Technology Test (FITT). The 30 item test was the same for LSS and USS. The average score of the total sample in the target grade level and for the 25% highest and lowest scoring students as well as the accuracy for estimating the score for the total target population in a country (95 % confidence) are displayed in Fig. 7. As it could be seen from the data the scores of the Bulgarian students both at LSS and USS are holding a lower than the average position. The Austrian students showed highest scores both for LSS and USS. However the test scores do not show only the effect of learning and using computers at school but rather the total experience and knowledge gained within and outside school. The relatively low achievements of the Bulgarian students are due the lack of enough additional sources of information about computers and the low percentages of the FITT topics having been studied in advance at school - 22% in LSS and 47% in USS. The highest correspondence between FITT topics and the content the students have learnt at school is in Austrian schools - 85% in LSS and 94% in USS. For Slovenia and Latvia this correspondence is respectively 87% and 82% (in USS).

The main implication from the FITT for Bulgaria is that the low scores do not mean a lack of learning abilities for Bulgarian students. For instance they are quite successful in the international programming Olympiads. Computer education in Bulgaria should be drawn towards the European standards. In addition better supply of computers, software and other teaching materials should be ensured for the Bulgarian schools as the students can not rely on access to computers outside school.

5. STAFF DEVELOPMENT

Table 3.

	Lower Secondary Schools							Upper Secondary Schools						
	AU	BUL	GE	GR	JPN	NET	USA	AU	BUL	IND	JPN	LAT	SLO	USA
A.	22	59	81	57	9	23	21	42	60	29	15	57	32	19
B.	57	39	31	29	54	16	43	63	36	29	49	24	90	52
C.	25	3	19	4	19	11	29	21	8	3	10	22	33	26
D.	0	1	1	0	0	0	3	0	2	0	3	0	0	5
E.	42	66	13	17	7	47	29	27	74	27	7	49	20	29
F.	6	19	9	19	31	15	11	11	22	7	37	46	20	12
G.	2	1	7	9	21	20	26	2	2	2	14	0	6	40
H.	95	13	23	7	62	80	43	93	21	32	68	M	22	40

Notes: M = information not available or too many missing cases (>20%).
The explanation of the agencies is:
A. Ministry of Education;
B. Local Educational Authority;
C. Teachers of other schools;
D. Parents;

E. Universities/(teacher training) colleges;
F. Teachers associations/ other associations;
G. Business and industry;
H. Support institutions/resource centers.

Teacher training is a key problem for a successful application of computers in education. As it can be seen from Table 3 the highest support for teacher training in Bulgaria comes from universities and other teacher training institutions. For instance the teacher development programme at Sofia University has been providing courses covering the most important aspects of application of computers in education since 1984 [2].During the courses the teachers have access to powerful computers and software and gain self-confidence in experiencing new styles of teaching. Unfortunately their enthusiasm does not last very long. The informal interviews and meetings with some teachers showed that once they returned to their schools and face all the problems - technical, organisational, curriculum, human, etc. - they could not overcome the burden and only a few of them applied what they had learned. During the last few years (mainly due financial reasons) teacher training and retraining courses have been rarely organised. According to the COMPED data the Bulgarian teacher feel lack of enough knowledge about computers and their application - 58% in LSS and 66% in USS report about such problem. They also can not find adequate support and guidelines for instructional use of computers - 59% in LSS and 57% in USS. More than 40% of teachers both in LSS and USS report for lack of enough training opportunities and enough time for computer lesson preparation.

6. CONCLUSIONS

On the basis of the above said the following suggestions for improvement of computer education in Bulgaria could be maid:

- a careful analysis of Bulgarian COMPED data should be made in order to better determine the current problems and needs in the field of computer education;
- a new national strategy for integration of communication and information technologies in education should be developed by taking into the consideration the new economic and social circumstances;
- relevant educational standards in communication and information technologies both for students and teachers should be adopted;
- a new national teacher training programme should be launched for providing continuing teacher education. Some advanced training methods such as flexible and distance learning by means of new information technology should be applied as well.
- following the tendency of decentralisation a network of teacher training and resource centres where teachers can refresh their knowledge, share ideas and experience, keep in touch with new trends in the field, receive educational software and literature, rely on competent help, should be established.
- the co-operation of Bulgaria with other leading in this field countries should be extended and strengthened. For example - the International Programme "Children in the Information Age" should be re-established.

VI. TEACHER DEVELOPMENT SUPPORT IN USING INFORMATION TECHNOLOGIES IN SCHOOLS

1. TEACHER DEVELOPMENT AND INFORMATION TECHNOLOGY (IT)

It is recognised that the teacher's role is essential in the adoption of any change in education. Teachers are the key factor for the successful integration of IT in schools too. Therefore the qualification of teachers to use IT competently in their professional practice is considered here an important task. After an initial training to provide a background in IT and make them aware of the potential of IT in education, teachers need further development and continuing support in the integration of IT into teaching and the learning process.

1.1 Some Observations.

According to recent studies related to teacher education and IT and proved by our own experience, the following are important factors influencing the process of teacher development:

Teacher's motivation: Convincing examples of applying IT in education have to be presented to the teachers. The teacher's efforts to enter a new field and adopt her/his teaching style to a new technological environment have to be encouraged and stimulated. Nationally approved standards for teacher development in IT have to exist [2].

Content of training: Building a basis in IT is necessary [4]. It will help teachers gain competence and feel confident. A balance between theory and practice in their further training - activity-based training taking into account classroom reality - is needed. Teachers have to be able to decide on the content of training and choose their own paths in a flexible training program [3].

Methodology and technology of teacher education: A demonstration of the usefulness of IT is necessary. The technology has to be extensively used in the training process by the trainers themselves. Discussions, reflections and support in

generating ideas of what can be done with technology in the teaching and learning process should also be included in the training. Teachers need to develop transferable skills.

Organisation of the training: Flexibility is essential: full and part-time courses, school-based training, "cascade" training [1]. Distance delivery of those could also be a useful option.

Dedicated course managers and tutors: Constant efforts are needed in the process of training and co-ordination of on-going activities.

Continuing support: Teachers need to be supported in their work after the training course. Information resources and consultants have to be accessible. The availability of teacher-supporting materials is important.

1.2 Where are we now?

There are traditions in Bulgaria in teacher-training concerning IT. Mainly higher education institutions offer teacher training programs. Most of them require a mathematics background. The experience gained so far shows some of the problems which have to be taken into consideration:

Content: The training is more theoretically oriented and often not related to classroom reality. Training programs are fixed and do not allow flexibility. Teachers can not decide on the training content.

Technology: Equipment in the training labs usually differs substantially from that in schools.

Course materials: Specially developed course materials for teachers are usually not provided.

Further support: Teachers come and go - the training units are not responsible for further support of teachers after the training period.

One step towards a better match of teachers' needs could be the establishment of Resource and Training Centres, where teachers can periodically update their qualification in a more flexible way, find up-to-date information and get continuing support in the process of their work.

2. SUPPORT OF TEACHER DEVELOPMENT IN THE FRAMEWORK OF THE PROJECT "EDUCATIONAL INITIATIVE OF IBM FOR BULGARIA"

2.1 Description of the Project.

The project "Educational Initiative of IBM for Bulgaria" was initiated in 1994 by IBM-Bulgaria, the Open Society Fund-Sofia and The Bulgarian Ministry of Education and was planned for a period of 2 years. The scope of the project is supporting the integration of computers and information technologies in Bulgarian schools. 28 secondary schools participate: 1 pilot school in Sofia and 27 country schools. These schools have been chosen on a competitive base. Each of them has been equipped within the project with a computer lab: Server (PS/1 486 DX2/66) + 7 Workstations (PS/1 486 SX/25). The software initially installed is: DOS 6.2, MS Windows 3.1, MS Works 3.0, NetWare LITE, LINKWAY.

A Teacher Training Centre with exactly the same equipment has been established at the Faculty of Mathematics and Informatics, University of Sofia, with the task to provide training and support for teachers from the participating schools.

The project activities are co-ordinated by an executive body in which each of the initiators is represented. IBM provides the initial hardware and software equipment. The Open Society Fund supports financially the starting-up activities: a 3-week initial training course for one teacher per participating school; upgrade of the existing hardware at the Teacher Training Centre with additional RAM, printers and screen projection system; the establishment of a library with relevant books, periodicals and software. The Ministry of Education is responsible for the overall organisation of the project activities relating to schools.

2.2 Teacher Development Scheme.

The Teacher Training Centre is hosted by the Faculty of Mathematics and Informatics at the University of Sofia. The main purpose of the Centre is to provide courses, information services and continuing support for teachers. The courses are carried out by the Educational Computer Systems Laboratory (ECSL) which has experience in pre- and in-service training of mathematics and informatics teachers. A project co-ordinator (a member of ECSL staff) is responsible for the overall activities of the Centre.

The teacher training during the first year of the project is planned in two phases: initial and specialised.

2.2.1 Initial Phase

The initial phase consists of a 3-week full-time course, offering a basic acquaintance with the hardware and software installed in each school lab. Such a course will be offered to all school project co-ordinators (one teacher from each school participating in the project). Until now one initial course has been carried out. Here are some details about the course:

Participants' profile: 12 teachers (school project co-ordinators) with a background in Mathematics or Engineering and with varying previous experience in teaching Informatics at Secondary School level.

Duration:3 weeks;

Daily schedule: 6 hours (tutorials and guided practice) + 3 additional hours free practice (with a consultant available)

Programme:

DOS 6.2 - an overview.
Working in WINDOWS 3.1 environment
Working in a Network: NOVEL LITE NetWare
MICROSOFT WORKS 3.0 in Education:
Text processing
Spreadsheets
Database
Integration
Classroom Applications
Computers in Education: Approaches and Methods, Versions of the Curricula adopted by the Ministry of Education
Presentation of Link Way
Closing seminar and discussion

This content of the initial course was chosen by the executive body to ensure that school project co-ordinators would feel comfortable with the available hardware and software and can immediately start working with it as well as helping their colleagues to start. The integrated package

"Microsoft Works" was presented in a project-oriented way and during the course every teacher developed a small project related to some school activity.

2.2.2. Specialised Phase.

This phase will provide more individualised training for school co-ordinators according to their competence, interests and the particularities of their schools. Every teacher will be offered 3 one-week courses until the end of the school year 94/95. To match better teachers' needs and to define the appropriate paths for their further training, a special questionnaire, "Support and Further Training Need Identification Questionnaire", was developed and filled in by the teachers during the initial phase. Here follow some details:

The participants were invited to choose topics for further training among different groups of modules (open questions for suggesting additional modules were also included).

- Suggested Topics for Further Training:
- Learning Environments ("Mathematics", "Geomland")
- Subject-oriented Software (Physics, Chemistry, Biology, Languages)
- Programming Languages (Logo for Windows, Turbo Pascal, Visual Basic, Prolog)
- Theoretical Aspects of Informatics (Program Verification, Program Synthesis)
- Applications (Textprocessing, Graphics, Databases, Spreadsheets, Statistics)
- Desktop Publishing
- Hypertext and Multimedia
- Communications (e-mail based school projects, BBS, global networking)
- Other .

These "self-definitions" of further training needs are useful, but teachers will not be left to determine completely by themselves what they need. It is the training team who will make the final decision about the emphasis in the content of the training and about the style of using IT in education which will be promoted by the Centre. In this sense, creating a feeling and appreciation of using open learning environments will be stimulated. As far as application software is concerned, a project-oriented style will be followed. Teachers will be stimulated to search for cross-curricular projects.

2.2.3. Course materials

The training team has the ambition to provide the teachers with relevant materials in Bulgarian. A set of handout materials was developed by the trainers for each module of the initial course. Each set consists of a reference part (structured information about the module itself) and a methodical part (teaching notes and hints for possible classroom applications). These materials were given to the participants at the beginning of each module. Thus each participant had a handy copy of necessary and useful information to use during the course and take home at the end. This turned out to be essential also for overcoming the language barrier - all the accompanying documentation which schools get, together with the equipment, is in English.

2.2.4. Evaluation.

At the end of the initial course the participants were invited to fill in (anonymously) a *Course Evaluation Sheet*. They were invited to share their impressions, opinion and recommendations as relating to:

Course structure and organisation;

Each module in the programme, according to:

- content,
- teaching performance,
- adequacy, sufficiency and quality of the handout materials prepared by the instructor,

Other comments

This provided a useful feedback and will be taken into account for the next courses.

2.3. Further support..

2.3.1. Studying the needs.

During the initial course the level of competence and needs of the participants was studied on the basis of specially developed questionnaires. The information collected gave the Teacher Centre coordinator an impression of the individual teacher's needs and helped him form a better view of the appropriate future activities of the Centre. Here are some details about the questionnaires:

The *Participant's Profile Questionnaire* is aimed at compiling a project on the participants' database and comprises the following items:

- full address for correspondence;
- current position;
- professional background and qualification;
- track of in-service training;
- experience in teaching and using IT at school;
- areas of competence;
- areas of interest;
- English language skills.

The teachers were also asked about the RESOURCES AND FURTHER SUPPORT by the Centre they would welcome:

- Literature (topics, acceptable languages).
- Software
- Specially developed materials for teachers (to be specified)
- Specially developed materials for students (short references, worksheets, etc.)
- Expectations and suggestions relating to the Teacher Centre's future activities.
- Suggestions on the form of contacts and co-operation with the Centre.
- Other.

2.3.2. Providing Information and Communication Resources.

A small library collection was gathered and made available to the teachers. It contains recent books on Computing and Education, textbooks in Informatics, Reference Guides and Handbooks, periodicals. The next step is to establish a software library.

A telephone "hot-line" is open for the teachers to contact the Centre when problems arise in their own school settings.

Providing Internet connection for the Centre and establishing e-mail links among the participating schools is also a priority task for the near future. A Bulletin Board System could also be a solution for providing information and communication.

3. A CONCEPT FOR FUTURE TEACHER DEVELOPMENT SUPPORT

On the basis of the experience gained so far and the analysis of the filled in questionnaires, conclusions were made and a concept for further teacher development support was developed. It was recognised that Resource and Training Centres (RTC) for teachers using IT is a necessity and it should act as a focal point offering up-to-date information, courses, seminars, discussions, software demonstrations and continuing support for teachers. These should include:

3.1. Information services.

The RTC team has to permanently search for up-to-date information about research and developments in the field of IT in Education. Having an Internet connection and access to relevant publications, international conferences and expert groups meetings is essential. Special arrangements with hardware, software and publishing companies for a regular supply of relevant materials would be helpful.

Inexpensive and reliable communication links between the teachers and the RTC are required: telephone "hot-line", fax, e-mail connection, an RTC newsletter, bulletin board system.

RTC should provide library facilities for teachers. These should not only have books and periodicals, but also copies of diploma theses on relevant topics. A software library must also be maintained.

3.2. Training.

A research approach - integrating research and practice - has to be adopted in RTC [6]. A team of specialists and trainers has to be formed at RTC to discuss and decide on the content of training. A modular training scheme has to be developed [3]. Careful planning for a continuing training is necessary, taking into account the existing pre-service training programs and aimed at establishing a smooth relation between pre- and in-service training. Links and collaboration between MA students in Mathematics and Informatics and in-service teachers can be beneficial.

A *teacher-centred model* [5] has to be adopted - the training scheme must be individualised as much as possible and the support offered must take into account the concrete situation - tasks and school environment - in which the teacher works. Flexible forms of delivery of the courses have to be found - full and part-time courses, optional short modules, school-based training, distance delivery.

3.3. Continuing support.

Keeping teachers informed about new developments in the field has to be an important task of the RTC. This should include discussions between experts and practitioners to find out the most appropriate way of IT application in education as a whole and in a particular setting.

"Listening to the teachers" - the RTC must provide a forum for teachers to express their needs and findings; to exchange ideas, experience and examples of good practice between themselves. This could be done personally (seminars, discussions) or in an electronic form (e-mail, BBS), or through a newsletter.

Building a national human network of specialists and practitioners ready to devote some of their time to help solving teachers' problems would be helpful and useful. Communication in this network should be supported electronically as well.

RTC has to help teachers in the establishment of international contacts for a collaborative work in international educational projects.

Creating a stimulus for teachers and contributing to a higher social esteem (formal and informal) of teachers working with technology should also be a RTC task. Encouraging and supporting future teachers to participate in the development of teacher and/or student-oriented materials and in the development of courseware and educational software could be motivating.

If RTC proves to be successful, local branches in different geographical regions can be established. These could be build around active and future teachers.

VII. THE CONTRIBUTION OF PROSVETA PUBLISHING HOUSE TO THE TEACHING OF INFORMATICS IN THE SECONDARY SCHOOLS IN BULGARIA

There is a long-standing tradition in every Bulgarian family to respect the scholar. Most parents strive to provide as good education for their children as possible. This ambition of the Bulgarian to study was one of the reasons - even 170 years ago when the nation was still under the Ottoman yoke - for publishing a *Primer with different instructions.*

For 50 years every Bulgarian has begun to learn the alphabet from the primers published by *Prosveta* Publishing House. *Prosveta* has published and is still publishing textbooks, supplementary school and methodological books. The publishers strive to publish books with the latest scientific information.

The development of informatics has not missed the attention either of Bulgarian scientists nor of *Prosveta*. The books published on informatics confirm this statement.

We shall trace the publishing of textbooks and books separately in this paper beginning with *Cybernetics and thought* by Konstantin Kostov, which was published in 1969 (1). It is a matter for debate whether to include this book in informatics literature but we have decided to do so since in it, for the first time, thought is discussed as an object of management. Seven years after the subject

Programming was included in the curricula for the mathematical classes in some schools and mathematical schools in 1974 *Algorithms and Their Preparation for Machine Realisation* (2) by Miroslav Ivanchev was published. The book was addressed mainly to teachers of informatics, because until that time a textbook had not been published. The book included short preface on the theory of algorithms and an elementary idea of machine languages and description of FORTRAN IV was presented. The examples of algorithms were related to the already studied material in algebra, geometry and numerical methods.

In 1978 four books were published on informatics. These were among the first books addressed specifically to students in Bulgaria. The first of them was *Elementary Knowledge of Cybernetics* (3) by T. Boyanov. It was addressed to a wider circle of readers - these eager to learn could become acquainted with terms like information, its measurement, information structures, algorithms and management.

The second book was *Algorithms* (4), written by P. Barnev and P. Azalov. General information about algorithms and their presentation through block diagrams was given in the book, and a number of concrete algorithms connected with funny questions and serious problems.

The principal construction of computers was presented in the third book published in 1978 called *Mathematical Bases of Computers* (5) by Hristo Hitov. This book was addressed to students and treated historical information, elements from the Boolean algebra, and the presentation of data in computers.

The last book, published in 1978 *Information and Management* (6) written by P. Barnev, was addressed to teachers. The meaningful terms information and management are explained in it.

The coming of information systems as helpers in all spheres of life was the reason in 1981 why A. Radensky's *Information Systems* (7) was published. It explained the essence of information systems using examples, and then discusses database management systems through which they are realised.

The book *Algorithms and Algorithmic Computing* (8) by D. Skordev as one of the series for students *Alef* was published in 1981. Some basic ideas from a relatively new field of mathematics - the theory of algorithms are discussed in the book. It tries to express in a simple way these ideas to students.

For teachers, who know the classic parts of elementary mathematics and wish to know the fundamentals of programming in 1983, a second book by A. Radensky *Mathematics and Programming* (9) was published. It shows the connection between some traditional methods for solving classical mathematical problems and methods for solving problems using computers.

For students with a great interest in maths and informatics a new series of books introduced was *Mathematics and Informatics - Extracurricular Work*. Within a period of six years, six books on informatics were published in this series. The first book, published in 1985, was *FORTRAN in Examples and Problems* (10) by P. Azalov. By giving a number of examples the language FORTRAN is explained. Problems given at students' competitions were also included in the book. In 1985 the next book from the same series was published, namely *Coding of Information* (11) by St. Dodunekov and I. Denev. Its aim was to provide opportunities for the serious students to get acquainted with elements from the theory of coding. In 1986 the first *Pravets* computers (Apple-2 compatible) were produced in Bulgaria but there was no available book for these wanting to work with them. So the book *Computer for Beginners* (12) by Morgan was translated into Bulgarian. It offers a system for learning on *Apple*, and its introduction, written by T. Boyanov, differentiates between *Pravets* and *Apple*.

From 1986/1987 informatics began to be studied in all schools. Students have already studied programming at school. At that time the book *Datastructures* (14) by P. Azalov and F. Zlatarova was published. With the knowledge from that book, students and specialists could make a qualitatively new step towards improving programming and also improve their style of making programs. With the expansion of the production of computers *Pravets* children also had more free access to computers and, as usually happens, children were the first to overcome the barrier of working with them. However, there was no book available for children. Thus we published the book *I Can Program at the Age of 9* (17) by P. Stanchev, which discussed an elementary course in programming on Basic for small children.

There were schools in which children started using computers at an early age on the Logo language. The authors R. Nikolov and E. Sendova have had great experience in their work with children and they offered the book *Informatics for Beginners* in 2 parts (23), (24). The ideology of the Logo language was explained in them and ready computer programs were used in the working up of the themes.

In 1990 *Basic in Examples and Problems* (28) by Rahnev, Garov, Gavrilov was published. The very title of the book reflects precisely its contents. Using it the reader learns some methods of programming. It includes also problems given at students' competitions.

So far we have presented in succession published by Prosveta dealing with questions from informatics books which filled the vacuum existing because of the lack of textbooks. But they also served as the basis for the writing of textbooks.

Now we shall consider the textbooks publishing for the 2 stages of the secondary comprehensive schools.

In 1967 the subject "programming" was included with a resolution from the Ministry of Education in the curriculum of some mathematical classes and mathematical schools, as we already mentioned. Until that date no textbooks had been published for these students. That was not an omission on the part of the publishers as textbooks are published only if ordered by the Ministry of Education.

The curriculum for 1986/1987 provided for the second school term informatics to be studied as a separate subject. So the Ministry of Education assigned *Prosveta Publishing House* to publish two textbooks on informatics for the students in 10th and

11th grades (15), (16) and (18), (19). These two textbooks written by different teams of authors - Barnev, Azalov, Dobrev, Bisterov and Angelov, Gavrilov, Garov - with different syllabuses aimed at teachers in informatics to enable them to choose the appropriate textbook for their students. The textbook by Barnev, etc. explain basic questions from informatics illustrated by the language of Basic while in the other textbook by Angelov, etc. programming on Basic prevail. Students who studied using that syllabus could choose the second stage of education which had a different duration. For the students studying in educative industrial schools where informatics was taught, three textbooks were published by Prosveta:

In 1986 *Informatics for 11th Grade (II stage)* (13) by M. Barneva and S. Stoykov; *Operating Systems* (27) by A. Hachikyan, A. Rahnev and K. Garov; *Programming and Algorithmic Languages* (29) by P. Azalov (1990).

Education in 8th Grade began with new syllabuses in 1988. These textbooks treated elements solely from informatics. For this batch of graduates textbooks were published in mathematics written by two teams of authors. The first one, led by Sendov, wrote *Mathematics and Informatics* in 4 parts (20), the second wrote separate textbooks in algebra, geometry and optional maths. The two teams used different approaches to the writing of their textbooks. The textbooks written by Sendov, etc., republished in 1992, contained "information corners" which presented programs with the language Logo and that approach continued in the textbooks for 9th, 10th and 11th grades. The textbooks for 8th grade in algebra by other team of authors has elements from the language of Basic.

In 1989 textbooks by two teams were published for 9th grade students. One by Barnev, Azalov, Dobrev and Bisterov, *Informatics for 9th Grade* (21), treated programming by INFO (hypothetical language), and for each example in the lab, practice was given with a version in Basic.

The textbook was republished in 1992 with the title of *Informatics I* (30). The basic examples for programming also contained the programs in Basic and Pascal.

The other team, led by Sendov, wrote a textbook in informatics under the title of *Mathematics and Informatics*, part I. The language of Logo was used. The second edition of this textbook is *Informatics I - a Reference Book* (31).

Two textbooks in informatics for 10th grade students were published in 1990. They were also written for different syllabuses. *Informatics for 10th grade - a Reference Book* (25) by Barnev and Azalov does not use any concrete language for programming while the other textbook written by Sendov, etc. again uses the language of Logo (26).

The second unrevised edition was published under the title *Informatics II - a Reference Book* (32).

The authors Barnev and Azalov of *Informatics II* had new ideas for this textbook and the Ministry of Education ordered it to be rewritten as the main textbook with five appendixes separately. Thus the new textbook *Informatics II* (33) by Barnev and Azalov was published in 1993. The five appendixes *Word-processing* (34) by Azalov and Zlatarova, *Database* (35) by Azalov and Kouneva, *Spreadsheets* (37) by Azalov and Hikov, *Bureautics* (38) by Barnev, *Computer Graphics* (37) by Barnev, Banchev were published in 1994.

The last textbook written by Azalov and Zlatarova is *Informatics with Pascal - a Reference Book* (39). The Ministry of Education announced a competition for its publications. From the three applicants *Prosveta* Publishing House won the competition and the textbook was published. We have given a complete survey of the published by Prosveta books and textbooks in informatics until today. We firmly believe in our contribution to the teaching of informatics.

APPENDIX A

List of books and textbooks in informatics published by Prosveta

No.	TITLE	AUTHOR/S/	YEAR OF PUBL.
1.	*Cybernetics and Thought*	Konstantin Kostov	1969
2.	*Algorithms and their Preparation for Machine Realisation*	Miroslav Ivanchev	1974
3.	*Elementary Knowledge of Cybernetics*	Todor Boyanov	1978
4.	*Algorithms*	Peter Barnev, Pavel Azalov	1978
5.	*Mathematical Bases of Computers*	Hristo Hitov	1978
6.	*Information and Management*	Peter Barnev	1978
7.	*Information System*	Atanas Radensky	1981
8.	*Algorithms and Algorithmic Computing*	Dimitar Skordev	1981
9.	*Mathematics and Programming*	Atanas Radensky	1983
10.	*FORTRAN in Examples and Problems*	Pavel Azalov	1985

11.	*Coding of Information*	Stephan Dodunekov, Yordan Denev	1985
12.	*Computer for Beginners*	Morgan	1986
13.	*Informatics for 11th Grade /II stage/*	Margarita Barneva, Stoyko Stoyanov	1986
14.	*Datastructures*	Pavel Azalov, Fanny Zlatarova	1987
15.	*Informatics for 10th Grade*	Barnev, Azalov, Dobrev, Bisterov	1987
16.	*Informatics for 10th Grade*	Angelov, Gavrilov, Garov	1987
17.	*I Can Program at the Age of 9*	Peter Stanchev	1987
18.	*Informatics for 11th Grade*	Barnev, Azalov, Dobrev, Bisterov	1987
19.	*Informatics for 11th Grade*	Angelov, Gavrilov, Garov	1987
20.	*Mathematics and Informatics for 8th Grade, p. I, II, III, IV*	Sendov et al.	1988
21.	*Informatics for 9th Grade*	Barnev, Azalov, Dobrev	1989
22.	*Mathematics and Informatics for 9th Grade, p. I, II, III, IV*	Dicheva, Nikolov, Sendova	1989
23.	*Informatics for Beginners, p. I*	R. Nikolov, E. Sendova	1989
24.	*Informatics for Beginners, p. II*	R. Nikolov, E. Sendova	1989
25.	*Informatics for 10th Grade*	P. Barnev, P. Azalov	1990
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NATIONAL REPORT OF BURUNDI

NEW INFORMATION TECHNOLOGIES (NIT) IN THE EDUCATIONAL SYSTEM OF BURUNDI

The use of information technologies in the system of education of Burundi cannot be considered as widespread. The situation in this field is close to critical, on the one hand, because of the lack of finance, and on the other, because of inadequate attention paid to timely application of NIT in the educational system and all advantages they can give to a user.

First steps in this field were made around 60s, when tape-recorders, compact-cassettes for languaue studies, slide-projectors, educational films etc. were first used as teaching aids. But these educational tools were not used to a full extent at secondary schools, especially in case of Church-run schools.

SCHOOL RADIO

In 1975 in the framework of the Program of the Education Bureau responsible for primary schools curricula, the Rural Schools Education Bureau (RSB) initiated so called School Radio with the aim to improve a professional level of teachers and to broadcast educational programs for school students and general public.

The programs of school radio were started at local broadcasting stations, at which all programs including educational ones were made by professional producers. At that time , they faced a lot of problems with hard- and software.

In 1979 a decision was taken to form an autonomous RSB-based "Regi-Studio" system for school needs only. The project was accoplished under UNICEF and French assistance. The programs were produced and recorded by the RSB and broadcasted over local channels of the National Radio.

School Radio provides educational programs for primary school teachers, and students through nourishing their constant interest to the process of learning by means of all sorts of radio-competitions.

Here is an example of School Radio broadcasting schedule:

day	time	program type	audience
Tuesday	3pm	preparatory programs	primary school students
Thursday	8pm	teachers' information	teachers and parents
Friday	3pm	preparatory programs	primary school students
Saturday	4pm	games & competitions	teachers, students, public

Thursday and Thursday programs are just only for school year period while the rest are broadcasted even at vocation time.

Saturday competition programs are used in primary or secondary classes as educational and instructive simulation games.

The format of a program can vary from a lecture-type to pure informative or containing elements of a competition game or a reportage. The progams can be used by teachers for enriching their teaching experience. According to them the programs help to prepare classes and to use teaching aids. Any of novel teaching tool is immediately reflected in broadcasting and incorporated into teaching process.

CURRENT PROBLEMS

- the majority of teachers are extremely busy working at two jobs and they cannot sacrifice classes to get time to listen to the radio;
- there is no proper feedback system; the broadcasting producers therefore cannot use teachers requests in later releases.
- teachers request model RSB lessons on the subjects which are considered complex. Unfortunately, radio broadcasts can reach only auditory recepters of the audience. Radio cannot show pictures, graphs and tables.

A possible solution could be found through use of audio-visual tools. TV sets must be used both at primary and secondary schools.

TV PROGRAMS

The Telecommunicaions Section of the Education Bureau and Secondary School Program has its own airtime on Television - half an hour a week beginning with February 1996. This program consists of five headings:

a). INFO

This heading covers some urgent news items from:

- EBSSP Directorate and other Ministerial Departments
- EBSSP Publications
- School Administrations which can provide interesting information on their schools

36 stories mainly about secondary school were issued under this heading. However, after December 1992 this program ceased to exist as it covered a problem of possible leadership change far too often.

b). "Come on, find an answer"

This heading deals with competition games for students. Participants are asked questions relating to general intellectual development of a child. Winners get prizes.

c). "Do you know?"

This heading covers specific EBSSP-based documentary projects.

Among numerous accomplished projects were:

- Bujumbura Port

•weather forecast
•calculations
•chimp
•snakes
•COTEBU
•deaf and dumb' programs
•hydroelectric dam

d). "Let's talk frankly"

This heading covers some problems of school life. Every month a new topic is chosen to be discussed in four sessions. The first session is normally an introductory one providing a general presentation of the problem. The second gives a chance to several participants to speak out their viewpoints on the problem. The third is run with expert participation on the issue. The fourth deals with the letters and responses received during the program time. Several programs on school failures, how to learn to learn, buildings repairs, water and hygiene, sexuality of the young, have been issued under the heading.

e). "IRABIR"

This heading has as its aim an introduction of trades which students can opt in the future.

Conditions of using School TV.

Environment in schools may differ. Out of the list of 16 schools, selected at random, all 16 have TV facilities (all in all there are 68 secondary schools, to say nothing of colleges. 80% of them have TV sets).

3 TV are out of working condition

1 recorder is out of work

4 recorders stolen

3 schools do not receive National Padio or Television at all

many (12) schools have a problem with students, namely, those who watch TV take their seats first, while the rest cannot find a seat to watch a program. In many schools the TV center is placed in a small room with windows overlooking the inner yard so that the students may watch TV programs through a window. The number of viewers may exceed 500.

INTERNATIONAL CONCORTIUM ON DISTANCE LEARNING TECHNOLOGIES IN FRENCH-SPEAKING COUNTRIES - ICDLTFSC

In 1992 a distance learning project was created by ACCT especially for Burundi.

The project is designed for transmitting French courses for non-qualified secondary school teachers, i.e. teachers who work and study at universities at the same time and those who haven't been trained to teach in French or those who haven't got a higher education in teaching.

In summer 1992, university professors who developed the distance education program and who wished to up-date it, created an AD program for further training of French teachers at secondary level.

The team of teachers of French was formed to update the program in several days. Now the trainees can learn the materials, form their own vision of the program and use methods of distant training in their work. Trainees can take home the materials, a student's guide and a questionnaire in which they can express their opinion with further return to ICDLTFSC.

All these undertakings are aimed at improving the program which was subject to criticism at the Closing Session in Bordeaux.

According to ICDLTFSC project at its advanced stage it was planned to open a new French school. Unfortunately, necessary documentation was not signed on time and the crisis that later broke out in the country made it impossible to continue experiments in this field.

However, the development of FAD concept of preparing materials goes on. Distance education is supposed to be included into the process of teaching in the nearest future.

COMPUTERS AND SOFTWARE.

We could say that the process of computerisation had little effect on the school sector (leaving aside Technical Schools and some University departments).

At the Central Administration level each separate agency (Departments, General Directorats, Offices, Ministerial services) is equipped at least with one computer and is using WP, LOTUS, EXCEL, and Dbase software.

There is a re-training center in Bujumbura for teaching office employees to use this software with respect to their functions. There are a lot of privat centers as well, that provide paid training in computer science. Many office workers refered to these services in order to learn how to use WP/Dbase, Lotus, Windows and other software.

DIFFICULTIES OF INTRODUCING NEW TECHNOLOGIES INTO TEACHING

- shortage of man-power that could widely introduce NIT into teaching process;
- lack of finance for prompt introduction of NIT into teaching process;
- problem of distant location of most rural schools from major communications and power grid which impede introduction of NIT into teaching;
- lack of due attention to NIT introduction into teaching.

PARTICIPATION IN INTERNATIONAL PROJECTS ON NIT APPLICATION

At present in Burundi there is a shortage of professional staff participating in International programmes on NIT application.

The participation in the Second International Congress UNESCO will be useful to the country. We hope to get much new and useful information on NIT application out of international cooperation. Burundi will consider international experience of, for instanct, TV-education to be able to form her own plan of applying this new leading system into National education.

PRESENTED BY
THE MINISTRY OF HIGHER AND SECONDARY EDUCATION AND ACADEMIC RESEARCH

NATIONAL REPORT OF CHAD

PREFACE

Chad, as it will be illustrated in this Report, is far behind in teaching of new information technologies. This gap is clearly observed on the levels of higher, secondary and technical education. Among the various reasons of this situation, one should point out the political instability, that has deorganized the country's education system.

The stabilizing measures have certainly been undertaken, but the absence of national policy in the informatics sphere, the lack of funds and qualified personnel still remain the main obstacles on the way of informatics development in Chad.

Crucial steps must be taken in the shortest possible time before the situation becoms irreversible. Probably, the channels of information transmission is the solution? Chad must find the answer shortly.

1. THE PRESENT-DAY SITUATION

THE NDGAMEN UNIVERSITY

The Faculty of Exact and Applied sciences

Computer facilities of this Faculty include:

1. Laboratory
- 2 IBM-compatible computers PC 80286;
- 1 IBM-compatible computer PC 80386;
- 1 computer IBM PC 80286;
- 1 computer «Macintosh», classical type;
- 1 computer «Macintosh» , IICX type;
- 1 printer of Image Writer II type;
- 1 printer Epson LX-800.

2. Office of Math Department Director
- 1 computer Compaq Prolinea 486.

3. Dean's secretariat
- 1 computer «Macintosh», classical type;
- 1 computer «Macintosh», DC 475 type;
- 1 printer of Image Writer II type.

4. Dean's office
- 1 computer «Macintosh», classical type;
- 1 printer of Laser Brother type.

Computer laboratories are intended for the second year students of Faculties « Mathematics and Physics» - 15 students, «Physics and Chemistry» - 15 students, « Natural Sciences» - 50 students and for 10 students of technical Faculties. The curriculum offers introduction courses on MS-DOS operation system and programming language Turbo Pascal. The disciplines are taught by two part-time teachers.

The project

The project of creation of informatics department has been worked out by the Technical College of the Orleans University for the Faculty of exact and applied sciences.

The project's fulfillment plan:

- year (n-2) - year (n-1): training of teaching and operating personnel;
- year n: introduction of the first year of studies (15 students, 32 weeks with 15 hours per week);
- year n+1: introduction of the second year of studies (10-12 students, 22 weeks with 15 hours per week and 10 weeks for field training at an enterprise).

Curriculum and teaching hours

Discipline	1st year	2nd year
Informatics	480	330
Mathematics	160	110
Management	160	110
English Language	80	55
Communication studies	80	55

The assessment of computer classroom construction
(in French Francs without taxation)

Items	Quantity	Sum
Tables and chairs	-	30 000,00
Micro-computers DX4100 RAM 8 Mb HDD 420 Mb Monitor 15Inc Ethernet cards Ne 2000, compatible	15	135 000,00
Server Pentium 90 MHz 16Mb HDD 2 GB Ethernet/bus cards PCI Monitor 15Inch CD-ROM discs	1	20 000,00
Inverter and anti-overload device	16	32 000,00
Laser printer HP4ML	2	15 000,00
Wiring	-	10 000,00
Total		242 000,00

The Analysis of the business circles' opinion on the necessity of informatics studying has proved the existence of demand (though limited , but real) for specialists in informatics of a senior technician qualification level. According to the Survey's conclusion, it is necessary to train highly-qualified technicians, possessing the following skills:

- operation of complicated information network system, that can be used simultaneously by several people;
- provision of an access to information and data compatibility in the system «Client-Server».

The Faculty of Law and Economics

Computer facilities of this Faculty include:

1. Laboratory

- 2 IBM-compatible computers PC 80286 (two of them are out of order);
- 1 dot printer (out of order).

2. Dean's secretariat

- 1 IBM-compatible computer PC 80286;
- 1 IBM-compatible computer PC 80486;
- 1 dot printer Epson LX-800;
- 1 dot printer Epson LQ-1070 (out of order);
- 1 printer of Laser Brother type (out of order).

Training is available from the first to the third year to 300 students of the «Economics» specialization. The discipline is taught by two teachers. The curriculum consists of:

1st year: operation system MS-DOS, WordPerfect and Lotus;

2nd year: introduction into programming , based on Turbo Pascal language;

3rd year: introduction into algorithmics, Dbase III+.

The secretariat of the Faculty of Law and Economics uses information tools daily. But the «Personnel control» function is not computerized in most of the faculties of the University and this causes mistakes and time expenses.

The Faculty of Philology and Humanities

In comparison with the others, the Faculty of Philology and Humanities is the best equipped one and it has the following computers for scientific research at its disposal:

1. Linguistic Department

- 1 computer «Macintosh» LC 630;
- 1 computer «Macintosh» LC 475;
- 1 printer StylWriter II;
- 1 printer Laser Writer 320.

2. Philological Department

- 1 computer «Macintosh» LC 320.

3. Geographic Department

- 1 computer «Macintosh» (multimedia);
- 1 printer StylWriter II.

4. Geographic Department

- 1 IBM -compatible PC 80486;
- 1 dot printer Epson LQ 1070.

5. Dean's secretariat

- 1 IBM -compatible PC;
- 1 dot printer Epson LX 800.

With the exception of the Office Informatics Course for post-graduates (16 students), this faculty doesn't offer any teaching courses of informatics.

Medical Faculty

Medical faculty doesn't practice the studying of informatics course, and all the equipment (one IBM-compatible computer PC and a printer Epson LQ 1170) is used for administrative purposes.

National Institution of Humanities

The National Institution of Humanities is equipped with one IBM-compatible computer PC and a printer Epson LX 800, used for administrative purposes. Though put in the curriculum, informatics and statistics haven't been studied in this institution because of the absence of laboratory, equipped with the corresponding hard- and software.

Central University Library

The Central University Library and its four divisions (Library of Exact and Applied Sciences, Humanitarian and Philological Library, Library of Law and Economics, Medical Library) has one IBM-compatible computer PC and a printer for control of their funds. In 1990, supporting the informatization

process, the French partners granted the University 18 micro-computers, 12 printers, a large amount of expendable material. But the lack of funds has actually ruined the program and, though part of the personnel has learnt the software for word processing, it cannot be of practical use because of the lack of equipment.

University Administration

The University Administration possesses:

1. Rector's secretariat - 1 IBM-compatible computer PC and 1 printer LaserJet 4M;
2. Deputy Rector's secretariat - 1 IBM-compatible computer PC and 1 printer LX 800;
3. Chief Secretary 's secretariat - 1 IBM-compatible computer PC and 1 printer Laser Brother;
4. Personnel service - 1 IBM-compatible computer PC and 1 printer Epson LQ 1070;
5. Bachelor training service - 1 IBM-compatible computer PC and 1 printer Epson LQ 1070
6. Central service of school training - 1 IBM-compatible computer PC and 1 printer Epson LQ 1070.

Computer is daily used by all the University Administration services. The best equipped sector is the Bachelor training service, the worst equipped - the Central service of school training.

CENTER OF INFORMATION PROCESSING

According to the PRIMTAF project, Canada presented 19 micro-computers, 8 printers, software and expendable materials to the University of Chad in 1995. A part of this equipment (12 IBM - compatible computers PC, linked in the network; one printer LaserJet 4MP; one printer DeskJet 560c; two printers Epson LQ 1070) was transferred to the Computer center, aimed at training as upgrading or re-training of people, working in governmental, mixed and private sectors.

Software of the Center of Information Processing and the Ndgamen University:

- Text processing: Word 6.0, WordPerfect 5.1, WordPerfect 6.0;
- Table editor : Excel 5.0, Lotus 1,2,3;
- Databases: Dbase III+, Dbase 5.0, FoxPro 2.6, Clipper;
- Control: Ciel (accounting), Saari Major (business control), Saari Major (accounting), Saari Major (wages).
- Documentation flow control: Texto;
- Project management: Project Bridjet Modeler, Project Workbench, Microsoft Project;
- Integral functions: Works 3.0;
- Graphics: MapInfo 3.02, PowerPoint;
- Statistics: SPSS;
- Polls: Survey Pro;
- Programming languages: Turbo Pascal, Turbo C, Basic.

NATIONAL CENTER OF SCIENTIFIC RESEARCHES SUPPORT (NCSRS)

At the National Center of Scientific Researches Support every service has its own modern micro-computer. Recently, a new computer network has been installed in the Publishing Department. The Manager of this Department has taken a 3 months' training period in France.

As the consequence of the visit of one of the Center's representatives in Dakar in May 1995, NCSRS has managed to arrange for the installation of an INTERNET provider at its premises. Unfortunately, the Chad's network is not linked with the international network, though this problem is being under discussion.

On October 27, 1995 the American delegation, headed by the United Nations Development Program adviser made evaluation of the situation in Chad. They declared about a possibility of granting necessary equipment and linking to international network, but the problem still remains unresolved. By now, only several international organizations (including the UN Development Program) are linked with this network.

NATIONAL INSTITUTION OF PUBLIC WORKS

Curriculum of the Institution pays proper attention to informatics. It has the following equipment:

- 1 IBM-compatible computer PC 80286 at Secretariat;
- 3 IBM-compatible computers PC in the Departments, dealing with basic training;
- 3 IBM-compatible computers PC 80486 in the system of professional upgrading and re-training .

Possessed software: Word 5, Winword, Autocad, Page Maker.

Project: National Institution of Public Works expects financing for the new computer-information center, which will be equipped with:

- 6 IBM- compatible computers PC Pentium;
- 1 drawing table of A3 type;
- 2 laser printers;
- 1 color laser printer ;
- CD-ROM Drivers.

CENTRAL SERVICES OF EDUCATION SYSTEM

The majority of the Departments of the Ministry of Education have informatics tools at their disposal for managing administrative problems. Some operation services, listed below, are equipped better then the others.

1. Statistics Department

Facilities - 4 IBM-compatible computers PC

Software - Word 6.0, WordPerfect 5.1, Excel 5.1, Lotus 1,2,3, Dbase IV.

2.Evaluation and Control Department (evaluates and controls the qualification level of teachers and the extent of students' knowledge).

Facilities - 3 IBM-compatible computers PC, 3 laser printer, 2 portable computers.

Software - Word 6.0, Excel 5.1.

HIGH INSTITUTION OF PEDAGOGICAL SCIENCES

Today , the students of the High Institution of Pedagogical Sciences don't study informatics. The limited micro-informatics course is organized in the framework of the «Teachers Training» program and the «Educational Masters Training program.

Equipment:

- for current administrative problems settling - 8 micro-computers, 1 portable computer, 1 printer.
- for teaching process - 2 micro-computers;
- for school printing facilities - 1 micro-computer

Software : Word 6.0, WordPerfect 5.1, WordPerfect 6.0, Excel 5.1, Lotus 1,2,3, Dbase IV.

Project: furnishing of a computer class with the equipment for teachers training.

TECHNICAL COMMERCIAL LYCEE

Informatics is not studied in the Technical

Commercial Lycee.

Equipment: 2 computers IBM PC XT (for the management)

Software: WordPerfect 5.1, Lotus 1,2,3, Dbase.

Project: to purchase 20 new computers under the program «Education - Occupational training - Employment» .

TECHNICAL INDUSTRIAL LYCEE

Informatics is not included in the curriculum. Micro-computers, used by the Administration, broke down many months ago.

FELIX EBOUE LYCEE

The Association of Students' Parents was planning to buy two micro-computers in the school year 1995/96.

* * *

The acquaintance with the role of informatics in large organizations of the Capital gives no hope that the situation in provincial lycees and colleges may be better. With state education system failing to provide informatics studies, there are private schools that include informatics courses (mostly for settling administrative problems) in their curricula. The largest of them are the Center of Occupational Training and Upgrading at the Ndgamen Chamber of Commerce and the High Management Institution.

2. STANDARDIZATION POLICY

There is no standardization policy for new information technologies in Chad. However, in the framework of the program «Education - Occupational training - Employment», the priority is given to the studies oriented to market needs and employment. As informatics is thought to be a necessary field of knowledge, one should expect the standardization policy to be worked out in a short time.

3. DIFFICULTIES

Obviously, Chad is falling behind in studying new information technologies. There can be a number of underlying reasons:

- political instability disrrupting the whole education system;
- low level of National Revenue compelling the government to settle only the most vital problems. In the sphere of education the government can afford to finance the minimum program, based on the cheapest technologies;
- insufficient skills of teachers. The majority of them haven't received proper knowledge and are unable to estimate the advantages of new technologies and promote their studying.
- difficulties with the uninterrupted electricity supply which is, by the way , the most expensive in the world. Numerous unexpected disconnections cause the loss of time and data and break computers down;
- absence of well-equipped technical services. Computer's breakdown is known to be a catastrophe.

These factors themselves don't explain the gap. The weak political will at the national level should be added to the list. Otherwise, it is impossible to understand the absence of informatics courses in curricula of the most prestigious colleges of the country.

4. SUGGESTIONS

In order to narrow the growing gap, Chad has to establish the National Body , accumulating human, material and financial resources, for elaboration of programs, fitting the political strategy of the country.

After the Congress closing it is necessary:

to arrange a national seminar on the problems of new technologies role in education system and in occupational training and their significance as of Chad's development factor;

to establish a national body promoting new technologies studying and their introduction into companies' and government bodies' activity.

All the measures, that should be taken, can be divided into the main groups:

Step 1

- analysis of the present situation;
- elaboration of a general plan;
- evaluation of needs;
- making out an operation graph.

Step2

- teachers training;
- working out teaching programs;
- promoting informatics studies in the University;
- executing experimental programs

Step 3

-inclusion of new information technologies studies in secondary technical and occupational education

Step 4

- inclusion of new information technologies studies in secondary education system.

* * *

Naturally, studying new information technologies can't be successful without changes in the professional sphere. But this process requires favorable environment for application of informatics in all spheres of life. This purpose can be achieved with the help of seminars and upgrading and re-training programs.

NATIONAL COMMISSION OF CHAD FOR UNESCO

NATIONAL REPORT OF CHILE

1. INTRODUCTION

The given report presents the major results of the Enlaces Project second year official implementation (Enlaces Interconnection). La Frontera University is responsible for the project development for the 4-year period since March 1993 in Araucania area and in lesser degree in other regions. The Enlaces project in the capital district is being coordinated by the Pope Catholic University of Chile.

Main objective of the Enlaces Project is to organise a net of educational centers for studying contents, costs, positive and negative sides of initiatives in the field of Educational Informatics. The Project includes the evaluation methods for its results and is aimed at defining the part of computer technologies and telecommunications for municipal schools, especially, in state funded, which do not possess oflarge budget.

By December 1994 there were 81 centers and 19 establishments in the network. Major part of them are situated in the 9th District including Angol, Vilcun, Lautaro, Temuco, Pitrufcen, Viliarica, Freire and Gorbea. The project base was yet enlarged due to agreements with Concepcion University and Los Lagos University in Osorno. These educational establishments and subnets in Santiago (Pope Catholic University), in Viliarica (the same) and in Angol (La Frontera University) enable setting of the basis for future decentralized growth. There are already three rural schools involved, two of them operating with mobile phones and one directly with radio.

The Net covers schools as a result of projects' tenders and it depends upon the equipment available and switch-in possibilities. Municipal and subsidized schools constituent the majority on the net. They recieve hardware equipment from the Ministry of Education: 3 computers, 1 printer, 1 modem and 1 CD-ROM and software (educational programs, La Plaza); have the possibility to teach their staff and recieve Enlaces support. Other funded schools can join the net as a result of projects' tenders while Enlaces provide software, teaching and net support. Private schools can obtain partially software and partially net support.

La Plaza program inside Enlaces teaches the use of computer both for learning programs and for communications (local, metropolitan, wide-area and international ones), for participation in educational projects, for finding and sending information in the net.

Right now, the experience gained shows that computer technologies should be introduced at schools paying special attention to the work with teachers and to the special features of every school, its situation, priorities, basic activities at the moment of technology installation. The succes of the project is basically achieved due to the job done by teaching staff and school principals of the schools involved in the net. The strategy of support, learning, continuous help, staff meeting, document procedures were designed for teachers. And that made technology implementation easier for many schools and enable the use of computer in administrative management.

2. BASIC POSITIONS

The Enlaces Project is a part of the MECE program with the Ministry of Education. It is an experimental one and its objectives are to evaluate the role, costs, negative and positive sides of computer use and telecommunications at schools. There are three major factors to dominate it:

- Chile Education System
- Learning Technologies Implementation experience in Chile and in the world
- Achievements and Tendencies in Information Technologies and Telecommunication development.

The analysis of these factors and the experience gained during the project development determined the definition of principles on which the Project should be based:

Informatics is a means, an instrument easy to use and to serve to teachers, other educators and students. That is to say that learning computer use should not be for the sake of learning only and should not become the restricted area "for experts only".

People have the leading part in education: students, teachers, administrators and not machines. Even the most powerful and perfect

computer is yet an instrument of support for the educational projects where people are involved. That's why we are armed at organizing a computer laboratory in every school where both students and teachers could work over different subjects and different projects, instead of providing every student with a computer.

Educational objectives of a school should define the use of a computer in it. As well as, the social and cultural grounds and geographic location should do. There are no common prescriptions for every school but there is a possibility of knowledge and experience exchange which can be modified and suit a special case.

New technologies and telecommunication bring new roles for hardware and software:

Pedagogic: support instrument and didactic material for teachers and students; motivation instrument to develop linguistic, communication, mental and art abilities and skills.

Social and Professional: personal contacts and experience exchange between teachers and students; widening life vision of students.

Administrative Support: important element in modernization and acceleration of a school administration process; education administration support.

The presence of a computer at school cannot serve as a guarrantee of learning effect. Internationally the hopes of the 80^s for the learning effect of technologies failed to come true. Now we can use the positive and negative experience of the past and witness the gradual process beginning with the adaptation of technology, taking it in, followed by the creative impulse to use it. The process is very slow - all teachers are being involved in it gradually - so it needs long-term support. It is difficult to use this reliable principle in developing countries because they concentrate on equipping their schools.

The mentioned principles show the frame of the Enlaces project development. We will go on with the positive moments of information and communication technologies for Chilean schools:

Equal opportunities and decentralization: schools can join the Schools Community regardless of location. For example, any teacher in the net has an access to the same information as others and participate in interschool projects on equal grounds regardless of where he lives: in Temuco, Las Condes, Freire or Boyeco.

Professional Growth: teachers can exchange experience, material, succes and advice if united by the net. They can also take part in group sessions and discussions over different subjects issues, eg. Spanish, Mathematics, teaching kids with learning difficulties, History, etc.

Management development: teachers and school principals can raise their job efficiency and make it easier through the use of computer technologies to keep diaries, notebooks, data bases, to prepare materials for exams and tests, students lists and for book-keeping.

Educational process modernization: teachers and students can use new learning software as didactic material. New learning programs' quality and quantity is improving every day. To use it we should change the pedagogic process structure, ways of delivery and aquiring knowledge, to stimulate abilities and develop gifts and skills of students.

Students demonstrate strong a wish to work with computers: teachers can use computer to stimulate education and to stimulate creativity.

The named positive moments have good influence over quality of education in school system. But we can expect informatics implementation to bring results in a social sphere. For example:

Having got access to the technology at school young people will bring changes to production field and a service sphere developing those technologies. To use technologies properly, to manipulate information one should have a high degree of knowledge and skills in the field which are necessary in today's world. Those skills are to be developed during school period. Eg., searching, underlinig important things, sythesis and information providing.

Due to the fact that young people will be having access to the world information nets for the whole of their school life regardless of the geographical location, their vision of the world is sure to widen. It teaches them to contact other people of different cultures, races, languages and interests. These skills are important in the world where international contacts have become necessary and usual.

3. PRIMARY OBJECTIVES AND TODAY'S SITUATION

1. INTRODUCTION

Futher we give information on the project objectives realization by January 1995.

PRIMARY OBJECTIVE 1: *To organise educational net* covering 100 schools and 10 establishments during the period of 1993-1997. 70 % of the net is located in Araucania, 20 % are in Santiago and 10 % are in other regions. The network will be based on computers, they be connected by means of telephone or radio. The software will provide net support for schools. The net will be open for other schools and establishments to join if they have necessary equipment and want to participate with their projects.

Today's situation: The set 100 schools are to be on the net by March 1995, and by the end of the year the number will be 300 schools. Now there are 81 schools 19 establishments on, including those who joined with their own equipment. The Enlaces net is a part of Internet that's why teachers and students have possibilities to contact schools, universities, libraries, discussion sites and similar

projects around the world.

PRIMARY OBJECTIVE 2: To organise at La Frontera University and Pope Catholic University Educational Informatics Centres (EIC) with the right staff, equipment and funds to support school net. Centres should control traffic in the net, to design and implement Learning Strategies for users and continuos education, to support school provided projects, to create and evaluate software, to provide schools involved in projects with technical and pedagogic support.

Today's situation: Now EIC at La Frontera University is organised. It occupies 600 sq.m. The team of teachers of various subjects, psychologists, telecommunication engeneers, software writers, computer designers, journalists and administration experts work over the Enlaces Project. Also it includes the computer centre at Pope Catholic University at its Programming Department in Santiago and in Viliarica. Later the University of Concepcion (8th District) and University of Los Lagos (10th District) joined the net.

PRIMARY OBJECTIVE 3: To convert three schools into experimental ones and on their basis to implement experimental job with new technologies and teaching and learning methods.

Today's situation: One school in Temuco is founded.

ACHIEVEMENTS

This project started in 1991 in several Santiago schools and was primarily experimental. Its objective was to evaluate the existing technologies to research the input capabilities of telephone lines for computer links, to settle a professional level necessary for computer use and basic multimedia, and also to look into ways of computer implementation at schools. In 1991 the project covered 3 schools in Santiago and Pope Catholic University. In 1992 in Santiago 8 new nodes appeared and they got stable connection with foreign schools.

That experience confirmed the importance of designing new implementation strategies and use of technologies at schools. It also proved that school educators of all levels should participate in that process. The experiment showed that children took in new conversational possibilities enthuasiatically, as well as the use of learning programs and that children should be taught minimum users skills to use computer efficiently.

1993 saw the net growth up to 33 nodes: 17 in Santiago and 14 in Temuco. The contacts with foreign schools grew. Main job was to create methods of joint use of technologies for teachers in different schools through various interschool projects and to modify and to widen software. And in general, it was the task to evaluate main areas for computer use at school.

The network grew up to 100 nodes: 81 schools and 19 establishments. Many of them had their own equipment.

2. MAJOR

Here is the joint table of the schools in the Districts, showing the origin of the equipment:

District	*Equipment provided by Ministry of Education*	*Own Equipment*	*Total number of schools*	*%*
Capital	13	7	20	24,7
6TH (*)	0	5	5	6,2
8TH	4	0	4	4,9
9TH	46	6	52	64,2
TOTAL	63	18	81	100
%	77,8 %	22,2 %	100 %	

* The 6th District net came to life with the help of the San Vincente Municipal Council in Tagua Tagua community. The Council equipped all schools of which 5 have joined the Enlaces net. Enlaces provided them with communication software, taught staff and students minimum computer use and switch them in. This example can be followed by other communities in other regions of the country. We expect such forces to bring other schools to Enlaces.

Establishments in the net are schools, faculties and departments of various Universities (La Frontera University, Pope Catholic in Santiago and Viliarica, Concepcion with the centre in Los Anjeles, Los Lagos University, ORT Chile, Acsis, etc.).

3. EXAMPLES FOR USE OF LA PLAZA (THE SQUARE) PROGRAM

The La Plaza program was designed to possibly ease the use of computer for teachers and students. It is a simple one and combine several items named Post Office, Newsstand, Museum, Culture CentreThe Square - access to the system.

We choose the image of a Square because every student and every teacher knows it immediately in any part of the country. This place

doesn't evoke bad assosiations, it is an attractive and familiar one serving as a meeting point for community members. Also there are different services here: banks, shops, City Hall, school, entertainments.

3.1. Post Office

The Post Office at the Square is a e-mail office one can have simple access to, teachers and students can easily send and recieve messages. Its aim is to build up informal atmosphere for first contacts and then to create a workgroup in Culture Centre sliding to personal contacts between teachers and students.

Children use the Post once a week: to write letters in different subjects, eg. looking for friends, quizzes exchange, their pets, interests, dreams, etc.

Teachers use the post in experimental regime because they have understood that learning telecommunications, looking for people of the same views in the net would demand patience and consume time. This is a universal phenomenon. In developed countries the use of nets has grown significantly though it took them several years to get accostomed to them and to study their use. The same picture is true for school teachers.

3.2. Newsstand

Newsstand is a window into the world of electronic information but it changes as time goes, as any paper or magazine does. It contains electronic newspaper section (environment, sports, for teachers only, etc.) which is being edited by teachers and students themselves.

In Newsstand there are short stories of educational contents with sound, animation, texts stimulating desire to read or write something. The number of the stories grow and every school has access to them.

The most popular sections of the electronic newspaper

Position	Name	Number of news in 1994
1	Thoughts	823
2	Interesting Facts	611
3	Sports	553
4	Schools	402
5	For Teachers Only	388
6	Ads	395
7	Environment	326
8	Information about the country	232
9	Information about the world	189

All those sections are of experimental character. In the future schools will be able to subscribe to them through computer as their number grow. In this case sections can be written by "agencies" (Museum, City Hall, Environmental Protection Ministry, News Agency, Library, etc.).

3.3. Museum is an information centre where the learning programs data is stored. Generally, it's the easiest data base oriented for a teacher who needs didactic materials. One can travel from Museum to Information, to the experience exchange section and new programs demonstration. CD-Roms are being used since 1994. Here's a licenced programs' list:

- Graulier's Multimedia Encyclopedia
- Animals (San Diego Zoo CD)
- The Language of Lyrics (music)
- A Tortoise and a Hare
- Carmen San Diego
- Decisions - Environment
- Juanito and His Magic Beans
- Earthenware in Chile
- XXth Century
- The Earth
- Lessons in Mathematics: Functions

In addition to those they work over programs that are difficult or impossible to buy on the market:

- Chilean Artists
- Architect's Workshop
- Peoples of the Earth
- Human Body
- "La Plaza" Program Manual
- NESCO: Healthy Teeth (delegated to the Dentistry Department of La Frontera University).

Here is the list of other programs sent to schools:

Claris Works: text editor, calculator, data base, graphic and drawing editors included

Kid Pix: drawing programm for kids

Hypercard: multimedia production

The most used-by programs for the last month of 1994:

1. Kid Pix
2. Claris Works
3. Human Body
4. Chilean Artists
5. Peoples of the Earth

3.4. Culture Centre

Culture Centre is a meeting point for those who realise joint projects of teachers and students from different schools. It also helps teachers to find colleagues of similar interests so they can exchange experiences, opinions, materials and documents (Eg. physical training instructors, professors of English, Literature Workshops, foreign connections, etc.).

Culture Centre and its working sectors
Here is the list of the most popular sectors and topics with Culture Centre

Number	Topic or Program	Number of Messages
	"ABC Teaches"	370
	"Mathematicing"	325
	Hallo, Chile	319
	Games and Sports	293
	Ecology	293
	Caught in the Net	252
	Square and I	236
	SOS	184
	We grow happilly	176
0	Kid Pix	136
1	Claris Works	89
2	Dinamicas	83
3	Necso	70

4. EXPERTS TRAINING, RESULTS EVALUATION, MONITORING

1. EXPERTS TRAINING

In 1993 Experts in schools connected recieved the following training: three introductory lessons (one week period) for groups of 12-15 teachers from the same school (totalling 195) were giving the skills necessary to work with "La Plaza".

The Learning Strategy for teachers in 1994 seriously differed from the mentioned one because schools were given most autonomous rights for that matter. The number of skills to obtain grew also: Teacher were able to study both Enlaces basic program and Claris Works consisting of the editor, data base, drawing program, etc. To optimize its use teachers learned the use of archieves and the way a hard disk works.

As the number of the involved schools grew so does the necessity to let them solve training issues themselves since the geography of the schools widened and was distancing from the Project Centre at La Frontera University. The experts were expecting that growth... there became three times as much schools involved... and they developed a multimedia program with various topics and training workshops. One has access to that program "The Learning Square" from the Square section "Museum".

Together with the already published textbooks and manuals this program was a trial basis for a telelearning method which is expected to be as efficient as usual learning methods. We should mention that teachers could us it as they believe it necessary, at every school.

The next step to bring new members to the net was its administrative decentralisation. It is expected that as the number of members will grow, assistance to most far situated and worst equipped schools is getting more and more complicated. To escape this supposed problem and to test the more reliable and more flexible system of the net widening it was agreed that: The Chilean Pope Catholic University in Viliarica would take control over Subcomponent 1 of the net (where they serve 6 schools); La Frontera University in Malieco would take Subcomponent 2 (5 schools in Angol and 1 in Collipulli. The same agreement was signed with the Concepcion University in Los Anjeles to work with 4 schools.

There is the following work plan for the teachers of the schools in the said subnets which

joined the project in the third semester (village schools near Temuco: Lautaro, Freire and others). The 1st stage consisted of:

Learning how La Plaza works, including basic elements of equipment functions. At this stage teachers were to study in groups of 3-5 persons (from 4 to 6 weeks) at least once a week until they would be able to deal with the "Learning Square" tasks properly. The subnet coordinators evaluate the results of learning for each teacher individually. He (she) is tested according to the 30-point "La Plaza" user list.

The 2d stage consisted of Learning how to use an operational system, archieves and a hard disk. Again at this stage of 4 to 6 weeks teachers were to work in groups with an interactive self learning system and textbooks to match. Effiency evaluation was practice-based and was carried out when a teacher felt himself (herself) ready.

The 3d and the last stage consisted of Learning how to use Claris Works and Kid Pix programs. The learning program was "Claris Works Help" with a textbook included. In some cases "Additional Manual on Claris Works" was used. The efficiency evaluation was carried by practice-based methods when the teachers felt themselves experienced enough.

Total number of the teachers involved (see Table)

Sub-Net	Stage 1	Stage 2	Stage 3	Total number
• Santiago	86	43	33	162
• Angol	138	67	55	260
• Viliarica	103	54	50	207
• Temuco and communities	115	18	10	143
• Los Anjeles	57	7	7	71
Totaling	499	189	155	843

Deminishing number of participants by the end of the stages can be explained by the fact that the First Stage was not completed in time. The learning period in many schools took twice as much time as was supposed either because of the lack of lateral control or because of the difficulties at the spot. Having learnt the use of La Plaza most teacher didn't believe it necessary to master the knowledge about other operational programs. There was yet another stopper: the working plan was not covering all teachers who needed computer in everyday use.

Workshops

This year mastered one more learning field: workshops for detailed study of instruments and specific technologies. Example number one: "Use and management of Claris Works and Kid Pix programs". This program was proposed by Viliarica subnet coordinators during winter holiday. 37 teachers studied it.

13 seminars course made serious impact into learning. Those seminars were presented For the First National Congress on Informatics and Educational Nets ENRED 95 which took place on 6, 7, 8 of October. The total number of participants in the seminars were 437 teachers. Seminars were followed by lectures by foreign and Chilean experts. All the delegates from the schools in the net had possibilities to meet each other and share experience. There were 550 delegates.

Many Informatics Programs' Coordinators saw the success of the seminars and offered their own developments for schools. That raised the Congress' efficiency very much. We noted the learning developments popularity so we set to produce Educational Workshops in 1995 aimed at: a) answering schools' demand and developing supply; b) founding experimental secondary colleges with coordinated teaching beginning March 1995.

In addition it was decided to organise school journalistic societies for school teachers at Temuco and to organise seminars from one to two days depending upon the needs of teachers from the schools in the net.

2. EVALUATION

The job done in these two years let us evaluate the project efficiency in the field of school education.

For this matter an evaluation system was developed which cover wide range of marks. Though we didn't hope that it could be efficient in every field we began wide-aspect evaluation. We draw a primary picture of these aspects in the schools in the net and then we tested each school thouroughly comparing them to the primary picture.

We included in the evaluation such factors like territory, population, school level. Here are aspects we have evaluated up now.

1993 Primary pictures in 12 schools in Temuco and 6 schools in Santiago

1. Testing 1800 children in these schools participating in the project according to the following characteristics:

Creative activity (speed, flexibility and originality in product making). Development of learning levels. Level of comprehension when reading. Group interactivity (towards the task and with other pupils). Self evaluation according to learning tasks. Controls were set on intellectual levels and serious learning deviations.

2. Testing 207 teachers according to the following characteristics:

Mentor's role appreciation by teachers Learning objectives appreciation, appreciation of Learning process and school climate.

Levels of success, autonomy, fixed behavior, selfevaluation and efficiency.

Teaching styles types: professional, initiative, paternalistic and selfmaking.

3. Testing 1200 parents and guardians of the children involved in the project according to the following characteristics: diligence, statisfaction with school, evaluation and activeness.

1994 Comparison to the Primary picture 1 and number growth.

Primary picture 1 was drawn in 6 schools in Viliarica, 5 school of Angol, 3 of Los Anjeles (8th District), 7 of Santiago (one specialized school and one school for children with Dawn Syndrome) and in one school in Temuco (rural one). The testing positions were the same. The respondents included:

- 3000 students
- 450 teachers
- 2000 parents

To compare it with the Primary Picture we tested the same people we had tested in 1993. The information is being processed. We already have primary results for characteristics, like reading comprehension where we can expect changes in the direction of thought. But we are looking for the results from the schools that joined the project later to make sure changes take place because of Enlaces.

3. REVIEWS

Polls were being held regularly in schools to have quick and exact answers to questions about the use of technology.

In 1994 teachers from schools in the net in Temuco were polled. Here are its results. The left diagram shows the use of computers and software in learning process: 1% bad, 48 % good, 51 % very good. The right diagram shows improvement in contact with students: 19 % more or less, 76 % significantly, 5 % not much.

Page 14. In the upper left corner:

The use of communication instruments in the educational process: 14 % more or less, 3 % not much, 83 % much.

In the upper right corner:

How much can it damage learning process if the net will be switched off:

12 % not very much, 3 % not much, 71 % very much.

In the middle to the left: computer

The monitoring gave the full picture of how often Museum, Square, Culture Centre, Newsstand are visited.

Here is the graphic showing the traffic monitoring. Decisions over the net software, time to visit schools due to the schedule, etc., are taken on its basis.

Weekly schedule of a secondary school in Temuco.

5. PLANS

1. NET DEVELOPMENT BY THE SCHOOLS WITH OWN EQUIPMENT

We regularly develop choice strategy, development, motivation, implementation of software that can be copied for schools, especially for those involved in the Enlaces project. At the same time new achievements in telecommunication technologies and new programs developments are used to widen the net bandwidth.

One most important moment in the net growth is to integrate schools or establishments with their own equipment. The simplified version of La Plaza is designed (colorless, soundless and no video) for that, but one can join the net and exchange ideas, news, experience (as text files).

2. Switching of other establishments to the net.

Establishments (schools, universities, Technical Training Centres, private persons, etc.) who wish to join the net (with money, equipment, place, lines) should remember the following:

a) Software and hardware

In 1995 Enlaces have "La Plaza" program with communication capabilities and multimedia learning materials. One should possess an Apple Macintosh 8/180 computer with a 14" colour display or PC with Windows since March 1995 to use these programs.

The Enlaces Project has software for DOS Environment. 17 enables net access and let you send text files only. This version services older PCs AC, XT with monochrome displays without hard disk and minimum memory.

We can add that an establishment can use other Internet-compatible software (Eudora, MacWeb, etc.).

2. NET MEMBERS

Possibilities and Obligations

To join the Enlaces net an establishment should:

Send a request for membership. The net reserves are limited so they will consider the request judging by a school's capabilitiy to switch in to the Internet, its readiness to take some obligations and its real abilities to support Enlaces. At the talks the Enlaces management and the school principle/owner should sign agrement describing the

project contents, which a school would like to realise due to Enlaces, the ways it would be carried out, human and material resources for it.

Switch-in. It would be better for school to be located in the Enlaces contact zone: that is since 1995 all the phone-connected places in the 9th District, some Capital District communities, Los Anjeles, Concepcion, Osorno. Place out the contact zone can join Enlaces though the closest Internet node (one should turn for help to the University close to his place). In 1995 we expect to widen the Enlaces' cover zone after the support centres are on.

The equipment that the establishment own (modem, computer, software) should be compatible with the one of the Enlaces net (Internet standard switch software, own programs or "La Plaza").

An establishment should be able to pay expences and costs including those of Internet.

We advise all potential members to get in touch with our coordinators before purchasing equipment. You can keep connection with us in Internet, our address: enlaces - ufro@ enlaces. ufro.cl

MINISTRY OF EDUCATION

LA FRONTERA UNIVERSITY

NATIONAL REPORT OF CHINA

EDUCATION TECHNOLOGIES IN CHINA

INTRODUCTION

China has a territory of 9.6 million km, a population of 1.1 billion and 30 provinces/autonomous regions and 517 cities. In recent years she has achieved great growth in her national economy. The Chinese government has all along paid attention to the promotion of cultural and educational undertakings and raised the slogan of bringing prosperity to the nation through science and technology. "The National Program of Educational Reform and Development" was published in 1993, designing a blueprint for a system of education with Chinese socialist characteristics. In this document the development and utilization of educational technology are stressed.

From the perspective of social progress throughout history, it is evident that education is the mainstay of a nation, and that education is the very foundation of economic growth. The relatively low level of education in China has seriously hampered the advance of China's modernization. How to make the best use of the limited resources of education and the latest educational technology to train highly qualified personnel as soonest and as numerically the largest as we can — this is the major problem confronting education in China.

THE EXISTING EDUCATIONAL SYSTEM IN CHINA
is indicated in Tables 1 - 4, as follows:

Table 1.

Basic Education

	Number of Schools	Number of Students
Elementary Schools	700,000	124,210,000
Ordinary Junior Middle Schools	68,415	40,822,000
Professional Junior Middle Schools	1,582	562,400
Special Schools for disabled children	1,123	168,600

Table 2.

Professional/Technical Education

	Number of Schools	Number of Students
General Technical Middle School	3,964	2,820,300
Professional High School	8,403	3,063,500
Technical Middle School	4,447	1,716,700

Table 3.

General Higher Education

	Number of Schools	Number of Students
Ordinary Higher Education	1,065	2,535,500 BS/BA 88,800 MS/MA 17,600 Ph.D

Table 4.

Adult Education

	Number of Schools	Number of Students
Adult Higher Education	1,183	1,862,900
Adult Training Middle School	4,783	2,067,600

This educational structure is basically adapted to the demand for personnel at different levels to secure social advance in China. However, in respect of the quality of personnel, there still exists a considerable gap between our education and the first-rate education in the world. Numerically speaking, the personnel we can train, as shown in the above Tables, fall far short of the amount needed for our social advance.

The development of science and technology, especially that of information technology, has created the possibility of improving the conditions of education in China. The present paper will introduce, mainly in two aspects, the current situation of educational information technology in China and its prospective developments.

THE STRUCTURE OF EDUCATIONAL TECHNOLOGY IN CHINA

(including its subdivisions) is as follows:

(1) The audio-visual education centers in higher education institutions and professions/industries, which help spread educational technology among the respective institutions or professions.

(2) The local audio-visual centers (AVCs), headed by the National Audio-Visual Center of China (NAVCC) which help spread educational technology among the primary and secondary schools throughout the country.

(3) The local radio-television universities, headed by the Central Radio-Television University, which undertake, chiefly through the nationwide TV networks, formal-schooling education and education without academic credentials of various kinds throughout the country.

(4) The agricultural radio-television schools set up by the Ministry of Agriculture, which undertake education in rural areas in agricultural techniques in the form of technical secondary schools with academic credentials.

(5) The network of educational TV stations, headed by the China Education Television (CETV), which render television-broadcast service for the above-mentioned various forms of education.

(6) The China Education and Research Network (CERNET), which provides the means of academic exchange, both domestic and international, in the service of teaching and research at key universities in China.

Education with Audio-Visual Aids

The Chinese government has paid great attention to the utilization of modern means of instruction in primary and secondary schools as well as in regular HEIs. In order to popularize the use of audio-visual aids in primary and secondary schools, the National Audio-Visual Center of China and many local audio-visual centers (AVCs) have been established. According to available data, among the resources processed by these facilities are 2 billion frames of projector slides, 8 million hours of sound recordings, 8 million hours of video materials, in addition to a number of educational films (or film strips), and a collection of compact discs (including VCD and CD-ROM) and a collection of software used for CAI. Through the cooperation between the NAVCC and AVCs at various levels and the audio-visual education centers and AV classrooms of various educational institutions, remarkable progress has been made in applying modem media to classroom education provided in schools of all kinds. Moreover, progress has been achieved through relevant instructional design renewal of educational concepts and reforms for the enhancement of the efficacy of teaching, the optimization of teaching process, and other efforts to realize the goal of modernizing school education.

Education Television

As China is a developing country with a vast territory and a large population, in the education sector, besides doing a good job of running regular educational institutions at various levels with their programs delivered essentially by face-to-face tuition, efforts have been made to develop distance education through the utilization of modem means of instruction so as to effectively expand the scale of educational provision and create opportunities for more people to receive lifelong education.

As early as 1960, when black-and-white television sets just began to enter the homes of China's common people, radio and television universities (RTVUs) were established in such metropolitan cities as Beijing and Shanghai. With the advent of a new era of reform and opening up in China and concomitant with the formation of microwave television networks established in various regions of China, the Central Radio and Television University (CRTVU) was established in China in early 1979. In 1980, the Agricultural Radio and Television Institute (ARTVI) oriented to audiences and viewers in the countryside was established. With the commission of a satellite-transmitted educational TV channel, China Television Teachers College (CTVTC) was established in 1986 conducting service training of primary and secondary school teachers. China Liaoyuan Radio and Television School (CLRTVS) was established in 1990 providing programs of rural practical techniques oriented to the needs of rural developments. Thus, a multi-dimensional and highly diversified new framework of distance education has gradually taken shape in China over the years.

At present, the complex system of China's RTVU's is composed of the CRTVU (comprising also CTVTC and CLRTVS), 44 provincial-level RTVUs, 696 local branches of RTVUs, and over 1,600 county (or urban district-level working stations of RTVUs.

On the other hand, the Chinese government has invested in developing a network of satellite-transmitted educational TV programs. This network comprises China Education Television (CETV), which has at its disposal three satellite TV channels and a decimeter TV channel serving the needs of the Beijing area, 10 provincial-level educational TV stations and covering 1,000 relay stations, and over 10,000 satellite ground receivers. Besides, the cable television services in more than 200 cities have taken part in replaying the programs of CETV. Through the integration of these two networks, a wide-ranging network of distance education covering both urban and rural areas has taken shape in China.

By 1994 a cumulative total of 1,778,000 students had graduated from 359 subdegree (short-

cycle higher education) level programs (specialties) offered by the RTVUs throughout the country in diverse fields of science, engineering, agriculture and medicine; the humanities, economics, political science and law; and fine arts, physical education, and teacher education, accounting for 14.74% of the total output of graduates of all regular and adult HEIs of the nation in the same period. Besides, 3000,000 have successfully completed specialized secondary school programs provided by the RTVUs.

1,006,000 have graduated from the programs offered by ARTVI. The development of distance education in China has contributed a great deal to the formation of a new educational framework in China, to the renewal of educational concepts, to the improvement of teaching methods, to the expansion of educational provision, and to the improvement of educational structure, and to the modernization of education.

Computer Networks

China's economy has been growing very fast in recent years and China is becoming more and more open to the outside world. At the same time, the construction of the global information infrastructure has become a world trend. The Chinese government is promoting the construction of the China Information Infrastructure (CII), with the Internet connection forming one of the major concerns.

In December 1993, the China Education and Research Network (CERNET) project started to be planned. It is the first nation-wide education and research computer network in China. The CERNET project is funded by the Chinese government and directly managed by the Chinese State Education Commission. CERNET will connect all the universities and institutes in China in the near future and will connect high schools, middle schools, primary schools and other education and research entities by the end of this century. CERNET will link to the global Internet and will become a major part of the Chinese Internet community.

The main objective of the CERNET project is to establish a nation-wide education and research network infrastructure to support education and research in and among universities, institutes and schools in China using the up-to-date telecommunication and computer techniques. Its specific aims are as follows:

(1) Establish a nationwide backbone which connects eight regional networks and connect them to the global Internet.

(2) Set up a national network center.

(3) Set up ten regional network nodes.

(4) Adopt TCP/IP as the network protocol and establish network management systems.

(5) Provide Internet applications and develop China's information resources and applications.

CERNET has a three-layer hierarchy (the nation-wide backbone, regional networks and campus networks). The CERNET national backbone uses Digital Data Network (leased line) offered by China's Ministry of Post and Telecommunication (MPT). It forms a multiple ring topology and it has an international link connected to the Internet in the United States. Links to Hong Kong and Germany will be installed in the near future.

CERNET finished its first phase of implementation in December 1995. Currently, there are more than 100 universities connected to CERNET from all provinces and regions except Tibet. The regional distribution of these universities and the corresponding IP blocks (CIDR) are shown in Table 5. It is clear that the Internet development in coast areas is much faster than remote areas in China, the former having

enjoyed much faster economic growth. This indicates the correlation between Internet development and economical development.

Table 5.

CERNET Current Connectivity

Region	# of Univ.	# of conn.	IP Block
Beijing	191	10	202.112/15, 101.204/14, 162.105/16, 166.111/16
Shanghai	153	10	202.120/15
Nanjing	156	23	202.119/16, 202.194/15, 202.38.64/19
Xi'an	100	12	202.117/16, 202.200/15
Guangzhou	74	17	202.116/16, 202.192/15, 202.38.192/18
Wuhan	156	16	202.114/16, 202.196/15
Chengdu	113	9	202.115/16, 202.202/15
Shenyang	147	11	202.118/16, 202.198/15

CERNET is a nation-wide education and research network in China. CERNET has very rich information resources about China both in English and in Chinese. The starting point of CERNET information is www.edu.cn.

The CERNET information resources fall into 6 categories.

(1) University information. In general, it contains university history, departments, courses and related information.

(2) Information concerning technical/specialized topics. For example, China's stamp collection, ancient Chinese poems, China's water resources, mines and treasure, Chinese law database, universities equipment database. Such information is provided by experts in the specific fields concerned.

(3) Information concerning international sport events. For example, the 43th World Ping-Pong Championship, the 95 Asia College Student Championship, 3rd City Championship and so on.

(4) Hot topics for the general public. For example. Silk Road tourist, Cantonese food recipe and Chinese folk arts.

(5) Libraries with html interface. For example Tsinghua University Library and Peking University Library.

(6) Electronic magazines. China's Scholars Abroad. Mirror sites.

(7) Mirror sites.

Although CERNET has so far only finished its first phase of construction, it is the most important constituent of the information infrastructure in the top universities in China. CERNET makes it possible for our professors, graduate students and undergraduate students keep track of the research developments all over the world and communicate with cooperators/friends at home and abroad. CERNET also enables the outside world to know the education system and the education reforms in China. In addition, the digital library and remote education projects are being carried out based on CERNET, which is playing a more and more important role in China's education and research.

CONCLUSION

At present, China is one of the countries, which undergo the world's fastest development of their national economy. Economic development makes very high demands on education, and at the same time affords the necessary conditions for the improvement of educational technology. With the advance in the construction of the global information infrastructure, we are confronted with a tremendous opportunity and challenge to move towards new educational models in an information-oriented society through making full use of the existing facilities for audio-visual education, such as the educational TV stations, the China Education and Research Network etc. The policy we are ready to adopt is to bring into play the role of the educational TV stations throughout the country and that of the China Education and Research Network and actively to carry on research and development in integrating these two means in order to satisfy the demands of education at different levels.

NATIONAL REPORT OF CONGO

NEW INFORMATION TECHNOLOGIES IN EDUCATION SYSTEM

1. PREFACE

A National report, written in the form that was prescribed to the developing countries, can't illustrate sufficiently enough the required points as the scope of application of new technologies in the country and especially in the education system is quite narrow.

But the number of computers, used in government offices and education facilities of Congo, amounts to 5000 units. This makes us think that the fulfillment of the minimal program of informatization, which implies building up of the National Information Computer System, will lead us to the acquaintance with new technologies. The International Program of Communication Development constantly points to the drawbacks of this sphere. Actually, the only factor that slows down the development of this preferable sector is the lack of investments, estimated as 1% of Gross Domestic Product. Supporting the necessity of the rapid development of this sphere , the developing countries should look for other ways of settling the problem, then those offered for the developed states.

It is necessary to make special steps in this direction by counting on regional and international cooperation. Unfortunately , the execution of the bilateral cooperation programs are still accompanied by shortcomings, that form disproportion among the African countries, especially to the south of the Sahara. As to Congo, the following problems deserve particular attention:

- the present state of telecommunication networks (the development of networks with high carrying capacity and usage of optical cables);
- system and parametric studying of teleinformation networks;
- the terms of creatinig teleinformation networks for linking to the Internet system (working out of protocols, interfaces, etc);
- setting up an Internet server;
- training of a sufficient number of qualified personnel;
- popularization of new information technologies (participation in distant education programs);
- setting up a commission exercising an overall control of the situation .

2. THE STATE OF THE PROBLEM

Information science has shaken the world during last decade. Its rapid and constant development has reached up the level of applied programs in all spheres of life. The integration of informatics and telecommunication in the 70-s was called teleinformatics and moved the information sector toward new area of communication. Telematics, born by teleinformatics, is the discipline that will be used in equipping telephone stations that have to manage high density information flows, transmittrd in digital signals.

At the National Administration of Post and Communication and other information organizations (radio and television of Congo) theoretical introduction of telematics and new communications started rather late, in the 80-s. The year of 1990 was the beginning of their practical use in communication and information services: the Center of Temporal Communication (Centre de communication temporelle) was put into operation at the National Administration of Post and Communication in Brazzaville. The point is that the problem of popularization of informatics in Africa, and in Congo , in particular, was raised in 1980. That is why there are no quantitative assessments of the informatics and new information technologies spreading in

education system.

Preliminary arrangements in the frameworks of the Investigation of the process of setting up and utilization of teleinformatics and new information technologies in Africa were made unsystematically. They revealed considerable disproportion between countries in the discussed sphere , characteristic for the whole Southern region of Africa, especially for the countries to the south of the Sahara.

With the Program «The Decade of Transport and Communication in Africa» having been unrealized, each country carried out independently its minimum programs of the telematics and new information products spreading.

Congo participates in the ATF/CEFTI program. We have applied our first experience to the «Transit» project, financed by the Business Forum of French-speaking Countries. As a result, a special Internet server was assembled in the Forum's head-office in Paris. The system is furnished with the following minimum of equipment:

- 1 micro-computer IBM 486 DX2
- 1 modem (9000 Kbps)
- 1 printer HP 550.

Thus, there was set a «SITATEX BZV 8X.STX/28» station, providing a possibility of dialog with the whole group of correspondents. Its linking will be temporarily carried out through the network of the International Society of Space Communications. The established station can serve the teaching personnel of the M.Nguabi University as a mean of setting up relationship with their colleagues. It will also promote the application of new information technologies in higher education system.

3. THE PRESENT STATE OF THE BACKBONE NETWORK

Congo possesses a standard ground IVA station, situated in Brazzaville surroundings and directed to the Atlantic Ocean. There is also a more updated ground digital station, assembled in 40 km from the city Point-Noir. These two units provide an access to international networks. Still functioning on the base of the analogue technology, the Universal Service Network is unable to provide rapid information transmission. At present, the project of setting up a digital information transmission network has been presented and is likely to be soon placed in operation. Today, only private networks are able to handle massive flows of information. The International Society of Space Communications' network, being the base for the E-mail project «Transit», is one of them.

Other private information networks can be utilized (e.g. the Radiotelephone Network (CYRTEL).

Congo shows the average dynamics of telephone and private information networks development: from 1990 the increase makes up 60 % for Congo and 100% - for Africa. In order to catch up with the pace of the «communication and information revolution», radical measures should be taken. In particular, it is important to install an information network, based on the telephone and television channels of the National Administration of Post and Communication.

Functioning of about 100 computers and other equipment in the Commutation Centers provides assurance that the development will grow at a rapid pace after setting up the national teleinformation network. This work can be originated from the project «Technical space» that is being fulfilled by the group of experts, concluding communication engineers, teachers and scientists. This project is realized after placing the «SYTATEX» station into operation in Brazzaville.

In fact, the «Technical space» project, initiated by the National Center of Documentation, Scientific and Technical Information, presupposes pooling together all the existing local networks through the dial-up telecommunication network. First of all, it involves networks of research centers (M. Nguabi University) and International organizations (World Health Organization, UN Development program, AGRI-Congo, AGIP and others).

Our country has made use of the resources of the General Informatics Program, offered by UNESCO. Though our representatives took part in several international conferences, the country didn't receive computer equipment for its education system as we hadn't work out a proper project. That is why Congo submitted the «Technical space» project to the French-Speaking Countries' Experts Committee on the Problems of Telecommunications and Information Technologies. Thus, we are entering the «Transit» project, financed by the Business Forum of French-Speaking Countries, which has given the «SYTATEX» E-mail station into our disposal.

Besides this station , there is a server of the International French-Speaking Countries' Data Bank. Its technical facilities include: a micro-computer «DELL», a laser printer «Jet SL», software of «CDS/ISIS» type. The capacity of the system is 2000 information positions, that equals to the capacity of all the national libraries. By the way, our country acts as a distributor of the «CDS/ISIS» software, belonging to the Documentation Center of

the Regional African Office of the World Health Organization.

The largest private companies of the country operate tabout twenty telecommunication systems of «L.A.N.» and «W.A.N.» types.

The installation of the «SYFED» server, integrating the Electronic French-Speaking Network for research and education systems seems to be feasible. The possibilities of these projects and networks will expand with the introduction of a new network, elaborated by the American Firm «ATT» and called «Africa OME: Optical African Network». As a result , the applied technology will provide African countries with a free access to the services and information of international data banks. Their technical facilities amount to about 5 mln computers, linked to Internet. The «Young Africa» magazine (# 1801, July 1995) graded this event as a «technological breakthrough».

Informatisation of school management, carried out with the help of UNESCO, and the planned informatization of the University will lay the base for the composing of a local network of the education system in Congo.

4. RECOMMENDATIONS

The main objectives of this Congress can be formulated as follows:

- establishment of the Permanent Observing Committee for the Program of elaboration and carrying out of educational policies and application of new information technologies - NIT. (Congo suggests a non-governmental status for this organization);
- popularization of NIT as the preferable instrument of progress and supporting NIT development;
- studying the problems of effective introduction of NIT in the developing countries;
- determining ratios of NIT development;
- supporting the working out of national plans of the NIT development in the education system;
- harmonization of services and equipment tariffs;
- providing professional training and human resources development;
- using of statistics;
- carrying out research and information exchange;
- participation in different International organizations, related to NIT.

5. CONCLUSION

It is impossible to talk about the progress of NIT in the developing countries without analyzing the situation in some of them. The survey is likely to be oriented to the desire of finding both the most successful and the most undeveloped fields. And this process should be accompanied by passing of technologies .

During the next stage, the analysis could consider all aspects of the problem (development level, real needs from the point of view of newly creatd services, control over NIT development, etc.). Such approach will make it possible to elaborate measures, conserving and perfecting the achieved results, to propose new rational solutions within a short period of time. And all these steps prove the above mentioned thesis that the developing countries have to look for an alternative way , than the developed states.

Thus, the Congress should be more pragmatic and should offer new forms of cooperation.

APPENDIX

The Research Program of the process of telematics and new information products introduction and application in Africa.

1. Telematics definition and its contents
2. New information products - toys or necessities: an automobile radiophone, teleconferences (including audio - and teleconferences), telecopying, teletext, videotext, teleanswers, automated dialing systems, storage devices, etc.
3. It is a necessity to apply telematics and new information products to the African countries with their development level and needs?
4. Who can be today's and tomorrow's users of telematics and new information products (government bodies, companies, rural communities,

education, medicine, agriculture, etc.)?

5. What product , based on telematics can be suggested?

6. Political, economic, social and cultural consequences of the presence or absence of telematics in Africa.

7. If the large projects carried out under the Program «The Decade of Transport and Telecommunications in Africa» can be continued without the fulfillment of minimum program of telematics and new information products development?

- If «yes», what will be the consequences?
- If «no», what will be probable and desirable advantages

8. What kind of information popularization policy should be carried out in Africa for promoting the development of telematics and new information products, adopted to Africa.

9. Conclusion.

PRESENTED BY

THE GENERAL DIRECTORATE OF TECHNICAL EDUCATION AND OCCUPATIONAL TRAINING
BRAZZAVILLE

THE NATIONAL REPORT OF CROATIA

INFORMATION TECHNOLOGY IN EDUCATION

ABSTRACT

Croats are an old nation who had their state centuries ago and then have lost it. Recently they regained it and realised their future depends, among other things, on their ability to adopt and implement latest information technologies in all aspects of their lives.

In less than five years one of the best academic and research information infrastructures has been deployed covering the whole community and culminating in the brand new 155 Mbps ATM core backbone.

Croatian future plans concentrate on spreading the infrastructure and technology into elementary and secondary education as well as other aspects of alternative, additional and continuous education.

Introduction of country's leading individuals as well as decision-makers to IT, its applications and its consequences is considered to be one of the priorities. Educational process and system is considered to be the crucial importance in achieving those goals and to have the decisive role in creating the nation's capability to take an active role in the future world.

In achieving those goals a number of problems is expected: financial, social and psychological.

This paper suggests that our ability to transform education and use it to transform the society will determine our ability to survive at all.

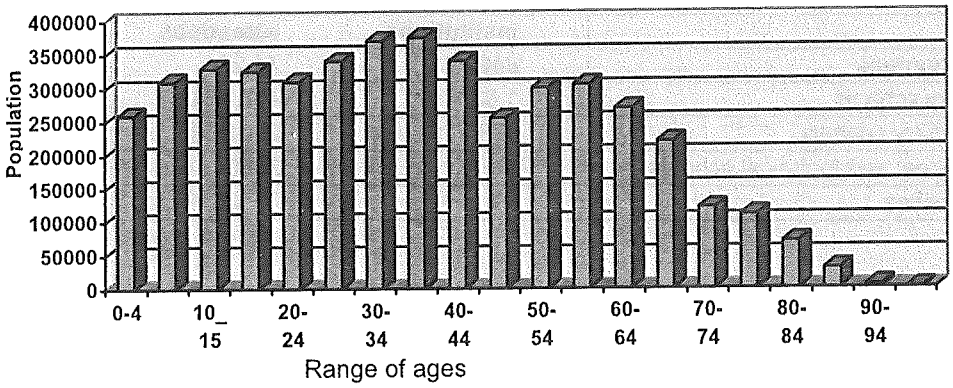
1. CROATIA IN GENERAL

Croatia is a Mediterranean state in central Europe. It covers 57,000 square km of land, framed with 2,000 km of land borders and 6,000 km of coastline along the Adriatic sea. A special geographical beauty present 1,185 islands.

Croats inhabited Dalmatia the southmost part of contemporary Croatia along the Adriatic sea, about 630 A.C. The first Croatian state was established in 892 A.D. and its independence lasted for three centuries. Afterwards, Croats have been a constituent nation in various states until 1990 when Croatia declared its independence. United Nations recognised Croatia as a sovereign state in 1992.

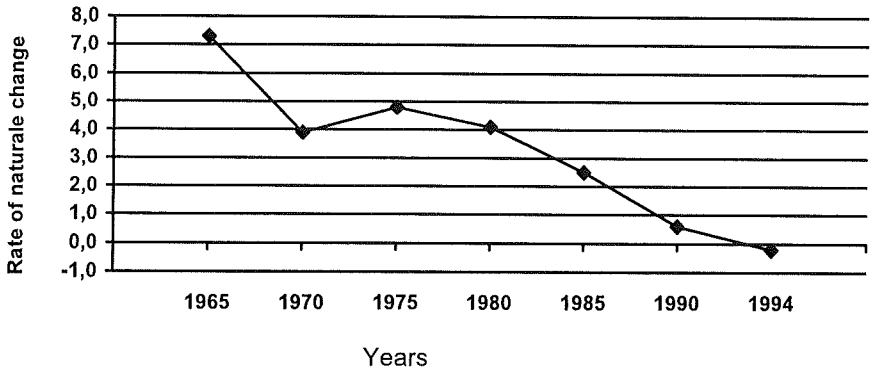
Today's population of Croatia counts 4.8 million, 67.5% of which are in active age, between 15 and 64 years.

Population according to five-years age groups



The war in ex-Yugoslavia from 1991 till Dayton agreement in 1995, inflicted significant social changes reflecting in decrease of GNP from 24.4 billion USD in 1990 to 11.86 billion USD in 1993. Population growth was continuously decreasing since 1975 and reached its minimum at -0.2% in 1994.

Rate of natural change in population



2. EDUCATIONAL SYSTEM IN CROATIA

The oldest written document in Croatian language is a monument "Bascanska ploca" from 1100, in glagolic script. First university was founded in 1669. According to census in 1991 illiteracy in Croatia is at 3%.

Croatian educational system is compatible with those in most European states which enables easy transfer of students at every level. This is often exploited during secondary or higher education. Degrees from most Croatian faculties are recognised in the world.

The educational system has four levels:

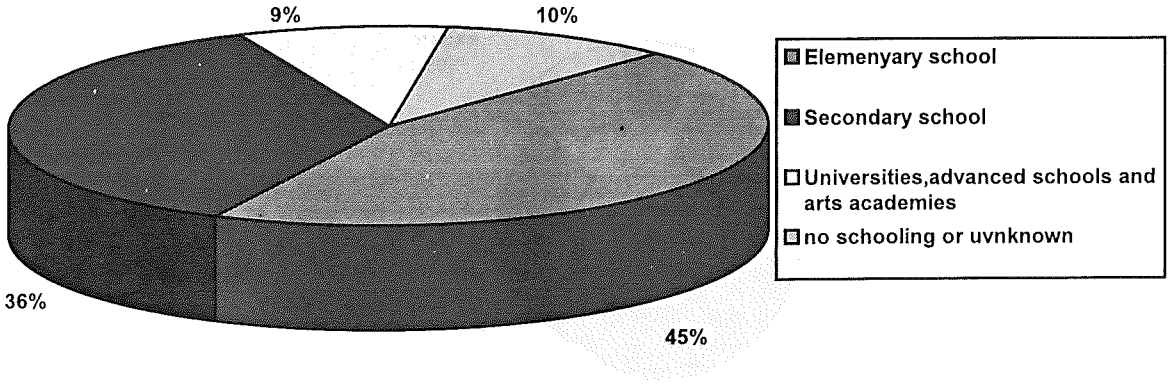
- kindergarten for ages one to seven
- primary education in duration of eight years
- secondary education in duration three to four years
- higher education in duration of three to six years

Number of education institutes, attendees and teachers in school year 1994/95

	Institutions	Attendees	Teachers
Kindergartens	846	74,274	5,081
Primary schools	1,936	438,461	24,091
Secondary schools	478	200,358	15,449
Vocational and technical schools	3	2660	79
Universities	61	77525	5814

The new law on education allows privately owned educational institutions at all levels. However, the majority is still owned by the government and the education is free to all citizens of Croatia. Students do pay for textbooks, food and lodging although a part of those expenses is subsided from the state budget.

Population aged 15 and more years by second degree



2.1. PRIMARY AND SECONDARY EDUCATION

The primary and secondary education in Croatia are free to all citizens of Croatia. Primary education is mandatory for all kids over seven years old.

In addition to regular forms of primary and secondary education there are: education of children with learning disabilities, education of adults and primary musical and dance education.

Special education for children with learning and other disabilities is conducted in elementary and secondary schools for 80,000 students using individual instruction and special techniques.

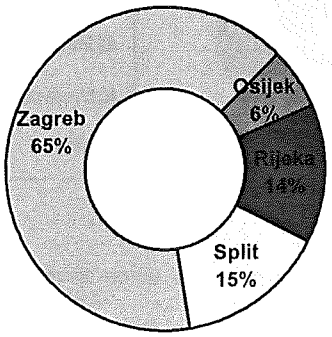
Elementary and secondary education for adults is conducted according to special curriculum and program of instruction, and can be pursued by attending classes or passing examinations. The costs of such education are borne by students themselves or their employers or the Department of Employment.

Ethnical and national unions and minorities have special elementary and secondary schools or classes.

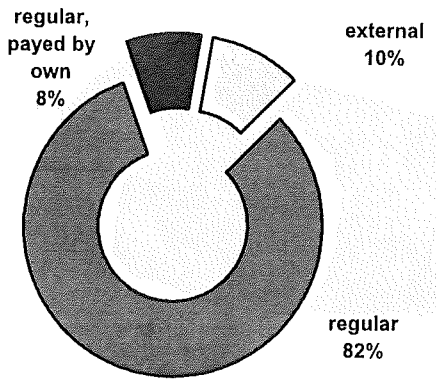
2.2. HIGHER EDUCATION

The Croatian academic community consists of four universities: Rijeka, Osijek, Split and Zagreb. 6,000 teachers educate 80, 000 students..

Number of students by universities

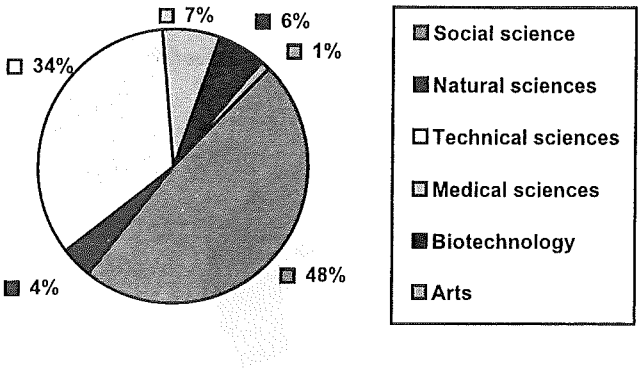


Number of students by type of schooling



Number of vocational and technical schools and universities and students by science fields

	Institutions	Students
Natural sciences	2	3,240
Technical sciences	26	27,620
Medical sciences	4	5,760
Biotechnology	5	5,046
Social science	25	37,759
Arts	3	760



2.3. CONTINUOUS EDUCATION

Currently there is very low demand for continuous education. Statistics show that 48% of participants in a survey in 1975 with about five years of working experience attended some kind of additional education. In 1987 this number has fallen to only 11%. This negative trend is due to labour laws and regulations imposed from ex-Yugoslav regime in the seventies which obstructed and discouraged workers to stream for better education. Today, this number has only slightly grow to 13.7%, mainly due to the war situation present in the country since its declaration of independence.

This situation is unacceptable since trends in employment and market of working force as well as trends in economy in general expect workers to keep up to date with changes in their profession and enable themselves to work in interdisciplinary areas.

Additional problem is the question of literature. Croatian market is rather small so publications are relatively expensive. The same is true for imported international literature due to high transportation costs and relatively low average incomes of citizens.

3. THE ROLE OF MINISTRY OF SCIENCE AND TECHNOLOGY

Ministry of Science and Technology is organised in five departments. One of them is Department for Information Technology. It's duties are:

- co-ordination of development and application of IT in all areas of public activities
- development of information system for academic and research community
- development and maintenance of IS for the Ministry

Definition and enforcement of Law on Information Activities and other regulatory documents the Ministry should facilitate and co-ordinate deployment and usage of IT in all areas of public interest or whenever equipment, SW or services are being purchased with money from state budget. Application of standards is necessary in order to ensure compatibility of people, data and equipment.

The primary method for stimulation of deployment of IT are pilot projects which target real-life problems in real environment and give case studies for similar problems. This helps non-IT people to get the feeling of the benefits, but also requirements of the application of IT. Pilot projects are usually performed by academic and public research institutes though other candidates are not excluded.

National information systems in various areas of human activity are increasingly gaining in importance for everyday's life. Their compatibility, connectibility and data interchargeability are therefore of great importance. In addition, a small country like Croatia has to take care on the usage of its professionals in key areas. This all means that not only hardware, software, applications and data but also people need to be compatible and exchangeable between different national information systems.

Thus, Ministry has adopted the policy which requires all new systems to be built on open operating systems platforms originating from UNIX, mandatory use of TCP/IP protocols and international EDI standards.

Enforcement of this policy should prevent unnecessary development of propietary systems requiring specialists of limited use and resulting in closed worlds.

The main goal of the whole effort is to improve the quality of life of every citizen.

The introduction of IT in academic and research community is undergoing. Activities are focused on providing necessary tools and infrastructure which are of common importance. This includes, but is not limited to: PC's, network nodes (UNIX workstations), modems, office software, programming languages, database systems, scientific databases and referential information. In order to facilitate the usage of advanced ITs, a variety of pilot projects are being initiated. Their role is twofold: to demonstrate the usage of IT in some activity or process and to introduce an academic group to team work and project management.

"Scientific Information System" also belongs to the domain of Ministry. Its aim is to provide an information infrastructure for preservation and dissemination of all types of information acquired or produced in scientific research in Croatia. The development and deployment of system is being centred around six thematic centres covering specialised scientific areas and fields. It is intended not only for better co-operation among scientists but to facilitate co-operation of science and business, as well.

4. CURRENT STATUS OF INFORMATION TECHNOLOGY

4.1. The Internet in Croatia

The main information infrastructure of the modern society is computer-communication network. Today, it is quite clear that it should be some kind of "information super-highway" based on TCP/IP technology.

Only five years ago it was not so obvious but it was then when Ministry of Science and Technology of Republic of Croatia decided that one of key elements of Croatia's strength in future (both social and economical) will be it's ability to use and develop modern computer-communication infrastructure.

Therefore, in the middle of war, in autumn 1991 the idea of Croatian Academic and Research Network was conceived and in less than a year a national infrastructure based on Internet technology covering all four universities has been created and put in operation.

Today, less than five years after, CARNet reached each and every faculty and institute and upgraded it's core backbone to the latest 155 Mbps ATM technology.

A special care has been taken not to profile the network from information consumers point of view, but rather to stimulate users to provide information from the very beginning. It has been achieved by equipping each institution with at least one network node based on UNIX workstation and running networked information services on it.

Thus users were able from the beginning to supply their own information or digests to the network.

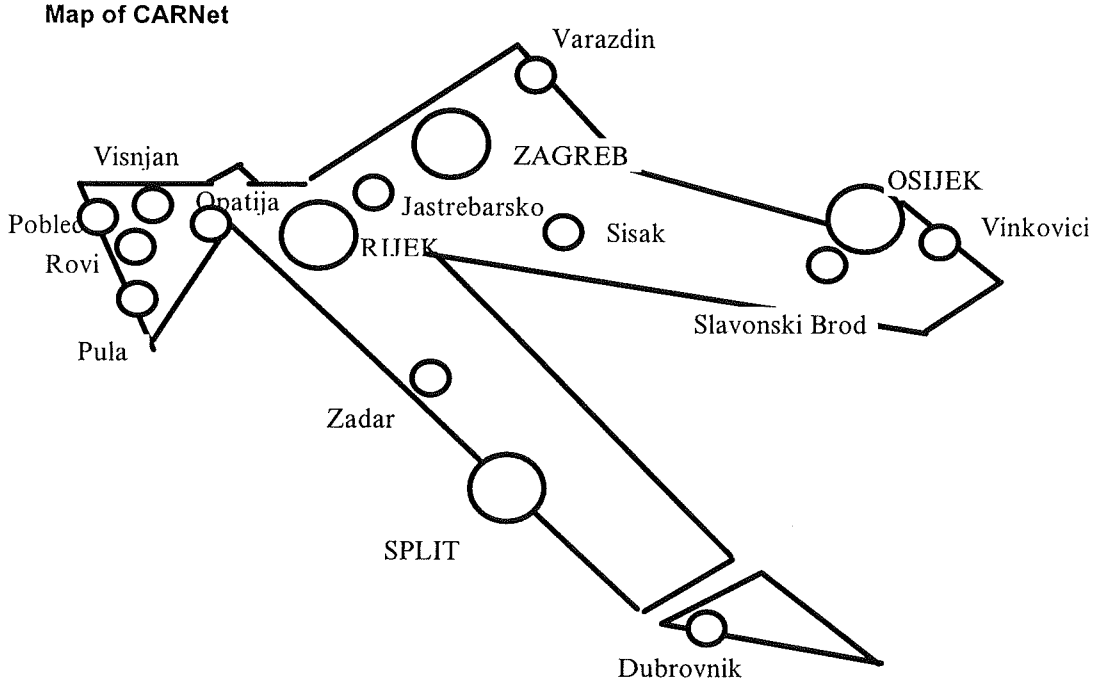
This infrastructure was available to all segments of Croatian society enabling contact with latest information technology to institutions, companies, groups and individuals.

The project did not confine itself to acquisition of equipment and software only. Education of users and developers, pilot and user support projects are equally important.

Numerous pilot projects help to demonstrate usage and importance of IT in various fields of

human activities. The most important projects are: the office of the President, government, Croatian Radio and Television, travel agencies and various medical pilots aimed at laymen, students and professionals.

Map of CARNet



Services provided and examples given helped rise broader attention and thus initiate creation of IT market. It enabled Croatian Post and Telecommunications to start it's own Internet service and thus open doors to commercial activities.

Although CARNet allows access to technology and services to all citizens free of charge, it's aim is not to substitute or compete with commercial or not-for-profit organisations. Still, CARNet provides services to more than 6,000 users on it's public host and negotiates deployment of Internet access point in public libraries in attempt to accelerate the spread of IT usage among "ordinary" citizens.

International project "GLOBE" is being used as a launching vehicle for penetration of IT into elementary and secondary schools.

4.2. COMPUTERS IN CLASSROOM AND WORKPLACE

The global trend in development of IT is towards personalisation and closest possible approach to individual user. As a consequence it means that users are no longer prepared to travel to IT access point. They expect it on their desktop.

It means that every student and teacher should have a personal computer on their desktop with appropriate connection to global Internet. However, it is impossible to achieve for a country like Croatia, not only because of the huge number of units which should be deployed. The second problem is ever shorter living cycle of IT equipment. Five years old PC is practically unusable.

Therefore, the number of educational workplaces equipped with IT is too low. In average, about 1,000 PCs enter classrooms of elementary and secondary schools every year. The same is true for universities and research institutes. The required number would be about three times higher.

However, much better situation is in global connectivity. Academic community is completely "connected", and process for elementary and secondary schools is about to start.

5. PROBLEMS ENCOUNTERED SO FAR

Although great efforts have been made to supply sufficient number of PCs and other required IT equipment to classrooms and workplaces in the academic, research and educational community the absolute number is still too low. Additional problem is in the fact that the equipment is not homogenised in the sense of age and technological level which complicates maintenance and uniformity of applications.

However, this is not the greatest problem. Existing equipment should be used to it's maximum, which is not the case. The major problem is the lack of educational contents (products) utilising new IT. In addition there are very few contents to be used out of regular educational process.

To achieve this is two primary factors: a number of producers and a critical mass of skilled and motivated teachers. And this is where the major problem lies.

The chronical lack of money in state-funded education prevents creation of educational software market and competing producers. This situation is worsened with the fact that interest for additional and continuous education is decreasing for the past twenty years. State policy of ex-Yugoslav regime only discouraged individuals motivated for auto-

education.

The lack of domestic educational material has been substituted with the quality products from the world market. Small Croatian market makes translations expensive and lack of state policy makes imports equally expensive.

All mentioned is accompanied by the general fear of new technologies in middle and old generations of citizens, professional and educators, as well as in huge administrative structures.

Children and users are much faster and are on the forefront adopting and using new Its and they leave far behind their teachers and administrations. The result is the chronical lack of acceptable use policies and rules of behaviour in virtual world.

Fast penetration of IT in everyday's life brings common social problems into this new world of electrons and photons. However, the means and organisations that should prevent or fight them do not follow that speed.

Therefore, aggressiveness, selfishness, ruthlessness and misuse are sometime more visible and annoying in electronical than in material world. Instead of repressive and law enforcement methods, education would be much more fruitful in making Cyberspace a better place for living.

6. FUTURE IMPLEMENTATION OF IT IN EDUCATION

The long term strategy in the field of nation-wide introduction and implementation of IT should take care to provide sufficient information, presentation, reading materials and hands-on experience to political and economical leaders and decision-makers in general.

Specialised presentations and courses will be organised for the members of the government, parlament, political parties and state-owned companies.

Case studies and real life examples of those who faced similar problems world-wide are most convincing methods for getting attention and trust in IT.

This activity has to be organised on a wide front, simultaneously attacking all fields of human and social activities: public administration, public health, education, tourism, commerce, army and others. Likewise, this process has to include individuals in the highest positions in hierarchy but this mustn't be the only focus, IS and IM executives and professionals need to be included as well.

For future generations it is crucial to ensure that today's generations of new teachers leave their schools with knowledge, confidence and enthusiasm about IT. However, it is important to avoid situation in which teachers community would be divided in two camps: those who can and those who can't. Therefore, courses, training and textbooks need to be prepared for older generation of teachers. In the whole activity, a special care should be taken for the needs of non-technical teachers.

Literature and best international educational software need to be translated and localised for use in national educational process. This is the easiest way to quickly start the process. It should be immediately followed with government initiatives in production of domestic educational material.

This century has seen hundreds of thousands Croats leaving the homeland and starting new life elsewhere in the world. They have been driven by economical and political forces and majority remain outside of Croatia. Today, it is believed that as many as 3 million people world-wide consider themselves to be of Croatian origin. This is a great tragedy of Croatian people, but it is also a great treasure for the small nation.

Cultural and economical ties between diaspora and homeland need to be intensified. IT can help in a great deal by providing textbooks in Croatian language, display of Croatian national and cultural heritage, establishing databases of economical interest. It can help diaspora influence events within the homeland, but also get a homeland a better picture of needs and potential of diaspora.

Croats have been successful in selling their potentials world-wide. IT might help them to do the same, but this time, without selling their physical being, i.e. emigrating.

7. PROBLEMS EXPECTED

The problems we discuss here are problems of educational process. The main subject in it is the teacher. It is the basic element from which success or failure will result. Therefore, the main problems to be expected in Croatia are in establishment of positive selection of new teachers, motivation and enthusiasm. Social status and material conditions are key elements in achieving those goals.

Croatian educational system is relatively large and thus introduction of IT infrastructure poses a financial and organisational problem. It is expected that financial sources will be weak for several more years and that several generations of equipment deployed need to be accepted as normal operational environment. Awareness should be kept in mind of the consequences of this state to the applications and educational programs.

A multitude of laws and other legal documents need to be defined and enforced in order to create a stable environment for development, application and use of IT in all types of activities.

Educational system has huge role in educating users not only in the use of IT but also in proper use and behaviour as well as rising the awareness of new relations such as copyright and license issues.

It is equally important to stress information acquisition as information providing in educational process. A great deal can be achieved by taking information from premiere sources. However, true results are achieved only through active co-operation which assumes intensive sharing of own information, i.e. information providing.

Great dynamics in IT market and economy in general requires that technical aspects of IT be

separated from the content, legally, financially and administratively. The trend should be toward decentralisation, demonopolisation and deregulation.

Without government intervention it is hard to expect faster creation of educational software market and producers. A kind of "New DEAL" is required in order to start things rolling.

Privacy and security issues are in the centre of interest of Cyberspace citizens and those who consider to apply for citizenship. In order to compensate these problems and seek viable solution it is necessary to separate technical and social aspects of the problem and thoroughly re-examine and redefine the fundamental values of our society.

Education has the major role in this process.

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NATIONAL REPORT OF CUBA

REPORT ON THE MODERN STATE OF NEW INFORMATION TECHNOLOGIES IN THE EDUCATIONAL SYSTEM OF CUBA

The state educational system in Cuba consists of the following subsystems:

- *Pre-school education*
- *General polytechnical and labor education*
- *Special education*
- *Technical and professional education*
- *Adult education*
- *Higher education*

In the academic year 1986/87 a wide-range introduction of the State Program of Educational informatics into the national educational system began. Since then, this program has become the priority direction in education.

Introducing informatics into education is done on three levels:

1. State educational system.

2. System of industry-branch and territorial institutions for raising qualification, which comprises refresher courses for persons employed in industry or service.

3. System of Popular Distribution, which includes computer and electronic youth clubs, pioneer palaces, and mass media. Various educational and entertaining actions with unlimited access are organized within this system.

The initial objectives of the Ministry of Education were:

1. To familiarize pupils with computer equipment and to cause their interest in studying the computer.

2. To develop pupils' skills of interactive work with the computer and peripheral devices.

3. To teach pupils basic concepts and methods of work with information, so as they could solve simple problems (especially in other subjects) and apply their knowledge in various situations.

The program was introduced on the following levels:

- in all higher education centers, where informatics was taught as separate subject in all departments and was included in the graduates' diploma;
- in higher pedagogical colleges (there are 14 of them) and in the centers preparing teachers. Informatics was included in the teaching plan (the contents of the course differs depending on the specialization). A new specialization called "Informatics teacher" was introduced;
- in baccalaureate schools, where the course of informatics is taught 3 years and includes 200 hours of lectures;
- in high school, where pupils could choose informatics as optional subject according to the program "Sphere of interests". Informatics was taught two hours per week. Various methods were used in schools in order to familiarize pupils with computer equipment and show them the role of computers in the society;
- in 157 primary schools by way of an experiment intended to study possible methods and forms of introduction computers on this level to develop rudiments of computer using culture (in the LOGO language) in the framework of courses of mathematics and native language;
- in 45 specialized schools for children with psychological deviations;
- in the centers of technical and professional education a one-year course of informatics was introduced for all professions (the contents of the course depends on the profession).

To perform all that, it was necessary to fulfill the program of investment and teachers training.

22,000 computers, both 8 and 16-bit, were

purchased.

In the institutions included in the program, laboratories with 11 working places on the average were organized. The number of laboratories depends on the number of pupils, so as to have one computer for 2-4 pupils during the lesson.

At the first stage, 3,500 practicing teachers and graduates of pedagogical colleges, as well as scientists with diploma, were promptly reshaped into teachers of informatics. At the second stage, training teachers of informatics in pedagogical colleges began.

A teaching plan for training teachers of informatics was developed, didactic concepts for each type of education were worked out, textbooks and activity books for each level of education were published.

Measures for development and evaluation of educational software were taken; this is necessary for the further development of the program of educational informatics.

Moreover, finances and computer equipment for education management were allocated. This measures were applied to the central educational agencies, provincial educational committees, and pedagogical colleges, with the purpose of processing information about the level of pupils' knowledge and about the pedagogical staff, planning incomes, processing statistical information, information on the number of children attending school, etc.

We can draw the following conclusions from the ten year experience of fulfilling this program:

1. Of all the components of the Program of Educational informatics, preparation of the personnel is the most important for success.

2. Concerning general objectives, contents, and didactic concepts, one could point out that:

- preparing pupils to problem solving with the aid of computer should be the principal part of the program;
- while teaching basic informatics, one should include it in the contents of the school program in order to form culture and skills of using computer;
- taking into account what we said above, one should make teaching via problem solution, which is the main didactic method in teaching informatics.

Introduction of information technologies into education implies paying special attention to the following problems:

- demand for information technologies;
- study of skills and needs of users of iinformation technologies;
- social, psychological, and cultural problems that influence upon usage of information technologies;
- psychology, sociology, and ethics of users and groups of users;
- methods and techniques of transmitting information technologies from the manufacturer to the user;
- qualification of teachers that use information technologies;
- orientation at information service in education;
- the necessity of working with non-standard methods and service;
- harmonious inclusion of information technologies into teaching plans and programs.

PROSPECTS AT EACH OF THE STAGES OF EDUCATION

In the primary school, the number of computer-training centers will be increased. The main purpose is the same: to familiarize a child with the computer world and to use informatics as an aid in studying various subjects.

In the special education, work with children with psychic anomalies will be continued; informatics will be introduced into programs of other courses in order to support the treatment the children receive.

In the basic high school, informatics will be introduced as a separate subject. The objective of developing basic computer education with the use of computer programs or software packages remains the principal one. These programs are intended to develop basic skills of interactive work on personal computers, of using computers for solving problems in other subjects and for other needs.

On the baccalaureate level, informatics remains a separate subject still. The main objective is to supplement basic knowledge of informatics with specialized software packages and elements of programming. The result of this should be development of skills of computer-aided problem solving.

In the technical and professional education the main objective is teaching applied informatics, dependent on the specialty, and the development of skills for solving problems that arise in industry or service. All this should be accomplished by teaching programming languages and skills of using software systems.

In the preparation of informatics teachers, the main stress will be made upon their technical and didactic training, which will allow to raise the level of teaching.

In other pedagogical professions, the teaching of informatics will depend on the character of the profession and the subject.

In colleges, systematic training of practicing teachers will be organized basing on postgraduate student courses.

It is also planned to create a network for the

National Educational System; this network will be used for distant education, accessing databases, processing information pertaining to management of education, exchange of software, technical, and scientific documentation.

Concerning the obstacles to introduction of the new technologies, we came to the following conclusion:

The main obstacle is of economic character. The present financial restrictions did not allow to systematically invest into new technologies for education and specialized technical documentation.

The Cuban program of educational informatics is not supported by any international program.

DEVELOPMENT OF INFORMATICS IN CUBAN UNIVERSITIES UNDER THE AUSPICES OF THE MINISTRY OF HIGHER EDUCATION

INTRODUCTION

The computerization program for higher education was approved by the Cuban Government in 1984, with the purpose of developing and applying the strategy of introduction computer equipment on this level of education.

At the first stage the program was financed centrally by the state. A major step was made then in the direction of outlining development prospects of national culture in informatics, and needs of various educational services in computerization were determined.

The ministries and organizations having the greatest need in computerization of the educational process were included in the program.

Due to the economical crisis in the country, in the first months of 1991 a decision was made to decentralize the program; it was suggested that the universities change over to self-financing. In particular, it was decided by the Ministry of Higher Education that under these circumstances each university should take the responsibility for fulfilling this program as far as its currency income permits.

The aim of this document is to give an account of the most important points in the history of the computerization program for the Cuban university system, of its present state and prospects, and of the priorities outlined by the Ministry of Higher Education.

1. EVALUATING THE RESULTS OF INTRODUCING THE COMPUTERIZATION PROGRAM

During the ten years that have passed since the moment the computerization program was outlined, significant progress was made. Further on we name the branches in which the success is apparent.

A. Professional education

The computerization program allowed one to include computer literacy in plans and programs of all disciplines, both computer oriented and those where informatics is needed as teaching means and/or tool.

Speaking of preparation of experts in informatics or modern information technologies, one should say that, as a result of intensive work, 13,000 specialists were prepared, including 2,111 experts in electronic equipment and microchips, 3,142 experts in automated control systems, 3,920 experts in telecommunication, 1,500 experts in programming and 1,400 experts in engineering informatics (numerical methods).

For each specialization, a plan of using computers was developed that provided for optimization of the educational process by creating real situations to be analyzed during the classes or increasing quality and exactness of solving various problems. This plan was called General plan for computerization of professional education and became the main document according to which introduction of computer literacy into teaching programs was done.

Each program determined exactly the needs of future specialists in computerization and teaching plans in informatics. We have serious achievements in introduction of computers into the process of training veterinarians, chemical and mechanical engineers.

Introduction of computers allowed to add new methods to those used by professionals in their work, thus allowing to solve the problems that are very hard to solve using old methods.

It should be noted also that one of the achievements of this program is changes in the public opinion about the necessity of introduction the computer as essential tool for solution of many problems. Although these changes in mentality cannot be called universal, they should contribute to a breakthrough which will allow the specialists to use their professional potential more efficiently.

The computerization program contains the

concept of final user, according to which the classical schemes of mastering one programming language for each separate occasion were discarded.

The flexibility of the computerization program allowed one to adjust software and equipment to needs of each particular branch of knowledge and guaranteed the steady development of technologies.

The obvious success of the program in developing methods of application of computers to professional training allowed us to conclude five years ago that we were in the avantguard of the third world and able to compete with some of the developed countries.

The present crisis and the stringent economical blockade imposed on us by the United States are the reasons for the ceasing of funding the computerization program, which had negative effect on the performance of the equipment and made it 83% obsolete. All this told very negatively on the quality of training specialists. For example, the operating environment Windows, which became standard as early as five years ago, can be installed only on 27% of our computers.

B. Training professors, scientists, and post-graduate students

Training professors and researchers is one of the principal factors in attaining the prospects of the computerization program. To that end, for each discipline, the scope of knowledge and skills in informatics required for a professor of it was established. It is clear that efficiency of introduction elements of programming and modern technologies in general depends on to what extent the professor himself has mastered the computer and uses it in his work. This is why the shortage of equipment has a very negative effect upon the level of training of our professors.

Concerning post-graduate training of professors, considerable success was made in this field, because we managed to satisfy the needs in various branches of education, consulting, and service of computer equipment.

We managed to have about 130 refresher classes in informatics for users and personnel, even though shortage of the necessary equipment had its negative effect on this kind of activity, too. A great number of students participated in these classes; the equipment installed in non-university organizations was used as well. In the framework of this activity, 5 teacher-training programs were accomplished (for training teachers of informatics in general, teachers of informatics for engineers and architects, teachers of educational informatics, teachers of programming and of applied programming) and one program for training specialists in computer-aided design and typesetting. 50 persons attended these classes.

There are also a few professions which, not being of a purely computer character, require some knowledge of software and computer architecture. On the other hand, of 169 professions existing in the country, 125 (74%) include computer literacy as one of the disciplines in their syllabi.

An important role in training teachers, scientists, and graduate students was played by the Regional Center of Computer Training for Teachers of Architecture and Engineering (CREPIAI), which is a branch of the Jose Antonio Echeveria Polytechical Institute and by the Center of Informatics for Managers, which is a branch of the Habana University. Both of these centers were created under the auspices of UNESCO.

C. Research

An extensive use of computers is observed in this field; it is thanks to the computers that most of the success in the sphere of higher education was achieved. This statement may be supported by the fact that at the contest of projects submitted to the Ministry of Education for financing, most of the projects submitted imply the use of computer as indispensable ingredient. Of course, levels of the projects vary since the command of computer is not the same in all the groups.

Some scientific teams regard informatics as subject of their research, others are related directly to development of software. Among the teams working with applied programming, those working upon applications of informatics to education stand out. In 8 of 15 universities belonging to the Ministry of Higher Education there are research teams that actively work in the field of educational informatics, that investigate and develop software, programming languages, multimedia, etc. It is a proof of their fruitful work that 50% of works submitted to the Congress "Informatics in Education", which took place in Habana in March 1996 in the framework of the Convention "Informatics in Education", were from our universities.

One of the methods of stimulating interest in informatics among scientists and students is the Students' Computer Contests for the students of the last five years. The number of participants of this competition is steadily growing.

D. Management and using scientific and technical information with the aid of computers

The network of the Center of Scientific and Technical Information of the Ministry of Higher Education was created in 1972; since then and until 1984 the organization of this network had been improved. The finances assigned to this network were used for the purchase of equipment and information and for automating management of university libraries. Since 1984 to 1989 the final phase of creation of the network began, that is 19 centers of information (or main libraries of 15 universities of the Ministry of Higher Education) were founded.

During this second stage, the main investments were made into the purchase of information, computers, copiers, laser printers, CD ROMs, scanners, modems, and other materials required for strengthening the network. After 1989, one continued investing in the network, for information was purchased and the performance of the network was enhanced.

At present, about 3 million copies of books, periodicals, and other documents are stored in the universities. This is why such services as photocopying, computer-aided bibliographical and context search were organized, and databases were created. At the moment we have 300 databases that store more than a million records. Only in 1994/95, the support service allowed to add 77 thousand original articles to these databases (9 articles per one professor or researcher on the average). The network exchange among 3,000 organizations, in which 39 university scientific journals are published, has achieved a great scope. Several thousands of copies of the journals, to the total cost of more than 100 US dollars, take part in this exchange.

As an important event in the history of the network, one should point out the creation of the "National Server of Scientific and Technical Information" with the REDUNIV node. This server is situated in the Center of Scientific and Technical Information of the Ministry of Higher Education (the ICT/MES center), from where the program of development of the network is directed and coordinated. REDUNIV provides e-mail, spreadsheets, referative, bibliographic, mixed and control databases that were purchased or developed in the network. All services are supported by the database control system CDS/ISIS, which is known as MICROSIS and has been distributed by UNESCO.

On the other hand, the ICT/MES center distributes the MICROSIS system in all the country, to which end 90 courses and seminars have been organized starting with 1995; about 1500 persons from 22 organizations attended these courses.

One should point out that REDUNIV node gives our universities the access to the Cuban Academy of Sciences network via X.25 protocol, which gives access to other national services and to the international email via UUCP.

In spite of all these achievements, the access to scientific and technical information with the aid of modern technologies is extremely difficult due to problems with equipment and to the poor quality of national telephone lines.

E. Management of the universities

Speaking of computerization of administrative functions in the universities, a new tendency should be pointed out: the automated systems are coming closer to the final user, thus breaking the older schemes of functioning of computer centers. The systems developed by the Ministry of Higher Education and by the universities themselves allowed to improve the working discipline and to secure more efficient administration of the universities.

The grave situation with equipment had its negative effect both on this field of activity and on the capabilities of the personnel specialized in installation and service of the network in the universities. During the last 5 years, we managed to maintain the level of automation of management in our university centers; in those with the greater potential, their own programs were developed or the base programs were improved.

2. THE FUTURE OF THE PROGRAM OF COMPUTERIZATION OF THE HIGHER EDUCATION IN CUBA

In November 1995, the National Commission in Computerization of the Ministry of Higher Education in Cuba was founded. Experts from all the universities are members of this commission. They decide the directions in which one should develop the computerization program and what parts of the program, which had been created 10 years ago, should be updated.

The measures taken indicate that the Cuban revolutionary Government sees the strategic importance of the computerization program for the future development of our country and gives it a financial support even in the present grave economical situation.

It is certain that one should prepare such a computerization program that will allow our universities to make a breakthrough, that will be realistic enough not to be so dependent on the financial difficulties caused by the present severe crisis. If the program is to perform badly, this will certainly have its effect on the quality of training of the future specialists, and the drawbacks of the programs, with which we will have to fight, will become clear.

One of the fundamental priorities of the computerization program is creating the culture of work in the computer nets and of using the sources of scientific, engineering, administrative, and economical information. This orientation guarantees that our specialists will be ready to work in the national networks and, in the nearest future, in the Internet. This strategy will allow us not to be overwhelmed by the avalanche of new technologies, whose development causes extensive exchange of information between the developed and developing countries. We will be also sure that our students, professors, and scientists are ready to use these resources adequately, by creating the true image of our country and the Revolution in the Internet. To achieve this end it is necessary to create computer networks that join the maximal number of universities and to teach the professors and computer experts so as they could include the new knowledge and concepts into the syllabi of all the disciplines.

The distribution of resources in the higher education will be based upon dividing the existing professions into three groups; for each of these groups, it will be indicated to what extent usage of computers and new information technologies is a priority for each of the disciplines in these groups. It is obvious that the first group will consist of the professions for which informatics is one of the main disciplines, as well as those dependent on the modern computer equipment.

The computerization program should make a special stress upon training specialists and

professors, as well as graduate students. It is the graduate students who are responsible for the revision of all computerization programs from the standpoint of the new technologies and for the introduction of the revised programs. Using computers in research will become the second priority, taking into account the extent to which it influences quality and efficiency of research.

The administration of the Ministry of Higher Education knows very well to what extent computer technologies, telecommunications, scientific information, and modern information technologies are intertwined in the modern world. Creating a technological and methodological base for the development of knowledge and skills pertaining to the usage of this technology, introducing its elements into the basic syllabi of each profession, and attaining the new level of information culture in our country are both the main objective of the new Computerization Program for Higher Education and our most ardent wish.

HABANA,

THE REPUBLIC OF CUBA

MINISTRY OF EDUCATION
MINISTRY OF HIGH EDUCATION

NATIONAL REPORT OF FINLAND

EDUCATION AND INFORMATICS IN FINLAND

THE EDUCATION SYSTEM OF FINLAND

The most essential goal of the Finnish educational policy is to provide the entire population with a high level of education. The education system is built to offer people opportunities to proceed in different types and channels of education according to their own abilities and needs, regardless of their place of residence, economic situation, sex or mother tongue. Instruction is mainly given in Finnish or Swedish. In Lapland it is also possible to study in Sami language.

PRESCHOOL EDUCATION

Preschool education, which is not compulsory in Finland, is arranged for 6-year-old children in a day care centre or in a preschool group attached to a comprehensive school. Annually, more than half of the age group participates in preschool education, some 2 % of whom is given preschool education in comprehensive schools.

COMPULSORY EDUCATION-COMPREHENSIVE SCHOOL

In Finland the compulsory school age begins at seven and continues for ten years unless the person has completed the syllabus of the comprehensive school earlier. In general, it takes nine years to complete the comprehensive school. It is the duty of the local authorities to provide comprehensive school education or other corresponding studies for children of compulsory school age resident in their areas. The majority of children attend to comprehensive school studies arranged by municipalities. However, it is possible to study also elsewhere, for example, in private schools, in hospital schools or at home. Some 62000 children start their comprehensive school education annually.

SENIOR SECONDARY SCHOOL

Senior secondary schools provide general education and continue the basic general education provided by comprehensive schools. Nearly 60 % of the comprehensive school-leavers opt for upper secondary school. The upper secondary school terminates in a national school leaving examination, the matriculation examination, which in 1994 was taken by some 30 000 students. The completion of upper secondary education and matriculation examination give general eligibility for university studies and vocational education intended for matriculated students. Under certain conditions universities may also admit students who have not passed the matriculation examination.

VOCATIONAL EDUCATION

Basic vocational training (2-3 years) is given in multi disciplinary or specialized vocational schools. Higher vocational education (3-5 years) is usually given at specialized colleges which can be entered either after comprehensive school or (usually) after completed secondary level studies, Apprenticeship is provided as an alternative route to these qualifications. Polytechnics is in Finland a new Fachhochschule-type institution of higher vocational education whose 3-4 year programmes lead to an academic degree.

UNIVERSITIES

The basic university degree (candidate, master's degree) consists of three stages and takes 5-6 years to complete.

The Finnish universities consists of 20 institutions, of which 10 are multi-faculty universities, 6 specialised universities, and 4 art academies. The universities are located in 11 cities. The number of university students is 135,000. The total number of staff is 23,500, of which 7,500 are teachers.

ADULT EDUCATION

Finnish adult education can be grouped into basic general education, basic vocational education and liberal education. Adults are also offered the same kind basic education - vocational, general and higher education- as is provided for the young.

THE STARTING POINT IN FINLAND IN USING NIT IN EDUCATION

Finland has a good base for development as an information society, which benefits from modem information technology. The network of educational establishments is dense and there is an extensive supply of training opportunities after comprehensive school. About 60 percent of each age group go on to upper secondary school. Over 90 percent of each age group, after completing comprehensive school or upper secondary school, go on to attend a vocational training institution, polytechnic or university. The supply of adult education has increased rapidly since the 1980s.

Information is readily available to people throughout Finland. The nationwide public library system has been designed according to a networked model based on cooperation and division of responsibilities. Every Finnish municipality maintains a public library. In total, these public libraries have over 2,000 service units providing services, which are available to all citizens. About 80 percent of public libraries have computerized library systems, and this percentage continues to increase. Currently, libraries use over ten different computer systems.

There are some 800 scientific libraries in Finland and university libraries represent a central part of this network. Unlike the situation in many

other countries, scientific libraries in Finland are public services and open to everyone. The joint data network of university libraries is the backbone of the computer systems in scientific libraries. The uniform structure of this system makes it unique in the world.

In some sectors, the information technology and telecommunications industry in Finland is a world leader, and the development targets set by the EU have already been reached. The quality of Finnish information technology has been recognized in OECD reports, among others. The level of information technology employed in society and business life is relatively high, this is also true in some sectors of education and training.

Major improvements in information technology and telecommunications have also taken place in the science and research sectors, especially during the last five years.

Scientific computing and symbolic data processing have both solid traditions and established positions in Finland. Internationally, computational science and research are at the leading edge, and the results obtained *are* transferred to companies for use in their product development. Finnish research leads the world in some sectors of the data processing field.

Progress in very exacting areas such as supercomputer projects and information network development has been made possible by effective national cooperation and division of responsibilities between the universities.

The number of Internet connections per capita in Finland Us one of the highest in the world.

INFORMATION TECHNOLOGY STRATEGY FOR EDUCATION

Education and research are crucial factors for the development of Finland as an information society. For the citizens of such a society to prosper, they must possess a good general education, a wide variety of capabilities to act and solve problems, and the professional competences and skills required by the continuous changes inherent in a working life based on networks.

The Finnish Ministry of Education has published in 1995 a document on the strategies for developing education and research in accordance with the demands of the Information Society. The strategies and attendant measures cover the ground up till the year 2000. The implementation of certain steps was begun in the current year. The main areas of development are the following:

FROM ONE-OFF TRAINING TO LIFELONG LEARNING

Networking methods and the changing requirements for professional competence demand that the education system is both flexible and adaptable. Educational authorities and organizations must promote networking of the education system and create open learning environments to support the development from "once-and-for-all" training towards lifelong learning. Individual study opportunities must be improved at all levels of education, and study methods, teaching material, as well as the required information services need to be developed.

To ensure that the adoption of new teaching methods and the use of information technology is effective, their development and application must become a part of the everyday activity of universities and educational establishments.

The use of open and flexible learning methods and teaching materials should be increased in adult education establishments, civic and workers' institutes, as well as in open university education. Students should be shown how to benefit from the use of information technology as a learning tool.

The ability of libraries and information services to serve the public in acquiring information should be improved. The libraries should be developed as nodes in the open information network, and their role in providing user support for information networks and electronic information products should be strengthened.

BASIC INFORMATION SOCIETY SKILLS FOR ALL

The task of comprehensive school is to give every girl and boy the multi-faceted basic skills and competences required to find and manage

information and to communicate. These are basic requirements in the information society and are essential for further education. All levels of the education system should support the continuous updating of these skills.

The comprehensive school must ensure that every pupil learns how to acquire information independently from different sources, how to manage and process information and how to use information in an analytical and critical manner.

The task of the comprehensive school is to provide every pupil with basic skills in using information technology. Girls in particular need to be encouraged to use information technology.

The use of information technology as a learning tool in initial general and vocational education should be increased as specified in the new national criteria for curricula. Information technology should not be taught as a separate subject, it should be a factor that is integrated into the teaching of other subjects.

The municipalities need to ensure that the schools have the equipment and network facilities necessary for teaching the basic information technology skills. Continuing education should be increased to guarantee that teachers and necessary support staff possess an adequate level of competence.

Adults must have the opportunity to learn the basic skills of obtaining and managing information, communicating and understanding information technology. They must have the opportunity to improve these skills continuously.

VOCATIONAL SKILLS IN THE INFORMATION SOCIETY

Vocational education should provide such skills for living in the information society that correspond to the requirements of a networked working life, one which is continuously changing and becoming increasingly international.

Educational authorities and organizations

should together ensure that the initial and continuing education that supports the information industry is sufficient, at the right level, and of the required quality. A national goal should be that professional competence in the different sectors of the information industry in Finland is counted among the best in the world.

The know-how of professionals in the information industries need to be extended to meet the diverse needs of changing job requirements. The introduction of information technology causes particular needs for change throughout initial and continuing education in the fields of library and information services.

FOCUS ON THE TEACHERS

In implementing the principle of lifelong learning, teachers' professional skills are absolutely essential. Teachers need not only to know how to manage and communicate information in their own field, they must also be able to teach methods of obtaining and using information to enable learners to work independently. Teachers should have the ability to use the media necessary for open and flexible learning and be able to modify and develop material in ways which make it suitable for them to use. The prerequisites and content of basic and supplementary teacher training must be developed to respond to these requirements.

DEVELOPMENT OF INFORMATION PRODUCTS AND SERVICES

The availability and competitiveness of high-quality Finnish information products serving education and research must be guaranteed.

Using the new methods which technology makes available, information resources need to be made available for both national and international use. To ensure that Finnish information services function smoothly as a part of a global electronic library, the technological capacity and know-how required to achieve this need to be developed.

The production, distribution and utilization of information products published in digital form must be increased in a variety of sectors, especially in education and training, research and public administration, and in the libraries, information services and archives which serve these sectors. Support is needed for Finland's emerging multimedia production facilities and related businesses through commissioned work and subcontract work.

RESEARCH IN THE INFORMATION SOCIETY

Developments in information technology impact all fields of research, from basic to applied. Nowadays, in almost all cases, information technology is an essential part of the research process. The prerequisites of scientific computing, such as adequate high-performance computing capacity, workstation facilities and high-speed network connections are crucial factors in competitive research.

Finnish universities and scientific research aim to be at the international forefront in applying information technology. Participation in the information technology programmes of the European Union should be active. Finnish education and research should be among the first to attain the goals set by the RTJ for applying information technology and telecommunications.

Developments toward the information society, the application of information technology and increased networking have far-reaching economic, social and cultural impact that requires further research. The focus of pedagogical research should be on the fields of media and learning, and on the interaction between humans and machines.

EDUCATION AND RESEARCH NETWORKS

The national information infrastructure, the Finnish Information Highway, should be assembled as a multi-layer, seamless system. The information network for education, training and research will be a part of a global open network.

The Internet and emerging standards for broadband networks and services should provide the foundation for the education and research information network in Finland.

Schools and educational establishments must be integrated with their local environment. Links between schools and educational establishments at different levels and operating in different fields must be increased, and links with community and business life improved. The information networks should be structured so that they support these developments. The most effective technical way of achieving this is based on regional networking and cooperation.

Information network services are to be made available to all schools and libraries. An adequate level of service should be guaranteed to all educational establishments. Both scientific and public libraries must be guaranteed not only adequate facilities, but also the telecommunications links and expertise required to utilize these effectively. Special attention should be paid to the development of public library information network services and to the development of libraries as nodes in the open information network.

LIMITING FACTORS

In the 1980s, substantial hardware investments were made in schools providing general education and in vocational institutes. At the same time, continuing education for teachers was organized on a large scale. In recent years, as a whole, the school system has not kept pace with the rest of society in terms of information technology, even though a number of advanced regional communication network projects are in progress and several development projects in open and distance teaching and multimedia materials are under way.

The use of information technology in education and training has also been held back by a lack of applications. Finland is a small market *and* language area, and hence production of electronic information products has got off to a slow start. This is clearly seen in the production of educational software. The weak economic situation has also reduced demand for such software.

Currently, the level of information technology equipment available differs from school to school, and some of it i.s obsolete. The situation is worst in

primary education. Even where adequate equipment exists, it is often not fully utilized. Teachers have differing abilities in using information technology. The level of utilization of telecommunication services and

information networks is still low in Finnish schools, mainly due to the slow development in equipment resources. Cooperation between educational institutions in using teaching resources has been rare. All these factors have slowed down the development of an organizational culture that utilizes information technology.

DEVELOPMENT PROJECTS

Based on the above-mentioned strategy of the Ministry of Education a development programme was launched at the beginning of 1996 with an aim to improve the schools' computer hardware and permanently link individual educational institutions up with Internet. The programme will be concluded by the year 2000.

The name of the programme is Suomi tietoyhteiskunnaksi - koulutus tiedon valtatielle (Help make Finland an information society - help put the school on the road to better knowledge). The programme includes projects for developing classroom practices turning to the best account the new information technology and developing new Finnish multimedia programmes and study materials for use on the net. Over the next three years the government intends to support the local school owners and mandators with roughly FIM 100 million in order that the latter will be able to purchase PCs to the schools and enlarge their information networks. The programme has been enthusiastically and universally applauded. About 80 percent of the schools and their owners have expressed a wish to be part of the programme already in its first year.

INFORMATION TECNOLOGY IN NATIONAL CURRICULA

Curricula at all levels of education in Finland, from preprimary education to university postgraduate programmes, have just been renewed.

Decision-making concerning the organization and content of general and vocational education has been transferred to those who maintain the schools: the municipalities and federations of municipalities. At national level, general criteria for curricula provide the framework for steering education.

New national criteria for curricula for comprehensive schools and upper secondary schools were approved in January 1994. The national criteria for curricula for upper secondary vocational education were approved at the beginning of 1995. The criteria for curricula for higher level and institute level were approved in February 1996. At present, national criteria are under preparation for the vocational diploma and special vocational diploma in adult education, as provided for in the law concerning vocational diplomas.

Requirements of technical basic education, including information technology skills, are incorporated in the curriculum criteria for basic general education. The principles for how these skills should be taught vary from one curriculum to another.

COMPREHENSIVE SCHOOLS AND UPPER SECONDARY SCHOOLS

In the national criteria for curricula for comprehensive schools, pupils are expected to learn how to utilize information technology applications. The study goal is that the pupil, irrespective of previous experience, learns how to use computers and the most common software applications and is also able to make a realistic assessment of the possibilities of utilizing information technology in different subjects.

In the criteria for curricula for comprehensive schools, information technology has not been allocated a separate number of lessons; it is regarded as an integrated theme. Study goals for information technology have been set, but since it is an integrated theme, teaching takes place either in conjunction with other subjects or, in the upper levels of comprehensive schools, as an optional subject, depending on the local curriculum.

In the curriculum for upper secondary schools, information technology is not specified as a subject, course, or separate integrated theme, and no specific goals are set for the skills to be acquired. However, upper secondary school studies include optional, applied courses which can be taken either at the student's own school or at another educational establishment. These optional courses may include studies in information technology. In both comprehensive school and upper secondary school, information technology is used as a tool when studying other subjects.

VOCATIONAL EDUCATION

According to the curriculum criteria for vocational education, information technology must be taken into account from a variety of points of view in all studies, both as a subject in its own right and as a tool for learning other subjects. In general studies, from which a student may choose courses worth between one and four credits (study weeks), information technology is an optional subject available to all students. Information technology is also an optional subject in adult vocational education.

General studies are intended only for those students who enter vocational education from comprehensive school. No general studies are separately defined for students entering from upper secondary schools. The goals of the general studies are included in the national criteria for curricula in every field and degree. This means that the emphasis on the teaching of information technology varies according to the field and the degree. The general goal is to teach the students to use the hardware, software and information resources available in their own field and for them to gain an understanding of the basic functions of computers.

At institute and higher vocational level,

students may choose from one to five credits in information technology studies. The aim is that the students become knowledgeable in how to use information technology to retrieve, produce and process knowledge in their future occupations. They should learn to access and use domestic and foreign networks and be aware of the versatility of IT and the new multimedia and how to make the most of them. They should further be able to act naturally and responsibly as users and producers of information technology.

The national core curricula provide a good basis for making use of the new information technology. How IT is taught and made use of, however, is ultimately in the hands of the individual school. It has been found that the curricula especially of small lower stage comprehensive schools show very little IT. Also at the upper stage of comprehensive school and in upper secondary school the use of information and communication technology has been scarce except for the optional courses in IT. The development programme introduced by the Ministry of Education has, however, helped change general attitudes and many schools are currently revising their curricula in regard to their information and communication technology content. The use of Internet in teaching is an interest common to most schools.

UNIVERSITIES

The universities in Finland are autonomous and they are responsible for developing their own curricula. Recently initiated evaluations of university activities have clearly encouraged the universities to pursue this work. The evaluations have been the basis for the development of degrees and degree programmes. A new two-level basic degree system has already been adopted in six academic fields. During 1995, the intention is to have new degree statutes in force in six or seven additional disciplines. Once this has been achieved, 90 percent of new students will be studying in accordance with the new two-level system. The reform of diplomas concerns both structure and content. The goals are to make study more effective and to improve the quality of research work.

In the performance agreements made between the universities and the Ministry of Education, it has already been decided that universities carry out regular evaluations of their teaching and that students take part in these evaluations.

NEW WAYS OF LEARNING AND TEACHING USING NIT

Modern concepts of learning emphasize the students' responsibility for their own learning and their active role in seeking and using information. The role of the teacher changes from being a distributor of book learning into being a tutor guiding the students. The school environment becomes a centre for learning and activity. In libraries and information services, telecommunication and digital information products are increasingly found alongside traditional services as information sources of equal value.

The development of information technology has facilitated new types of teaching arrangements and a more flexible division of responsibilities between universities and educational establishments. Education units can agree on joint distance teaching, which is able to reach students throughout the country.

This makes possible an increase in educational opportunities while reducing costs resulting from the duplication of teaching. Locally, the focus can be on tutoring support for students and on reinforcement of the learning process. For working people, the possibility of studying without time and place constraints is important.

The furthest on the way in Finland is the development of open and flexible study practices in adult vocational education and training. In this sector work for the turning into the best account of new equipment has been steadily done already for years. Development work has been effected in project networks, each comprising thirty educational institutions. Areas of stress have been the development of action models for open learning milieus and the development of study materials for distance teaching. The work goes on. Next in line is the development of distance operated upper secondary schools for adults and the opportunities of mature students to pass examinations using data nets. These projects will be launched in 1996. In addition to the data networks, the use of radio and television in adult education will increase.

Information technology is widely used in Finnish university education. Different kinds of computers are available to both teachers and students, and special computer rooms with terminals, microcomputers or workstations are provided for educational use. However, more information technology is needed, but the lack of financial resources for additional investments and for employing new personnel in maintenance and support is the most important obstacle in trying to meet this demand.

Within the framework of the national strategy for education, training and research in the information society, special projects have been agreed in annual negotiations between the universities and the Ministry of Education. These projects include training courses in information technology, as well as developing hardware and software and campus networks of the universities.

PARTICIPATION IN INTERNATIONAL PROGRAMMES

In Finland, several small-scale experiments on networked training arrangements have already been carried out or are currently under way. Several of these projects have been executed within the framework of the EU telematics programme. The large-scale introduction of new learning methods

demands that the development and application of these method's and the technology required to support them become part of the day-to-day activity of universities and educational establishments.

Finland's membership in the European Union has enhanced the interest of the schools to participate in international projects. So for instance the LEONARDO programme has approved five Finnish coordinated projects developing the use of multimedia and IT in education.

COMPUTERS AND SOFTWARE

SCHOOL AND INSTITUTES

Hardware

Exact figures on the number of PCs in Finnish schools are lacking. The number has been estimated by the authorities to be on average the following:

	PCs /school	PCs/number of students
Lower stage comprehens. schools	4	28
Upper stage comprehens. schools	22	14
Upper secondary schools	21	11
Vocational institutions (Including Polytechnics)	60	3-10

Software

All schools with computer hardware also carry the necessary central software. Further, some computer assisted teaching programmes are in use, but not to the extent as could be wished for. There are very few programmes to be had in Finnish and the few there are have not yet reached all the schools.

The most use of computer aided software has been made at vocational institutions who also have the best hardware. The education authorities have supported the production of domestic software for use in schools for more than ten years now, but only recently, with the advent of multimedia software and CD-ROM, have these programs spread also to the non-vocational general education institutions. At the moment there are 10 CD-ROM disks available in Finnish, some further ten being prepared with the support of the education authorities. Due to a very small market, the publishers are not very keen on producing teaching materials in the new media.

Schools are only learning to produce WWW material for the Web.

UNIVERSITIES

Hardware

Information technology at the universities includes different kinds of computers: from individual microcomputers to supercomputers, peripheral devices, and local area networks. Many students also use their own personal computers for their studies. Multi-user servers can be used either via classroom terminals, microcomputers or workstations, or from home by using a modem and telecommunication connections. Microcomputers and workstations can also be used separately, with software either installed in the hard disk or loaded from network servers. The total number of microcomputers and workstations available to students at the universities is about 4,500. This means one device for every 30 students, on an average, but the ratio varies from 1/100 to 1/15. Efforts are taken to reach one device for every ten students by the end of this decade. Teaching staff as well as research and administration staff have normally microcomputers or workstations in personal use. Portable computers are also widely used.

Software

The most common operating system in multi-user servers and workstations is Unix. Microcomputers run mainly MS-DOS and Windows, but also Macintoshes exist with their own operating system. Computers which are used in instruction are provided with the necessary software. Teas or even hundreds of different programs are being used at universities for various purposes. Microcomputers are also equipped with necessary telecommunication accessories and programs for using other computers and network services.

Networking

At the universities, practically all computers are connected to the local area network of the university (Ethernet), which are linked via Finnish University and Research Network (FUNET) to international Internet. Internet connection offers a wide range of services to its users: electronic mail, news groups, remote login, file transfer, World Wide Web, and so on.

The FUNET network was upgraded to ATM (asynchronous transfer mode) technology in 1995. Current connections between universities are nowadays 10 - 34 Mbit/s. International connections from FUNET to Nordic network NORDUnet has also been upgraded to 34 Mbit/s recently. Since need for network services is constantly increasing, the FUNHT network needs to be developed further so that the transmission speed would increase. Also international links to Nordic countries, to other Europe and to the United States, must also be upgraded in coming years. Universities will also upgrade their local area networks and take the ATM technology more efficiently in use.

PREPARED BY
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NATIONAL REPORT OF FRANCE

EDUCATIONAL MULTIMEDIA IN FRANCE

INTRODUCTION

At the beginning of 70s different forms of information technologies were introduced in the educational system of France. During the period of the last 25 years all lyceum and colleges were equipped with computers as the result of some programmes implementation in the field of national education ("1000 micros", "100000 micros", "Informatics for everyone"). Near 5% of teachers took informatics pedagogics courses, which lasted for at least 3 months. Short-term courses of informatics basis training have been overall offered. After the adoption of the regulations, related to the information technologies application in education, software became a didactic means.

In is interesting to remark, that the objectives of informatics application in education, defined at the beginning of the 70s, has considerably changed since that time. The resume of the changes is the following:

- to provide the opportunity of information technologies application in different disciplines;
- mastering the concepts, used as the professional means of education;
- studying informatics methods.

The application of interactive multimedia for educational purposes is always very sensitive to every shift in the system of vocational training. In doesn't even matter, it is an agricultural, vocational or higher education. In any case the development of educational software involves the following perspectives:

- the modernisation of pedagogical practice (education individualisation; education differentiation depending on one's interests and abilities), which allows to increase the efficiency of education;
- the diversification of educational forms as the result of the diversification of the demands for education; it is considered in the national policy of territories accomplishment (the diversification of the modes of access to education; the development of different educational centres in the rural and urban regions for the partial solution of the problems of the isolation of those, who are willing to study, and of the deficiency of the students in some educational institutions);
- re-qualification of active employees and those, demanding a job, in every field of economy.

Depending on users' demands, the general purposes of informatics utilisation are divided into the following groups:

- the realisation of the citizens as soon as possible the necessity to appropriate to the modern technical culture, in particular to master information technologies;
- the admission of computer and multimedia advantages as didactic tools for youth and adults teaching;
- information technologies recognition by public institutions, in particular by the Ministry of the National Education and by the establishments of the system of agricultural education, less by the institutions of vocational education, which don't have defined specialisation in this field, and for the regional departments, which recently became responsible for some fields of education;
- information technologies application in everyday practice of vocational training and education, which is still occasional, though the responsible bodies are formed and there is a certain experience in the field of vocational, agricultural and higher education;
- the low level of families equipment, though many of them are very much interested in information technologies. There are two groups of interested consumers: parents, anxious about the progress of their children - pupils, who consider, that computer is the aid to improve their results at school; adults experience the demand for the means of self-learning in every field of knowledge and in particular in the field of living languages.

1. THE INDUSTRY OF EDUCATIONAL MULTIMEDIA

There are three large sectors in the consumers' market of pedagogical products:

- the market of articles of general consumption;
- the market of professional products, that is the market of intermediary products;
- informal market of exchange the pedagogical documents of establishments and organisations.

These markets are closely interlaced with each other in the field of finances and industry. However the structures, developing educational software,

represent a highly heterogeneous group, that consists of the following:

A. ISOLATED AUTHORS

They don't have any commercial structure, helping them to sell their production. Usually, they are teachers, since recently this group was supplemented with freelancers workers, who work on contract base with an educational institution or a publishing house.

B. BOOK PUBLISHING HOUSES

Publishing houses form departments and affiliates, dealing with software. Usually these are big publishing houses, specialising in the field of school literature, such as *Hatier* and *Nathan*. The public establishment the National Centre of Pedagogical Documentation (NCPD), one of the aims of which is to publish pedagogical materials, has a department of software *development (Unité des logiciels Educatifs)*. The system of agricultural education has a specialised establishment - the National Centre of Research and Resources in the field of Advanced Technologies (NCRRAT). The Centre has developed more than 10 CD-ROM programmes.

C. INFORMATICS COMPANIES

This group consists of the publishing houses, specialised in professional software with the departments of educational software development. Among them there are Microsoft (Microsoft Home affiliate) and Claris and servicing and information engineering companies, such as SYSECA and CISI. Most of their clients are the establishments, that are in need of special professional training of their personnel, or they are non-specialised producers, such as book publishing houses without any specialised department for software development.

D. AUDIO-VIDEO PRODUCERS

The TV channels *La Cinquiéme, TF1, France Télévision* and *Canal+* are intending to start the production of multimedia.

E. SPECIALISED PUBLISHING HOUSES

They have appeared quite recently and their experience in publishing is rather poor. These publishing houses are specialised in new information products (Informatique, Vidéodisque, Télématique, etc.). They are rather small, but able to produce industrial production for a wide range of consumers, as well as services for individual clients. Among them there are *Génésie, Jériko, Chrysis.*

F. SPECIALISED EQUIPMENT COMPANIES

It concerns producers of the equipment, used in the field of education, which applies information and communication technologies. These companies often have to produce "pedagogical production" as a supplement for the main equipment they manufacture. For example, the *Jeulin* and *Micrelec* companies, specialised in laboratory school equipment had to develop a series of data collecting software, compatible with the equipment, produced by them.

G. TRAINING CENTRES

It's quite often, that the centres, offering educational services in a form of courses (lectures) and tours of duty, need to apply new educational technologies for the widening of the range of their students and for the diversification of teaching means. They try to sell their developments through the agency of publishing houses. It is worth to mention, that some centres are specialised in distance education (the National Centre of Distance Education (NCDE), *le Centre National des Arts et Metiers (CNAM),* the Association of Adults' Vocational Education (AAVE). Owing to this fact they become the leaders in the field of educational software development.

There also a lot of ideas, concerning information technologies implementation in the field of higher education. Some of higher educational institutions have already established quasi-professional structures, able to concretise them (or promote their commercialisation). However, among the serious obstacles in the implementation of innovations are the individualisation of directorship, the absence of financial support, non-regulated stakes in the benefits of the authors or establishments, developing "pedagogical production".

The list of the before mentioned producers of educational software should be supplemented with the departments of big private and state companies (insurance company *l'Union des assurances de Paris (UAP),* the companies *Vendôme Formation, Electricité de France (EDF), Société Nationale des Chemin de Fer (SNCF), France Télécom,* etc.), developing software for their own needs.

H. CENTRES OF MUTUAL EDUCATION FINANCING, FUNDS AND ASSOCIATIONS

These are non-lucrative organisations, which main aim is the resources' parcelling among the demanding establishments. Some of these organisations are mainly busy with finances gathering and their distribution among the members of the Councils of education development. Others are working with projects in the field of software development, involving the members of these organisations aimed at the reduction of the corresponding costs. The example of these organisations is the Rhone-Alpes Region Association of the Educational Multimedia Development.

Sometimes other associations are developing software for concrete targets, mentioned in their constitutive documents. The *Association Française pour la Lecture* (for reading promoting) has

developed a number of products ELMO; the association *Enseignement public et informatique* has developed the product HYPERTEXTE; the fund *Avenir-Jeunesse-Entreprise* - CHOIX, etc.

I. RESEARCH LABORATORIES

Their production is the result of investigations in the field of educational multimedia. Among these laboratories there are *Laboratoire de Structure Discrete et de didactique* in Grenoble, the *Centre de recherche en Infirmatique* in Nancy, the laboratory *Représentation et Traitement de l'information Chimique* in Nice, etc. Their products are subsequently diffused though publishing houses. It happened so with the product Le géometre, developed by LSD and diffused by the publishing house Nathan/Edusoft.

J. MUSEUMS

Under the promotion of the National Union of Museums, many museums of France (*Le LouvreCité des sciences et de l'industrie (La Villette), le musee d'Orsay , le Centre Georges Pompidou, etc*) follow their own policy of the development multimedia, working in on-line and off-line regimes.

Lastly, we should note, that the sector of educational software producers is now in the process of radical transformation: intensive merging (*France Télécom* has purchased some small enterprises, *Chrysis de Logedic*; it has attached *Jeriko* and *Infogrammes*); concentration among industrial groups (*Liris* with the *Cité* group; *Havas Edition Electrique* joint *ODA* and *Arborescence, Hachette Multimedia, etc*); capital inflow, some activities stoppage, etc.

2. THE INFRASTRUCTURE OF NETS AND SERVICES

Regarding net's services, it's worth to mention, that, though the situation is rapidly changing, at present:

- the services of the interactive regime in the field of education are still not structured in France;

- the communication nets introduction in the system of educational services offering brings about radical changes in pedagogical means (from book and video cassette to interactive multimedia).

There are two basic types of nets: information nets and audio-video nets.

INFORMATION NETS

- The TELETEL net is widely applied in the field of various services and very little - in the field of education. This net is well adapted to interactive queries processing (information on transport time-tables; reserving spaces in airplanes, rooms in hotels, etc.) and much worse adapted for education purposes (there is no opportunity of documents transference, poor graphic interface, slow transmission). Mostly, in the system of education it is used for control.

- RNIS generalisation throughout the territory of the country still didn't change the situation, because the *Kiosque Micro*, which is really able to solve many problems, has opened quite recently. Though now, we are witnessing, how quick visual lectures became popular on the second stage of education, in higher school and vocational education on enterprises.

- The realisation of the RENATER net (French affiliate of Internet) gave higher school a potential opportunity to use such a fantastic means of education, as multimedia.

Some private nets on the base of Internet (Infonie, France on line, MHM), advertised the services in the field of education, emphasising pupils' training at home.

AUDIO-VIDEO NETS

There fore ways of their application:

- application in TV programmes of general channels, in particular of France 3;

- the global application in the framework of recently organised educational channel La Cinquiéme, broadcasted in the Fifth National Radio wave Net, before French - German programme ARTE;

- thematic application in some satellite or cable channels, for example the Planete channel, specialised in documentary information, or the Histoire channel, which is expected to be organised in the near future by *Institut national de l'Audiovisuel* and *SEPT/ARTE*;

- application for the special audience in particular cable nets, which have educational channel or a bank of query programmes, such as EDUCABLE, offered by CNDR, or the channel of the France 3 net, intended for Lorraine schools.

In the future these forms of application will be more often supplemented with information products editions.

3. USING EDUCATIONAL MULTIMEDIA

3.1. USING AT HOME

Only 7% (24 million) of all French families have compatible PC computers at home and only 2-3% of them have the other equipment (approx. 1 700 000 pieces in all these families).

However, the volume of CD-ROMs sale increases day after day: since September, 1993 till September, 1994 there were sold about 700 000 of products; according to some calculations in 1995 the

volume of sale will come to 1,6 million. The part of educational products is evaluated in 13%. According to the data of *Electre Multimédia* the main of them are the products for schoolchildren and encyclopaedias.

3.2. USING IN THE SYSTEM OF INITIAL EDUCATION

3.2.1. Primary education

The number of available multimedia equipment is still limited. The educational system has at its disposal 450 working places for the total number of 1100 pupils.

Usually computers are situated in classrooms and pupils are able to accomplish individual tasks. However such tasks are rather rare nowadays. Only the first steps are made in studding the programme LOGO, computer-aided training (EAO), including learning foreign languages.

Some publishers are already offering schools EAO multimedia, but we still don't know it is right.

There are no multimedia products as articles of general consumption for personal computers, financially available for schools. The appearance on the market of some products free for schools, such as "The magic theatre" *(d'Edusoft)* or *Gazelle* software, will partially solve the problem of schools' equipment with multimedia products. Apple production (Kid Pix, Apple Média Tools, Kid Works, etc.) offers wide opportunity for adaptation and creation, easily used by the children of the very early age and by their teachers.

We believe, that the successful Internet using, in particular in the school net on Vercor's Plateau, will get development.

3.2.2. Secondary education

The laws, regarding the decentralisation of the national control system, have considerably changed the allocation of responsibilities, concerning financing of equipment purchasing, between central and regional administration. Regional administration became in charge of some responsibilities, formerly concerning central administration, regarding equipment purchasing for secondary educational institutions. At the same time, the parallel trends of credits' decentralisation and strengthening the position of educational institutions led to the necessity to differ lyceums and colleges, which is closely connected with financial resources and the offering type of education. Rapid and sensible changes took place in this field: schools began to purchase computer equipment without any intermediaries. It has accelerated the realisation of the projects of cables' laying on and lyceums and colleges connection with general net.

At present 350 thousand of microcomputers were installed in 12 thousand of French public and private secondary schools of the system of general, technical and vocational education. Besides computers they were equipped with peripherals (printers, scanners, CD-ROMs, physical interfaces, etc.). The number of CD-ROMs, installed in lyceums and colleges comes to 12 thousand.

Most likely, that the new information space, which will be created in the near future, will be characterised by the three main tendencies:

- existing computer resources integration into a net and their connecting to big communication nets or data transmission nets. About 400 schools have already began to connect their computer resources to the net and during the next months this process should be developed. There is an experience of these nets connection to Internet through RENATER;
- the acquisition of multimedia devices, leading to television and informatics integration;
- the appearance of portable machines (in particular, in preparing classes of higher school), may radically change our attitude towards computer pedagogics, turning microcomputer into super-calculator.

Software for secondary education consists of two types of products:

- professional software, specially developed for the application on enterprises: operational systems and programming languages, general tools of bureautics, specialised tools.
- pedagogical software, specially developed for educational institutions. Most of them are developed by private publishing houses and information companies.

Our state has financed from the budget (80 million francs) purchasing software for secondary educational institutions. The Ministry of education introduced an original system of procedures, related to the acquisition of a right to use a software (mixed licences). These procedures make possible to reduce expenditures for the products, which were evaluated by expert commissions as the products of pedagogical interest (annually schools purchase something about 60 thousand of such products).

Computer education may be acquired not only in specially equipped halls, but in school computer classrooms also. Moreover, more and more computers are installed nowadays in artistic classrooms, lecture halls, laboratories, lounges for teachers and students.

3.2.3. Higher education

There are quite different places for computers in the establishments of higher education. But usually they are placed:

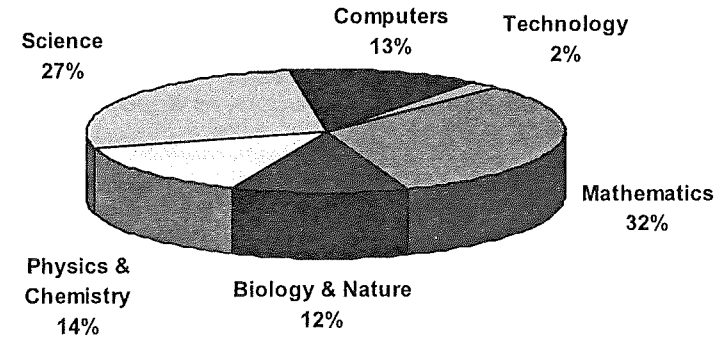
- in the special halls for informatics training or for the technical support of different disciplines teaching (calculations, statistics, econometrics, etc.); these halls are first of all used for compulsory education (practical training, working under teacher's direction). When there are no lessons, the halls are at the disposal of the students, who can study individually with the help of text programmes;
- specially equipped halls for self-learning of particular disciplines; they are usual for technical and medical universities; the students, who reserved working places, get at their disposal different educational products, permitting to acquire the necessary technical skills, to test yourself, to train and to evaluate your own knowledge of basic disciplines;
- specially equipped halls for learning modern languages; these halls either similar to the previous ones (microcomputers, connected to the net or autonomous), or they function like "language laboratories", in case they have the necessary equipment.

consisting of 21,000 hours. In addition, a training center for science and technology teachers was opened in Shiomi, which held courses for 4,000 teachers, with each teacher receiving one week of instruction.

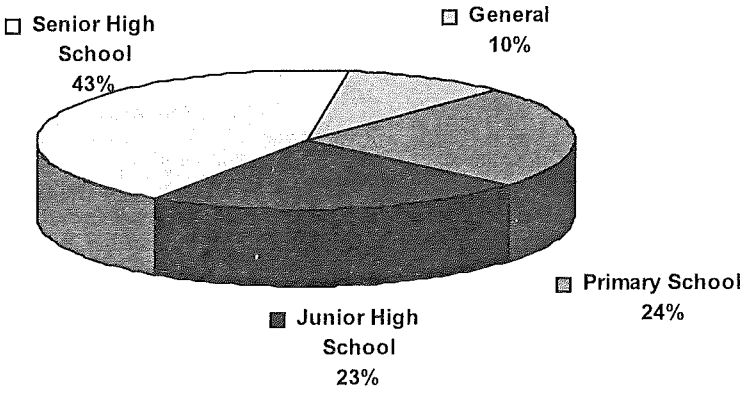
The schedule for 1995-96 includes around 260 courses for approximately 6,500 teachers. There will also be approximately 220 courses for about 4,000 pre-school teachers.

TRAINING COURSES - 1995 – 1996

Training Courses per Subject



Training Courses per Age Group



TEACHER TRAINING AND TEACHER TRAINING COLLEGES

Strong emphasis has been placed on the computerization and introduction of computerized communications to teachers training colleges. The Specialist Primary School Mathematics Teacher course is held at 7 academic colleges, and 10 college projects on mathematics, science and the integration of computers in teaching are due to commence in January 1996. A committee is currently examining the study curricula of teachers training courses at colleges for junior high school mathematics, primary school science and technology, and high school science and technology.

SOFTWARE EVALUATION

Educational software is an integral part of modern learning materials. The educational software market is full of products manufactured by commercial enterprises, with a minority of software designed by research bodies (e.g.. the study curricula department, universities, etc.). Developing educational/learning software is a costly business and the Ministry does not have sufficient funds to do this itself. It was, therefore, decided to use commercially developed products.

These consumers pay for educational software out of their own budgets, and decisions regarding the purchase of educational software are made by the consumers themselves (educational institutions). The Ministry of Education and Culture helps in an advisory capacity only. Unfortunately, educators don't have the resources to keep up-to-date with developments in the market and often buy products with which they are familiar, rather than the most suitable products.

In response to this state of affairs, the Education Ministry has established a software evaluation unit at the Technological Education Center in Holon. The Ministry wants to speed up the evaluation process in order to force the educational system to use software issued with an evaluation label. The

and graphic packages, offering 28-56 hours of training in a computerized communications environment, according to the teachers' work program.

3. Integration of Computers in Teaching - Beginners

Another type of training course involves the integration of computers in the instruction of specific study subjects. The course can be given to relatively small groups of teachers from a number of schools. Teachers undergoing the courses will familiarise themselves with various computerized materials which relate to their study subjects, and will learn to utilise computer-integrated study curricula in those areas.

4. The integration of computers in Teaching - Advanced

This course level is designed for teachers and co-ordinators with different areas of expertise, who have completed training courses for beginners and are interested in attending more advanced courses. These courses will include workshops covering the preparation of auxiliary materials suitable for the school study program.

5. Training Courses for School Staff

The computerized training course program also offers a range of courses for school staff conducted on a regional basis. School administrative staff, supervisors and co-ordinators will be offered courses by regional supervisors or training center managers. These courses are conducted by the training centers, and not part of the hours allocated to each school.

THE ROLE OF THE "COMPUTER INSTRUCTOR - ADVISOR"

In order to enable the introduction and proper implementation of computers in the school system, the Ministry of Education decided to allocate a number of training days for instructor-advisors, as part of the computerization program.

Computer instructor-advisors provide one day of training per week at most junior high schools. The instructor-advisor's role is to assist the school principal in the co-ordination of school computers, to help the subject co-ordinators and other members of the teaching staff with the proper integration of computers in the school's general education system, and to provide support for the different kinds of teaching-learning processes.

Together with the principal, the instructor-advisor formulates the annual work program for the field, as well as its implementation with regard to hardware and its uses, software, and the training courses in which the teachers participate during the year. It is also the instructor-advisor's responsibility, together with the principal and school staff, to lead and be actively involved in entire program while supporting and monitoring the initial stages of implementation. It is not his/her job to give the actual computer training courses at the school; however, he or she should be involved in their organisation, in determining their content and their operational framework, and in monitoring their implementation. The instructor-advisor is also responsible, in conjunction with subject co-ordinators, for helping teaching staff team how to integrate computers in their disciplines.

An extensive training system is provided for two types of instructors:

1. School instructor-advisors - for all age groups and types of education. The school instructors will act as tutors and instructors, supporting the process of computerization at the school.
2. Subject instructor-advisors - to work in conjunction and co-operation with the subject supervisors in the training of study subject instructors, as of the 1994-95 school year.

Implementation

1. 180 secondary school (junior and senior high school) instructors attended training courses.
2. 60 primary school instructors were also trained.

The training budget for the 1994-95 school year totalled around NIS 1.2 million.

The plan for the 1995-96 school year (some courses began instruction between July-August 1995) involved the following activities:

1. The training of an additional 150 primary school instructors.
2. The training of approximately 50 additional secondary school instructors.
3. The training of 30 special education school instructors.
4. The training of 300 instructors for the following subjects: Mathematics (30); English (90), Arabic (30), Geography (30), Bible (30), and Language and Expression (90).

The plan allows for the training of about 530 additional instructors.

The training budget for the 1995-96 school year totals approximately NIS 2.5 million.

IN-SERVICE TRAINING

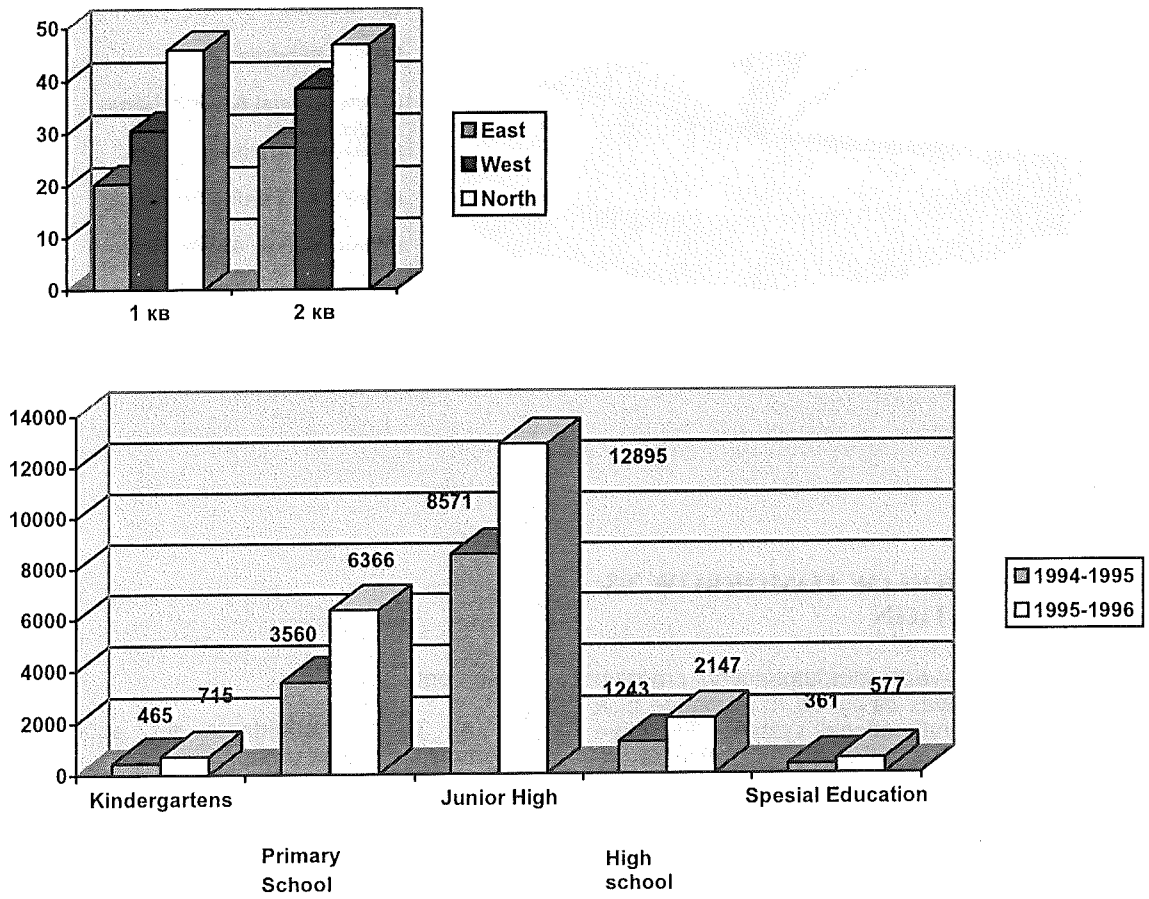
In-service training for teachers is conducted on a regional basis, in teachers training colleges, universities, the Technion, the Weizmann Institute and at the Technological Education Center (the responsibility for implementation lies with the training center in co-operation with supervisors).

Training courses are held for teachers of all age groups: pre-school, primary school, junior high school, high school, and for instructor-advisors in the following areas: mathematics, biology and natural sciences, physics, chemistry, computers and technology. Most courses involve the use of computer applications.

The object of the training courses is to consolidate the teacher's professional expertise, to familiarise teachers with different study curricula, to equip teachers with the necessary skills to integrate computers in their teaching subjects, as well as training teachers in educational leadership at various levels - subject centers, teachers' trainers and instructors, etc. The composition of the courses will be adapted to the development of new study curricula in different fields and to the wide-ranging activity involved in the computerization of the system and the equipping of laboratories.

In the 1993-94 school year, 232 training courses were conducted for 4,600 teachers,

Allocation of Computer Stations
(Cumulative)



TEACHER TRAINING

COMPUTER TRAINING COURSES IN THE SCHOOLS

The fundamental premise of the computerization program is that the training of teachers, in preparation for school computerization, is an indispensable step in the application and implementation of the computerization of schools and educational institutions. The planning of school training courses is formulated with the full co-operation of the school principal and school computerization advisory team.

Training courses will help to implement the school computerization program, and will provide solutions for the following:

1. Implementing of training course instructions and guidelines.
2. Providing a solution for the achievement of the computerization program's objectives and school priorities.
3. Ensuring that teacher training programs include individual familiarisation and practical experience based on teaching methods which enable optimum utilisation of the integration of computers in the learning process.

School training courses are designed to achieve different objectives. The planning and consolidation of training courses will be implemented on a number of levels in order to achieve the following objectives:

1. Preparatory

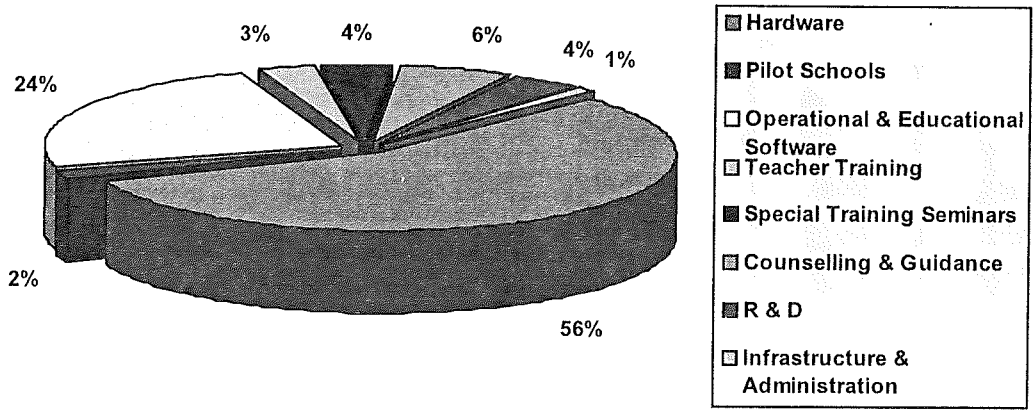
This level applies to those teachers with no experience in computerized communications. Teacher trainees will receive 28 hours of instruction on the subject of teaching in a computerized communications environment.

The training course covers the following topics: computers and society, computers and education, computerized work environments in the school, an introduction to communications and data bases, an introduction to multimedia and Windows, and the operation of computerized presentational materials and equipment.

2. Computerized Equipment

The second level of courses, following implementation of the preparatory training courses, is based on working with spreadsheets, data bases,

By Areas of Activities



IMPLEMENTATION OF TOMORROW '98: COMPUTERIZATION

In 1994, a five-year computerization program was initiated, which was designed to introduce new technologies to the educational system. The main focus of the program is the computerization of the educational system, particularly the junior high schools and teachers' colleges.

GOALS OF THE PROGRAM

1. To bring schools into the "information era" by creating a supportive environment capable of integrating information technologies in a range of activities within the school.
2. To reduce the gap between school culture prevailing culture outside the school environment.
3. To improve teaching and learning by training independent and creative learners, and to develop higher cognitive skills.
4. To enhance the status of teachers by promoting their professional level.

MAIN DIRECTIONS FOR IMPLEMENTATION OF THE PROGRAM

1. To train teachers to integrate computers in teaching, both future teachers in teacher training institutions, and teachers throughout the system, through various in-service training frameworks.

2. To expand the educational support and training system for teachers, schools and local authorities.

3. To equip schools with hardware and software, and replace outdated, unsuitable equipment.

4. To set standards for equipment and programs for all age groups.

5. To encourage the development of special programs and integrate these programs into the curricula.

6. To encourage special experiments, and to assess and distribute their results throughout the system.

7. To develop an infrastructure of information and computerized communications systems which will improve the education system by integrating information systems in teaching and learning.

EQUIPPING THE SCHOOL SYSTEM

Computerization of the schools and educational institutions commenced in 1994, with implementation of a "computerized package," which included hardware, operational and educational software, and teacher training and guidance.

The schools were equipped in a combined effort undertaken by the Israel's National Lottery and the local municipalities. The equipment was supplied by seven contractors, who also provided software and computer training services. As part of the ongoing process of computerization in the Tomorrow '98 program, 450 secondary schools were equipped with computers during the 1994-1995 school year, realising the goal of one computer per ten students.

- NIS 24.0 million - National Lottery budget
- NIS 24.8 million - Local municipalities' budgets

In addition to the above sources, the following points should be considered:

1. This budgetary framework is in draft form only. A detailed and up-to-date annual budget will be presented separately.

2. This program does not contain enough resources to computerise the entire educational system in the five-year period. As a result, an order of priority has been determined by means of which the upper school network will be computerized to a greater extent than the primary school network.

3. The five-year program should be planned while keeping in mind the project's continued operation beyond the five-year period.

4. Consideration should be given to supplementing the budgetary program with additional hours allocated from the Ministry's total programmed hours.

5. The cost of one computer station is estimated at about NIS 4,000. The final cost is subject to the outcome of the Education Ministry tenders.

Budget Set-up and Operational Procedures

The following are the principles and operational procedures of the budget:

1. The National Lottery, together with the local municipalities, will purchase hardware, including peripheral equipment, operational systems, local communications networks, with financing as follows:

a. All educational institutions: kindergartens, special education schools, and schools of all age groups 60% of the rate of financing the acquisition of hardware will be provided by the National Lottery, and 40% by the local municipalities.

b. Teachers' Seminars: full financing by the Ministry of Education.

2. The local municipalities will finance the acquisition of hardware together with the National Lottery, and acquisition of operational and educational software together with the Ministry of Education.

3. The Ministry of Education will allocate funds from its budget towards acquiring hardware, and operational and educational software for schools, teachers' seminars, training programs, guidance and counselling, communications infrastructure, research, experimentation, evaluation and development.

4. Efforts will be made to raise additional sources of financing from other government ministries in order to integrate new immigrants into the network.

5. General principles of financing:

a. The National Lottery will finance 60% of the cost of hardware operating systems, and operational software.

b. Local municipalities will finance 40% of the cost of hardware and operational software, and 50% of the cost of software and educational software.

c. The Ministry of Education will finance 50% of the cost of software and educational software, the entire cost of training programs, and the entire cost of ongoing guidance.

6. The budget of teacher-training institutions will be fully covered by the Ministry of Education and will operate under a separate program.

7. For every age group, an outline of operational and educational software programs will be determined, linked to the hardware and integral to the computerization package. The same applies to the training programs and guidance required by each institution, which will be supported by the program framework.

8. Those schools not equipped in keeping with the program's standards will be given the opportunity to acquire the equipment they lack. Old equipment will be transferred to other institutions and/or be taken out of circulation, as per procedures to be determined together with the National Lottery and implemented in the future.

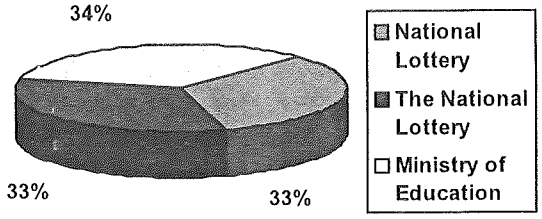
9. Responsibility for the program's operation: Science & Technology Division/ Computers in Education Department, in co-operation with the National Lottery and the local municipalities.

10. Decisions regarding hardware and software will be made in accordance with the Automation and Data Systems Division.

11. A forum for monitoring and control will be established; its members will include a representative of the Ministry of Education, a representative of the National Lottery, and a representative of the Center for Local Government.

BUDGET BREAKDOWN FOR COMPUTERIZATION PROGRAM

By Sources of Finance



per institution and as per specific requests.

- Kindergarten (compulsory) - one computer station for each kindergarten.

In the event that program implementation is continued for more than five years, the rate of supply in the primary school system will be matched to that of the secondary schools: one computer station for every ten students.

6. Allocation of resources (hardware, operational/educational software) to the schools will be carried out as follows:

- Approximately 75 percent of the resources will be allocated to the junior high schools (grades 7-9).

- High schools, primary schools, kindergartens and special education schools will be supported as the budget allows.

7. An extended training network within the school training framework will receive support as a direct spin-off of new salary agreements and teachers' needs, closely linked to the process of supplying hardware and operational/educational software.

8. Personnel will be trained for positions of responsibility in the field of computer integration in the schools, and training staff (especially new immigrants) as technical assistants at the schools.

9. Innovative projects which make use of new and unconventional teaching methods and technologies will be promoted. Within this framework, ten schools will be chosen from all school districts and sectors, to serve as model schools.

10. Schools in which alternative teaching methods are implemented will be. encouraged, so that computers may be integrated into the classes and help create a new learning environment.

11. The introduction of computers into special education schools will be encouraged at a rate of up to 50 schools per year.

12. The process of supplying computers to kindergartens is to be completed at a rate of up to 250 kindergartens per annum, by 1998.

13. Research which directly contributes towards the goals of the program is to be encouraged.

14. Operational and educational software are to be developed in Hebrew, applicable for optimum curricular coverage, without deviating from the conceptual nature of the program.

15. The program is to be implemented through the services of "implementation contractors" who will provide a computer package which includes hardware, software, training and guidance.

ORGANISATION STRUCTURE AND AREAS OF RESPONSIBILITY

The nature of the organisational structure and areas of responsibility for implementing the computerization program, as determined by the chief executive of the Ministry of Education during meetings of the Committee on Computerization, emphasises that the implementation of the program will be largely conducted by the existing Ministry divisions, each in its own area of jurisdiction.

Responsibility for operation of the program is defined as follows:

1. The Committee on Computerization chaired by the Ministry's Chief Executive formulates policies and follows up on their implementation.

2. A "Think-Tank" Staff - members: Chairman of the Pedagogic Council, the Tomorrow '98 chief administrator. Chief Scientist, Consultant to the Science & Technology Division - all of whom will consider and consolidate educational perceptions, work towards the integration of computers in education, and present their proposals for consideration before the Senior Computer Committee.

3. Operative Staff members: director of the Science & Technology Division, administration of the M.I.S. Division, administration of the Tomorrow '98 project, Director of Computers in Education Department are responsible for initiation, co-ordination and monitoring of the program's framework, as approved by the Senior Computer Committee.

4. Computers in Education Department, part of the Science & Technology Division: the implementary arm of the Senior Computer Committee and of the Operative Staff. Its main responsibility is to prepare the overall budget and monitor its use, as per the decisions of the Senior Computer Committee.

5. All divisions of the Ministry of Education are responsible for the initiation, planning and operation of the program, each in the area under its jurisdiction, following endorsement by the Tomorrow '98 administration.

Working Procedures

Procedures for implementing the computerization program, as laid down by the Chief Executive, chairman of the Senior Computer Committee, in applying computer integration in the educational network in both teaching and learning, will reflect the Ministry's work procedures:

1. Initiation: Under the jurisdiction of each division of the Ministry, and also open to other bodies outside the Ministry.

2. Policy-Making: Overall policy - the Senior Computer Committee, chaired by the Chief Executive. Sectoral policy - under the jurisdiction of each sector, in those areas under its authority, in accordance with general policy.

3. Co-ordination: The "Operative Staff" will co-ordinate the consequential results of the decisions taken by the Senior Computer Committee, which will also serve as the source of authority. Its organisational affiliation - the Science & Technology Division/Computers in Education Department, responsible of computer-related issues in the Ministry.

4. Budgeting: Initiation and general co-ordination of the program for computerization the Science & Technology Division/ Computers in Education Department. Discussion and authorisation: the Senior Computer Committee.

THE BUDGET

Budgetary Sources

The program will be based on an annual budget of NIS 72.8 million for a five-year period. The budgetary sources will be as follows:

- NIS 24.0 million - Ministry of Education's budget

school.

b. To create a supportive environment and to aid the school in its process of integrating information technologies, through a wide spectrum of activities.

2. To improve and revitalise the teaching and learning processes by the following:

a. Increasing the effectiveness of learning and teaching.

b. Training an independent and creative student.

c. Encouraging the development of superior thinking skills.

d. Encouraging educated learning.

e. Applying sophisticated information technologies as an impetus towards revitalising and promoting teaching and learning.

3. To enhance the teacher's status.

By promoting his/her professional level, as well as improving his/her self-esteem and social standing.

APPLYING THE GOALS IN THE CURRICULAR STUDY PROGRAMS

Translating these general goals into applied educational curricula can be expressed through the following objectives:

1. To facilitate achievement of the defined objectives in existing curricula that have not been achieved via the traditional teaching methods, by upgrading both the teaching of current curricular content and the normative standards.

2. To enable rapid implementation of the standard curricula by accelerating the rate of learning or by changing the order of teaching.

3. To add new content to the standard study frameworks which, so far, have not been included in the current curricula.

4. To introduce new subject content that was not included in precomputer-age curricula, but are computer-related (such as algorithmic thought, familiarity with data processing procedures, data displays and systems approach).

5. To change the attitude towards current curricular programs, for example, by breaking with the conventional limitations of areas of knowledge, and defining multi-disciplinary syllabi into multiple study units, deviating from the normal curricular teaching approach, and enabling independent and open learning, based on a flexible learning program.

6. To change the conventional teaching methods. Such changes can be achieved by adopting alternative teaching methods, and increasing the pedagogic autonomy of school principals and teachers. Furthermore, change can emerge in the organisational/logistic aspects of teaching by use of the computer in the revolutionary reorganisation of teaching and, perhaps, of the school itself.

THE MAJOR EMPHASES AND FOCUSES OF THE TOMORROW '98 PROGRAM

1. The main focus of the program will be applied to the junior high schools and teachers' seminars. Notwithstanding, attention will also be given, as far as the limited budget will allow, to kindergarten (compulsory), primary schools and high schools as well.

The cost of working with the teachers' seminars will be met by the Ministry of Education.

2. The five-year plan emphasises the following activities:

a. Training teachers to incorporate computers in teaching (all teacher trainees in teachers' seminars, and all the teachers within the various teachers training education frameworks).

b. Expanding the support and training networks for teachers, schools, and local municipalities.

c. Equipping schools with hardware and software, and replacing obsolete equipment with modern equipment.

d. Setting standards for hardware and software for all age groups. Encouraging the development of special software packages and their integration into the study programs.

e. Encouraging special experimentation, followed by evaluation and distribution throughout the system.

f. Encouraging special experimentation, followed by evaluation and distribution throughout the system

g. Developing an infrastructure of data banks and computer communications to improve pedagogic management and the integration of data bases into teaching and learning.

THE PRINCIPLES OF APPLICATION AND IMPLEMENTATION

In view of the above, the program reflects the following principles of application and implementation:

1. Computers are to be integrated into teacher's training institutions, enabling teacher trainees to acquire technological skills as an integral part of their training program.

2. The current network of training and counselling in computer applications is to be expanded in order to meet the demands for counselling, advice in purchasing, guidance in developing school programs, teacher training and teacher promotion as a direct result of school training programs.

3. Computerization of the schools and educational institutions will only be implemented by using a "computerized package" which includes hardware software and teacher training guidance. The integration of all these components will ensure the successful implementation of new technologies in the educational system.

4. The program for equipping the school system, from 1994, includes allocation of resources for the purchase of hardware, operational/educational software, training and guidance, the incorporation of which is a prerequisite to the successful introduction of new technologies into the education system.

5. The target number of computers is one computer station for every ten students (as recommended by the Poled Committee report). Based on the proposed budget allowance, the rate of supply will aim to meet the following standards:

- Junior high and high school - one computer station for every 10 students.
- Primary school - one computer station for every 20 students.
- Special education up to 10 computer stations

Areas of Activity in the Schools

ONE-KEY LOGO	LOGOWRITER		PASCAL, PROLOG, etc.
	DATA COLLECTION & PRESENTATION		COLLECTION & RESEARCH
	WORD PROCESSOR, DATABASE, SPREADSHEET		
	SIMULATIONS		
ACCORDING TO SUBJECTS IN CURRICULUM			
GRAPHICS & GAMES			

BASIC PREMISES

The program is based upon the following premises:

PEDAGOGICAL PREMISES

1. In the modern world, the capacity to use computers (computer literacy) is another basic skill in addition to the three familiar basic skills of reading, writing and calculating, and as such, every teacher and student within the educational system must acquire it.

2. Skills in data handling are vital to every modern, educated person, and must, therefore, become an integral part of instruction in all subjects. These skills can be efficiently acquired by integrating data technologies into the teaching of subject matter.

3. The computer's potential for contributing to effective learning and teaching is derived from its basic characteristics: interactivity, quick response, saving and retrieval of data, and rapid transition between different data displays (text, graphics, pictures).

4. A rich teaching environment, full of information technologies, may create learning stimulii and encourage meaningful and effective creativity and learning.

5. The integration of computers in instruction and learning may create two types of processes:

a. Preserving and reinforcing conventional teaching methods;

b. Creating change and innovation in instruction and learning. The process selected depends, to a large degree, upon the individual teacher's pedagogical viewpoint, the type of software used, and the manner in which computers are integrated into the teaching and learning processes. The program will favour trends toward change and encourage innovation in the field of active learning.

6. Any worthwhile study of non-trivial content cannot possibly depend on the model of "teacher-transfers-material" and a passive student who absorbs it; rather, the model must be that of dynamic, active and experiential learning, in which the student is involved in research and experimentation through an interactive medium.

7. The optimal effectiveness of the computer used by students will be achieved only when there is one computer station for every ten students, and when each student receives three hours of computer use a week.

8. The effective integration of computers in teaching is dependent on the teacher's approach to his or her profession, which should suit the type of software being used.

9. The teacher should be assisted in choosing the most suitable software which meets his/her needs of the specific subject material and teaching methods.

Mapping out those aspects of the software and their special features, and identifying the teaching patterns will facilitate distinguishing between software and computer applications which reinforce conventional teaching methods, and those that augment change and innovation in teaching and learning.

ORGANISATIONAL PREMISES

1. Integrating telecommunications in the education system will be the primary goal of educational policy for the next five years. This integration will be implemented by all units of the Ministry of Education.

2. The role of the Ministry of Education and Culture in this program will be to determine the principles of policy, create an infrastructure, allocate resources, set standards, initiate and encourage other groups to initiate a fuller integration of computers into the education network, stimulate R&D, and administer an experimental network and an ongoing control network of the hardware, software and activities.

3. All teachers within the school system, veterans and newcomers alike, must be computer-literate, as well as capable of integrating computers and telecommunication systems into their teaching.

GENERAL GOALS

The five–year program aims to create a technology-based learning environment within the schools, in order to achieve the following, in whole or in part:

1. To bring schools into the information era.

a. To narrow the gap between the school culture and the culture of the world around it, by creating an "information era" culture within the

COMPUTERIZED COMMUNICATIONS INFRASTRUCTURE

The Commission recommends the gradual establishment of the foundation for a nationwide computerized communications network serving the school system and enabling integration with other communications networks in Israel and abroad. Due to the high cost of this system, it is proposed to assemble it gradually, maintaining a reasonable range of implementation at every stage. The final structure of the communications infrastructure will include the following components:

SCHOOL NETWORKING

1. All computers in each school (in laboratories, classrooms and other activity centers) will be linked to a local network, by means of a server of sufficient power (equivalent to 286 or 68080) The number of servers required will be determined by the number of end stations (if the number of end stations exceeds 40, an additional server is required).

2. These networks will also constitute the sole system of school communications, and will enable communications between school computers and a main station in the Ministry of Education, and between teachers' and students' homes and the school's computerization system.

THE ORGANISATIONAL SYSTEM

An organisational infrastructure should be established to assist schools and the Ministry of Education with the operation and maintenance of computerization systems. This infrastructure is based on the following:

a. A professional computer co-ordinator appointed in each school will be responsible for the operation of computers.

b. The co-ordinator's duties will include: advising and guiding teachers, responsibility for maintenance and proper operation of equipment, assistance to the school principal in co-ordinating all activities related to school computers.

c. Scope of work: on average, the equivalent of about half a teacher's shift in an average-sized school.

d. These co-ordinators, most of whom will come from the teaching sector, will be trained in a special Ministry of Education training program.

A municipal computerization co-ordinator will be appointed in every local educational system under the auspices of the municipal Department of Education.

OUTLINE OF OPERATIONAL PROGRAM FOR 1994-1996

PROGRAM FOCUS

The main thrust of the program will be directed at junior high schools and teacher training colleges. At the same time, the needs of senior high schools, primary schools, kindergartens and special education institutions will also be addressed as far as possible within the budget framework.

PROGRAM HIGHLIGHTS

The following directions will be emphasised as part of the three-year plan:

1. Teacher training and in-service courses in the integration of computers in teaching.
2. Expansion of the educational instruction and support system for schools and local authorities.
3. Providing all Israeli teachers and pupils with basic technological skills (word processing, spreadsheet, databases and application generators) and the integration and use of these skills as part of the learning process.
4. Providing basic skills in database handling, computerized communications and additional innovative technologies (e.g. multimedia).
5. Equipping schools with hardware and software; replacement of outmoded equipment.
6. Setting standards for equipment and software for all age levels.
7. Encouraging development of special-purpose software and its integration into the curricula.
8. Encouraging special-purpose experiments, evaluation and dissemination of their results throughout the school system.
9. Development of technology and information-based organisational and communications infrastructure for use in improving educational administration.
10. Improving and modifying the teaching and learning processes, with a view toward promoting educational achievements.

ALLOCATION OF FINANCIAL RESOURCES

The program's financial resources will be directed to the following seven areas:

1. Hardware (equipment and maintenance).
2. Educational software and operational software.
3. In-service courses.
4. Education, consultation and guidance.
5. Infrastructure, communication and administration.
6. Research, development and experimentation.
7. Immigrant absorption - computer co-ordinators.

communications network for the school system, to enable integration with other communications networks In Israel and abroad. The computerized communication network will permit communication with databases and electronic libraries, which will be at the disposal of students and teachers.

ORGANISATIONAL SYSTEM

The Commission recommended the establishment of an organisational infrastructure to assist the schools and the Ministry of Education and Culture in the operation and maintenance of computerization systems. A professional computer co-ordinator appointed in each school will be responsible for computer operations, and a municipal computerization co-ordinator will be appointed in every municipal system under the auspices of the local Department of Education.

FAMILIARISATION WITH COMPUTERS

The commission recommended the establishment of a professional team to prepare a new and detailed curriculum for the teaching of "Computer Familiarisation" or "Computer Literacy" in junior high school classes. This curriculum is intended to provide pupils in the early stages of their studies with the following:

1. Fluency in the skilled use of computerized tools for processing and presentation of information.
2. Fluency in the information which can be processed by these tools.

RECOMMENDATIONS OF THE PELED COMMISSION

In order to ensure the proper integration of computer software in the teaching and learning processes, the Commission recommended the following:

1. To acquire skills in computer use.
2. To raise achievement levels in various subjects.
3. To improve thought processes and problem-solving abilities.
4. To acquire information handling skills.
5. To increase motivation for learning.
6. To create a learning environment rich in educational stimuli.
7. To create a driving force for innovation in teaching and learning.
8. To improve educational administration as a pedagogic tool.

VOCATIONAL TEACHERS IN-SERVICE TRAINING

The Commission recommended the preparation and implementation of a five to ten-year in-service training program to train all teachers in the Israeli school system in the integration of computer applications in teaching.

The curricula of the in-service training program will be based on basic teacher training programs in colleges. The in-service training courses in computer application areas will be given at university schools of education, in teachers' colleges, and at in-service training schools for teaching staff.

A complementary means of implementing in-service teacher training in computer applications is on-the-job training within the schools, whereby teachers will be guided as they work in the classroom.

DEVELOPMENT OF SOFTWARE AND TUTORIALS

The committee recommended initiating activity focused on software and tutorial development. In addition, the committee recommended the operation of a five-year development program, including the adaptation of existing curricula, with the following components:

1. Cataloguing the current inventory of tutorials in Israel (both locally-designed and imported).
2. Determining priorities in software and tutorial development (by subjects, learning stages and software tutorial types). '
3. Readaptation of curricula (goals, content and teaching method) and obligatory requirements (e.g. standard examinations, matriculation examinations) to the potential of computerization technologies.
4. Encouraging private companies to develop software and tutorials in accordance with clear, explicit specifications and Ministry of Education models.
5. Allocation of resources for the promotion of research and development centers in universities and teachers' colleges, in order to enable development of innovative tutorials in areas not commercially attractive to private companies.

HARDWARE

1. The equipping process is not a one-time campaign, but a continual process, which will require updating at least every 8-10 years.
2. The key to the proper equipping of any system is a ratio of one computer for every ten students.
3. Deployment of the computerization system in any school may be conducted on the basis of any of three configurations:
   a. Computer laboratory - up to 40 computers per laboratory.
   b. Regular classrooms - frontal teaching: one computer with suitable projection means; activity classroom: four computers per classroom.
   c. Special activity centers, such as science laboratories, art workshops, library, staff room, school secretary's office. Each school will deploy its computers on the basis of its own considerations and educational concepts.
4. Computers will have a minimal equivalency of 286 or 68080 processing levels; peripheral equipment will be commensurate with this standard.
5. The school computer system will be at the disposal of the community, and will serve extracurricular classes for children in the afternoons and during school vacations.

schools, and will involve them in the decision-making processes and their implementation. The project will provide support for the changes which occur at the schools as a result of the implementation of the program, glean ideas from the schools regarding different programs and their method of application, participate in their deliberations, and involve them in the determination of tasks and their methods of implementation. The program will locate and promote initiatives from schools and individual teachers for the advancement of science and technology education.

5. QUALITY CONTROL

One of the main problems involved in the application of Tomorrow '98 is the question of quality control. Quality control is difficult to realise in the field of education, both in terms of the quality of teaching by teachers, and in terms of the quality of learning by students.

The reason for this lies in the fact that the levels of quality are inherent in the subtle aspects of the dynamics of teacher-student interaction that takes place in the classroom – a dynamic process whose quality level can be evaluated subjectively by the expert observer, but cannot be defined by means of a series of objective criteria which determine the desired mode of behaviour in terms of single values. Much effort is currently being invested in the improvement of learning evaluation methods in order to advance teaching quality levels which should, of course, be used as much as possible.

Nevertheless, the way to ensure "product quality" in the application of the Tomorrow '98 project is, first and foremost, through the utilisation of the best resources available in Israel teachers, academics. Ministry of Education officials and additional parties involved in educational activity and their involvement in the development of advanced programs and approaches, and the training of teachers required by their application. Product quality will be determined by the individual and professional standards of those people involved in the various stages of the report's application.

"TOMORROW '98: COMPUTERIZATION OF ISRAEL'S SCHOOLS THE PELED COMMISSION REPORT

The unavoidable process of computerization in education presents the school systems with the challenge of integrating computers as tools to assist teachers and students in all areas of teaching, learning and educational administration. The creation of a "computer culture" in the schools is the way to cope with that challenge. The use of computers as a means for creating innovations has prompted the Science and Technology Division at the Ministry of Education and Culture to make new preparations, over the last two years, for the absorption of computers in Israel's schools. In view of this, the Ministry of Education and Culture appointed a commission of experts to formulate a master plan for the computerization of the school system. The commission, headed by Prof. Elad Poled of Ben-Gurion University, drew up recommendations and a policy framework for the introduction of computers into Israel's schools.

The commission, consisting of experts from Israel's academic institutions, presented its recommendations in the following areas:

1. Integration of computers in teaching and learning.
2. Teacher training and in-service training.
3. Familiarisation with computers.
4. Research and development.
5. Research and evaluation.
6. Infrastructure, hardware and communications.

The commission recommended the promotion of innovative concepts in teaching and learning, principally: the creation of a learning environment rich in educational stimuli; the creation of a driving force for innovation in teaching and learning; and the improvement of educational administration as a pedagogical tool. The commission's recommendations included the following:

MODEL DEVELOPMENT

In order to encourage the use of computers and integrate them into all school subjects, the commission recommended the development of several models.

TEACHER TRAINING

The commission recommended the foundation, expansion, and intensification of teacher training in the integration of computers in instruction and learning. It also recommended that a training program in computer operation be made an integral part of the curriculum in teachers' colleges and of teacher training programs in universities.

IN-SERVICE TRAINING

The commission recommended the preparation and implementation of a 5 to 10-year in-service training program to train all teachers throughout the school system in the use of computer applications in teaching.

DEVELOPMENT OF SOFTWARE AND TUTORIALS

The commission recommended initiating activity focused on software and tutorial development, trials in experimental schools, and evaluation. The development program will include encouraging private companies to develop software and tutorials, and the allocation of resources for the evaluation of tutorial integration into the curricula.

COMPUTERIZED COMMUNICATIONS INFRASTRUCTURE

The Commission recommended the establishment of a nationwide computerized

NATIONAL REPORT OF ISRAEL

PROMOTING SCIENCE TECHNOLOGY AND COMPUTER STUDIES: THE "TOMORROW '98" PROGRAM

INTRODUCTION

The overall objective of the Tomorrow '98 project is to improve the quality of science and technology education offered to children in Israel. The Ministry of Education adopted a five-year plan (1994-98) to implement the project.

Below are some of the key principles in the implementation of the project:

1. THE TEACHER AS THE FOCUS OF IMPLEMENTATION

The most important aim of the Tomorrow '98 project is to significantly improve the quality of science and technology education in Israel. The improvement of the quality of education will, first and foremost, be achieved by means of the daily academic interaction between teachers and students in the classroom. Thus, the implementation of the Tomorrow '98 project will highlight the advancement of teachers' level of professionalism, in terms of both content and teaching methods. The revision of study curricula will be accompanied by extensive activities involving training courses, in-service training and support, aimed at working together with teachers in adopting advanced methods of science teaching which devote special attention to the needs of the student, thereby generating a more meaningful level of study and enhancing the students' position vis-a-vis the school and learning in general.

Implementation of Tomorrow '98 involves emphasising the teacher's professional advancement through extensive training programs:

- Training professional primary school mathematics teachers
- Training co-ordinators for computer laboratories
- Training science and technology teachers for junior high schools
- Improving training for science teachers in senior high schools

2. THE STUDENT AS THE FOCUS OF INSTRUCTION AND LEARNING

The Tomorrow '98 project will devote special attention to the application of study curricula and teaching methods which revolve around improving the students' comprehension, mobility and enjoyment. This is a difficult objective to achieve, but not without precedent in Israel and throughout the world. The key to achieving these objectives is the emphasis placed on the qualitative aspects of the study material alongside the quantitative aspects ("principles in place of formulae"), particularly in mathematics and physics; the introduction of interactive teaching methods (with extensive integration of computer use); changing the perception of the student from a "material absorber" to that of an active partner in the evolution of concepts in his or her mind; and changing the perception of the teacher from a "material conduit" to an instructor in an interactive learning environment.

The primary means to be used in achieving these goals are the development of new programs which integrate science and technology, and the use of student-oriented teaching approaches - increasing the use of computers in teaching and extending individual learning.

3. COMPUTERS FOR THE ENHANCEMENT OF INSTRUCTION AND LEARNING

One of the most important tools, both in the enhancement of teaching and learning, and in the creation of change in teachers' attitudes, is the use of computers in all stages of teaching and learning. Thus, another area of particular importance for the Tomorrow '98 project is the introduction of "enlightened" methods of computer usage, which place the student at the center of the learning process and generate an interactive learning environment. The program entails the introduction of computers for teaching and learning at all levels of education, with the goal of reaching a ratio of one computer station for every ten students in the primary and junior high schools, and one per every twenty students in the high schools.

The program includes the establishment and operation of science laboratories with a view to maintaining a continuous link between academic and practical studies, and integrating scientific and technological aspects in teaching. The anticipated goal is that by the end of the project, every student will participate in 2-3 hours of laboratory activities every week.

4. SCHOOLS AS FULL PARTNERS IN THE IMPLEMENTATION PROCESSES

The school is the center of educational activity. Tomorrow '98 will devote a long-term and methodical effort to understanding the requirements of the

ous subject areas.

- Produce a core of highly skilled IT specialists to satisfy the needs of the market at home and abroad.

- Formation of 3 support group which may lend assistance in the following areas:

1. Curriculum support for IT
2. Software support and development for IT
3. Technical support
4. Training support

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FACTORS LIMITING PROGRESS IN THE DEVELOPMENT OF NEW TECHNOLOGIES (NITS)

SERVICE UTILITIES

The area of Guyana is 83,000 square miles, and has a population of about 750,000 persons. About 75% of the population are concentrated on the narrow, flat coastland, but many others live in small communities in the riverain, mountainous and other areas of Guyana. Educational Institutions exist throughout the length and breadth of Guyana. However many of these areas, particularly those external to the flat coastland, suffer from the lack of certain essential services, including:

- adequate and ready transportation facility;
- a ready supply of electricity (except where individuals own private generators);
- telephone system that boasts a penetration of 46,219 telephone lines has not yet been extended to many of these locations.

The National Broadcasting System is to date not powerful enough to broadcast all areas of Guyana.

The above mentioned utilities are integral the use of information technologies in all formal institutions of Guyana.

LACK OF TEACHERS WITH IT SKILL

Many of our secondary schools have acquired computers and attempted to start a programme of computer awareness in schools. Like many of their predecessors in other countries, the foresight to acquire skilled persons or offer training to existing staff before placing computers in the schools was sadly lacking. Many of the computers in some schools were and still are underutilized or not used at all, except in cases where VSO's help was sought.

Two of the secondary schools that have VSO's attached to them have done a remarkably good job in training students with few machines, this was evident in the Caribbean Examination Council (CXC) results obtained.. At one of our senior secondary school, about twenty students will be writing the CXC exam In June '96. These students suffer severe constraints, there are only 2 computers on which to prepare their practical pieces, complete assignments and have hands-on practice sessions.

FINANCE

The purchase of a computer still remains a big investment for schools. As a result, most of the secondary schools in Guyana have acquired computer through various donours. Unfortunately, many of these 'gifts' are very old versions of 4th generation computers and seems to be of little use in a school which has as its priority - the enhancement of teaching and learning through the use of CAL packages. For example, one school was given a few BBC computers, two others were given 2-each, 8088 computers Guyana has to be very careful in accepting these gifts, since it may prove very difficult to standardize our systems in the future.

NATIONAL POLICY FOR INFORMATION TECHNOLOGY IN EDUCATION

As the Ministry of Education, at the time of writing does not have a National Policy concerning the use of information technologies in education, the schools which took the initiative had no guidelines to follow in their work. Steps are now being taken to remedy this situation as a committee has been formed to produce a draft national policy in time for the new academic year '96-'97.

OUR VISION FOR THE FUTURE

Guyana which is now in an advantageous position of introducing information technology to schools after reviewing the successes and pitfalls of its predecessors, foresees a vision for the future to include:

- A population that is computer literate.

- Using IT as a planning and developmental tool in education.

- Production of a curriculum that integrates IT in the various subject areas.

- Preparation of students for the world of work and the existing new technologies.

- All teachers are skilled in using IT in vari-

at the main branch of Cyril Potter College of Education (CPCE). An option course in Information Technology was then introduced to primary in-service teachers by the institution. These students were exposed to the use and application of generic, computer assisted learning (CAL) software and an introduction to programming. This was a progressive step by the institution, hut to date only sixteen (16) students have elected to choose Information Technology as an option course. In a country where the '93 - '94 statistics shows that there are 98,003 primary school students and 3,746 primary school teachers, one can immediately perceive the problem of insufficient trained persons to deliver IT, if the current trend of training in such small numbers continue. Little or no training is offered to In-Service Secondary School Teachers.

SECONDARY SCHOOLS

Some secondary schools in three (3) of the ten democratic regions have fulfilled their desire to have the new technology in their schools. Computers were acquired mainly through Old Students' associations. Parent Teachers' Associations, other donors and The Ministry of education. In most of the schools, there existed great anomalies with regards to IT, the most important being that:

- there was no policy regarding how the computers should be used to enhance teaching/learning;
- there was a lack of skilled persons to deliver an IT program to students,
- Computers were stored away because schools lacked the preparedness for their use.

In some of the schools. Voluntary Service Officers (VSOs) played an integral role in delivering a computer awareness programme - as they saw fit, to students and in helping to train local teachers.

PRIMARY SCHOOLS

As at the lime of writing, there are no primary schools that have computers used for the enhancement of leaching and learning. The Ministry of Education is. however, trying to access funds for the introduction of computers into 6 primary schools in Guyana - A Pilot Project for the academic year 1996-1997.

INFORMAL SECTOR

Many private institutions offer computer courses to students for a fee. Most of the courses are mainly introductory, bur they lack the hands-on time to develop confidence and dexterity in using and applying the software. These schools provide the largest component of IT education in Guyana. The standard of tuition is variable as is the content, and each concentrate on basic computer applications such as word-processing, database and spreadsheet management. Some training in programming, computer-aided design, desktop publishing and technician courses is also offered. The courses offered by these institutions have not been accredited or certified by the Ministry of Education.

COMPUTER HARDWARE AND SOFTWARE IN THE EDUCATION SYSTEM

The provision, acquisition and use of software in the educational system, are major issues for educational officials in Guyana. This hinges on the fact that as a poor third world country, Guyana lacks the financial resources necessary for industrialized development. Hardware and software used in the educational system originate from and are bought from developed countries such as England and United States of America (USA). These include the following:

- *Generic packages viz.; word-processing, database and spreadsheet;*
- *Educational games:*
- *CAL packages; and*
- *Programming software.*

The disadvantage of such purchases is that the programmes are not specifically designed to suit our educational needs. In cases where purchase is made from USA, one finds that there is also the US-English spelling problem.

Additionally, the purchase of educational software is a new phenomenon: hence, suppliers do not readily have them available on stock, and they do not have catalogues from winch selection can be made. As most of them are not familiar with the educational curriculum, they can offer little or no advice about the choice of software.

This situation could, however, be remedied with the advent of the proliferation of computers in schools. The Guyanese programmers may be co-opted to sit with educators to design subject specific programmes which are suited to our local needs. Additionally, established suppliers could target this new market and make available catalogues and preview copies of software.

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"REPORTS AND SPEECHES"

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