Teachers and teacher education facing information and communication technologies

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Abstract

Information technology and communication technology are evolving and converging, giving rise to new tools for teaching and learning. Step by step, a new profession is emerging: the teacher of tomorrow. We will try to describe what the profession of the teacher of tomorrow will be like. Education now needs a real generalization and a real integration of new technologies. But generalization and integration are possible only if teacher education is redesigned. We will outline some elements for teacher education, starting from the experiences carried out in France. It is clearly impossible to provide a new teacher with all the competencies and knowledge he (she) will need through out his (her) career. Therefore, one must provide new teachers with "basic" competencies and knowledge, and prepare them to evolve and adapt. Consequently, not only the content of the training is important, but the methods used in teacher training play a major role.

Keywords

Information and communication technologies, education, teacher education

1 INTRODUCTION

Education has certainly not been influenced by Information and Communication Technologies (ICT) as much as one might have thought it would be ten years ago. Computers have been put in schools, some curricula have been changed, some teachers have been trained; but all this equipment is under-used, and in fact teaching and learning have been little affected by new technologies, and there is generally no real integration of ICT in teaching. At the same time, ICT are developing very rapidly, and influence society more and more. More and more pupils can use a computer or a calculator, but most of the time it is not at school that they learnt how to use it! A recent survey showed that in France, 85% of 13 year old pupils have a pocket

calculator and use it, but only 10% learnt how to use it at school. However, the evolution of society under the influence of ICT will change education and teaching, and the teaching profession will evolve. One must prepare and master this evolution, anticipate on what the teacher of tomorrow will be, and adapt teacher education to the new needs.

2 TOWARDS THE TEACHER OF TOMORROW

2.1 Evolutions

Information technologies are changing: computers are more and more powerful, more and more user-friendly, smaller and smaller, cheaper and cheaper. Software meets our needs (or we are creating new needs which meet the new computer facilities!) more and more. Information whatever its nature is digitalized (i.e. put into a sequence of 0 and 1): texts, images, pictures, sounds, can now be considered as similar information, which can be processed in similar ways.

Communication technologies are changing at the same time: New communication technologies enable lots of information (i.e. sequences of 0 and 1) to be carried very quickly and at a low price, making possible what was not before.

The joint developments of information technologies and communication technologies converge to provide new facilities: Information and Communication Technologies. So, different pieces of equipment are now more and more similar and may merge: A CD-ROM contains all kinds of information (sounds, music, images, video, texts, ...), and TV, computer, radio, record player, telephone, fax, may now appear as a single machine, or are at least closely connected.

This leads to multimedia and networks, which are the main results of the convergence between information technologies and communication technologies.

New ICT tools, multimedia, networks, influence education in several ways. They influence the knowledge itself, and the needs for knowledge. They influence the ways one can have access to knowledge, and therefore the status of knowledge itself. They influence teaching, providing a wide field of new possibilities. They influence learning, but a lot of research is necessary in order to understand and master the effects of ICT on learning. Many interesting experiments have been carried out: computers in classrooms, use of multimedia and a lot of educational software and products, experimentation, simulation and modelling, network working, video-conference teaching, etc. This changes the role of the school, the place of the school in knowledge transmission, and therefore changes the role of the teacher.

2.2 Generalization, Integration

A lot of experiments and successful innovations have been carried out. They are generally done by volunteers and enthusiastic teachers. It is certainly necessary to continue research and experimentation. But a major problem is now to have ALL teachers involved in information and communication technologies. And what is possible with a few of them is much more difficult with all of them. Generalization of ICT in teaching is a crucial point for the future, which we must address and solve. It requires a precise study of the obstacles against generalization, it needs technical and "hardware" actions, in order to simplify the access to technologies and their use in education, and it needs a huge effort in teacher education.

Integration is the second major problem. It is not simply a case of "adding" new technologies to what existed before: adding specialized rooms in schools, adding computers to classrooms,

adding a new technologies chapter to books and courses, adding computer activities to the existing syllabuses and curricula and to lessons. One needs to integrate ICT into education: integrate it into knowledge and subjects (i.e. take into account the evolutions of knowledge, of concepts, of subjects), integrate ICT into teaching (i.e. in contents and in methods), into learning, integrate ICT into the school, integrate ICT into the profession of the teacher. Once again, teacher education is an essential means in order to develop integration.

2.3 New competencies

Not only information and communication technologies influence the role of the teacher. In most countries, social parameters are important : more and more pupils can go to school and pursue their studies at a higher level. So, schools and classes are more and more heterogeneous, with pupils at very different levels of skills and capacities. Economic and social problems (unemployment, housing, poverty, social exclusion, delinquency, drug addiction, etc.) all influence what happens in schools, the behaviour of the pupils, and the needs of society with respect to education. Knowledge is more and more complex, and knowledge transmission more and more difficult. The role of school and education is discussed as a major point in most countries : Is it only to transmit given knowledge? Is it to accompany each pupil in knowledge acquisition? Is it to transmit social values? Is it to prepare the citizens of tomorrow and help pupils attain social insertion? Is it to contribute to the solution of social problems?

In any case, the role of a teacher is becoming more and more complex, and more and more diverse. Let us try to list some of the competencies a teacher will need :

- A teacher must master the knowledge to be transmitted;
- A teacher must master the teaching and learning processes;
- A teacher must be able to create and develop his (her) teaching; he (she) must have the competency of a technician and an engineer.
- A teacher must be able to build up his (her) own competencies permanently.
- A teacher must be able to use the results of educational research, and to question research.
- A teacher must transmit the love for learning and an appetite for knowledge to pupils.
- A teacher must arouse the curiosity of the pupils.
- A teacher must prepare and mould the citizens of tomorrow: their judgement, their freedom.
- A teacher must also prepare the pupils to pass their exams (this is a short term objective, compared to the previous one which is long term focussed).
- A teacher must sometimes replace the parents' authority when they fail.
- A teacher must apply and put into action a policy, the educational policy of the Minister.
- A teacher must be the guarantor of equity and equality for all pupils.
- A teacher must transmit the fundamental values of society.
- A teacher must be an adviser.
- A teacher must be an organizer.
- A teacher must be a leader and a manager.
- A teacher must be an evaluator.
- A teacher must be able to work alone (preparing lessons, marking works and examinations).
- A teacher must be able to work in teams, with colleagues (concertation, preparation of lessons, share competencies, reflection, research...).
- A teacher will have to work at home, and at his (her) office (but generally schools do not provide offices for teachers! Probably they will do more and more in the future).
- A teacher must be able to work in a lab (labs will develop, not only for sciences, but more and more in every subject, with the help of information and communication technologies).

- A teacher must be able to work with the whole class, but also with small groups, and with each pupil individually.
- A teacher must be able to evolve and adapt.
- A teacher must manage the fact that more and more, he (she) will not be the only one to transmit knowledge : he (she) will have to manage the access to knowledge, to help pupils organizing the knowledge, hierarchizing the knowledge.
- A teacher has to help the pupils to conceptualize, theorize, model, and build abstraction.

Such a list leads to some comments: Firstly, it is certainly impossible for a teacher to have all these competencies. Secondly, there is a risk of dilution between all the competencies. Thirdly, one must try to determine which competencies can be acquired in initial training and help then to acquire other competencies progressively, and which competencies need to be acquired in in-service training. A major competency for a teacher will be to be able to evolve and adapt, throughout the career. In-service training must therefore be considered as an essential part of the profession of a teacher, and no longer as an optional and luxurious activity.

3 TEACHER EDUCATION

3.1 Some principles

Some basic principles must be taken into account in teacher education and training, and especially regarding the integration of information and communication technologies.

- Teaching is a profession, for which one must be prepared, educated and trained. It is not enough to be good at mathematics in order to be a good mathematics teacher!
- The profession of a teacher is an intellectual profession, and a profession of freedom. It is essential to keep thinking, to take into account the diversity of pedagogical strategies.
- Knowledge (disciplines to be taught), human and social sciences, pedagogy and educational concerns, must be well balanced in teacher education.
- Teacher education needs a permanent interaction between theory and practice.
- It is impossible to provide a future teacher with all the competencies and knowledge he (she) needs, for an entire career. There is no "rucksack" for a good teacher! In-service training is an essential component of the profession of a teacher.
- Ability to evolve and adapt is an essential component of the profession of a teacher. This ability must be developed in initial education. Regarding ICT particularly, nobody knows how it will evolve during the next 30 years, and which competencies will be necessary in 20 years!
- Teacher education must include short term aims (such as "recipes" for teaching, or preparation for the first professional moments) and long term aims (more fundamental and theoretical inputs and reflections).
- Training methods are as important as contents. Teachers will generally teach not the way they are told to do, but reproduce the way they were taught. Therefore teacher education methods will change teacher behaviour.
- It is not enough to give courses ABOUT new technologies and their integration into education; ICT must be actually used in teacher education, in all its dimensions and components, and integrated in teacher education contents and methods (similarly, one does not learn collaborative work through courses about collaborative work, but by practising team work!).

- Future teachers are not only to be taught that it is possible to learn something through ICT. They must themselves actually learn something new through new technologies.
- In teacher education, ICT is both an object and a tool. Indeed, future teachers will have to teach ICT, will have to use ICT, and will have to integrate ICT into their teaching.

3.2 Teacher Education in France : the "IUFM's"

In 1990, a reform of teacher education was introduced in France. Before the reform, primary teachers were trained in "ecoles normales", out of the university community. Secondary teachers were trained by universities, but only in subject matter (they got pedagogical training, provided by inspectors, during the first year of their career). In 1990, new Institutions were created : University Institutes for Teacher Education (IUFM). They train primary and secondary teachers (student teachers must first take 3 years at university, then 2 years at IUFM). Thus primary and secondary teachers have the same level of training, and as a consequence the same salaries afterwards. In IUFM, education includes disciplines (primary teachers teach all the disciplines of primary school; secondary teachers generally teach only one discipline), human and social sciences (psychology, sociology, philosophy...), and professional and pedagogical inputs (pedagogy, didactics ...). Training includes practice periods in schools, with interaction between theory and practice. IUFM's are independent higher education institutions, similar to universities, which collaborate closely with universities. They also contribute to in-service training, and participate in educational research.

A particularity of France is that teacher recruitment is linked to teacher education. Teachers are recruited by the State, not by schools. The process of being recruited is a result of a competitive examination, which students take at the end of the first year at IUFM. If they succeed, they continue in second year (during which they are paid, as civil servants), and are then given a post.

The French State recruits about 26 000 new teachers every year. All together, IUFM's train about 90 000 students.

3.3 Integrating Information and Communication Technologies into Teacher Education

The integration of ICT into teacher education, has been a main concern for IUFM's. They started at a very low point, and had to develop ICT in many aspects. In 1995, all the IUFM's were asked to elaborate a 4-year plan. Plans include ICT integration.

The content of ICT education for future teachers is based on two aspects: ICT as tools, and integration of ICT. We try to avoid a lot of courses or modules about ICT. We prefer to have:

- some courses in order to help the students use and master the tools (word processing, main software, basics for using computers, multimedia, networks...);
- integration of ICT in the teaching of all other subjects, including the pedagogical use of ICT in each of these subjects.

As a first consequence, we do not need mainly specialists and computer scientists : we need all the staff to practise and integrate ICT in their teaching. This leads to an enormous problem of trainers' training. We are now implementing a trainers' training plan in order to have all our staff trained as soon as possible.

ICT integration in teacher education must include three main components : Social and cultural aspects (i.e. how ICT influence society, and which technologies and techniques are

available), technical aspects (ability to use software and hardware as a tool for practising the teacher profession), and pedagogical and didactical aspects (linked to the subjects and knowledge to teach). It must also be linked with the articulation between theory and practice which is an essential component of teacher education. So, we are working closely with schools which are equipped and in which there are teachers able to tutor and advise our students in ICT integration.

We want ALL our students to be able to use ICT. It raises the question of equipment. Our institute is spending a lot of money on ICT equipment, trying to do it in a very diverse way: equip the lecture halls, equip specialized rooms for new technologies (computers, audio-video, multimedia and networks, computer aided experimentation in sciences...), provide ordinary rooms with minimal equipment, have self-service rooms available to students when they need, have an ICT corner in libraries with CD-ROMs and software, etc. We also help our students buy their own equipment: every year, we organize exhibitions with equipment we have selected, and which are offered by companies at a lower price; a bank provides special loans for students in order to buy ICT equipment.

We installed an internal network (our institute is split into 5 different centres, in 5 different cities), first for management, but also for our staff to communicate and in this way to start using ICT as a daily, easy and useful tool. And we have started providing access to Internet, despite the fact that in France it is very expensive!

Our project includes the following actions:

- Integrate ICT in training programmes;
- Integrate ICT in the "scientific life" of the Institute;
- Establish a plan for ICT equipment in the Institute;
- Participate in the production of tools and products (such as CD-ROMs, multimedia tools, etc.);
- Develop an "ICT-library" (teachers are professionals; they need professional tools, and they need the most up-to-date tools; these tools must therefore be available in every teacher education institution);
- Develop networks, inside the Institute and with the exterior; develop tele-working (among our staff, and with the student teachers);
- Work in collaboration with external partners. In this way, we work together with other IUFMs in France, with the local universities, and with teacher education institutions in several countries. We participate in European projects aimed at developing ICT in teacher education.
- Implement a trainers' training plan;
- Develop research activities in the field of ICT in education and in teacher education.

All theses actions are not equally difficult, and some of them can only be long term actions. They need not only "good will", but a strong policy, structures and finance.

4 CONCLUSION

ICT seem to develop quicker in society than in education! It gives the schools new roles : it is no longer the only place where pupils can learn. Knowledge is now accessible in many other places, through many resources which are outside school. It is a challenge for educational systems to deal with these evolutions and to adapt to what society now needs. Teachers are the main actors of the changes; they must be prepared for their new roles. This makes it necessary to act both in teacher pre- and in-service training. The convergence between information

technologies and communication technologies, the convergence between technologies development and educational research development, lead to new tools and to new possibilities for teaching and learning. But certainly research, experiments and innovations are needed in order to progress, and to solve the two major difficulties : generalization, and integration.

5 REFERENCES

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