OCCE.2018

BOOK OF ABSTRACTS

Knierzinger A., Lewin C., Passey D., Sanchez E.(eds.)

IFIP TC3 Open Conference on Computers in Education

Empowering the Learner for Life in the Digital Age

24th to 28th June 2018
Linz, Austria

Welcome to OCCE.2018

Anton J. Knierzinger
Chair of Organizing Committee
University College of Education Linz

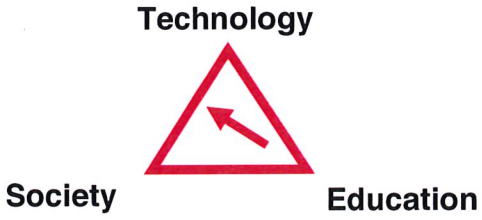
Welcome to OCCE.2018!
In this conference we will meet the challenges and opportunities emerging with the societal impact of digital technologies. The contributions to the conference, the discussions and presentations will cover the wide range of topics related to ICT in education, digital media and strategies of implementation in school.

Our vision is to form a community of all stakeholders of ICT in education:

- Researchers
- Practitioners / Teachers
- Decision and policy makers
- Industry

OCCE.2018 will be a forum where they can meet, discuss und share their experiences.

TC3 has chosen "Empowering the Learner for Life – in the Digital Age" as the title of our event in 2018. The icon of OCCE.2018 is a triangle. The corners symbolizes the three important players in the digital world:



The sides of the triangle denote the interactions between the three aspects, the arrow shows that education is the mechanism which allows us to positively control the effect of digital technology in all areas of our society.

If we see it in this way, ICT Education is not only one more subject which maybe meets the interest of our students. It has a big impact on both the future life of our students and the development of our society.
That means:

The work of ICT educators matters!

A Message from the Conference Chairs

Eric Sanchez
Université de Fribourg

Co-chair of International Programme Committee

Cathy Lewin
Manchester Metropolitan University

Co-chair of International Programme Committee

Today, young people face a challenging situation. Whilst they have the opportunity to benefit from powerful digital technologies which open up new learning opportunities they also need to deal with handling and making sense of such devices in a complex and non-stable world.

Consequently, we need to address the omnipresence of digital technologies, their increasing accessibility and power to shape action and perception, through the development of learners' understanding and application of creativity, computational thinking, media literacy and digital citizenship. This endeavor is not simply about adaptation to a new technology and its associated culture.

Digital technologies are not just a means of handling the given world, providing relevant learning experiences, enabling young people to more easily make connections with knowledgeable others and learn across boundaries. Digital technologies also enable young people to re-invent their world and society through being active creators and producers rather than passive consumers of knowledge and information. At the same time, the job market is shifting and young people now require a range of digital skills to meet employers' needs. There is currently a lack of clarity regarding what those skills should be.

This complex situation gives rise to many tensions. Will employers place greater value on computer science skills (eg coding) or transversal skills? To what extent does (hidden) datafication surrounding online use undermine security and anonymity? How can we ensure that digital learning opportunities are available to all, irrespective of gender, ethnicity and social class? How can we scale up and sustain innovative uses of digital technologies in education when new technologies are constantly emerging?

The challenges and opportunities emerging with the societal impact of digital technologies will be addressed through the topic.

A Message from the Doctoral Consortium Chair

Don Passey
Lancaster University

Chair of Doctoral Consortium

We are delighted to welcome doctoral students from across the world to this IFIP OCCE 2018 conference, and to the events we have planned for this Doctoral Consortium. All the doctoral students involved are currently enrolled at different stages of their doctoral studies, but all have a focus on research in IT or ICT education.

There are five key aims of the Doctoral Consortium; to:

- Offer opportunities to present at an international conference.
- Work with others and develop a supportive community of scholars and a spirit of collaborative research.
- Engage with other participants' current research work.
- Gain feedback on one's own research work.
- Be involved in developing guidance on future research directions.

The Doctoral Consortium starts with two 'sharing your practice' events, followed by an event during each day of the conference: a poster session; 'Publishing from your doctorate'; and 'Reflecting backwards and reflecting forwards'. I am delighted that three highly experienced senior researchers in IT and ICT in education, bringing a wealth of expertise from different country contexts, have kindly agreed to work with me in these events; Prof Dr Christine Bescherer, University of Education Ludwigsburg, Germany; Dr Jaana Holvikivi, Helsinki Metropolia University of Applied Sciences, Finland; and Dr Keith Turvey, University of Brighton, UK.

All conference participants will have chance to see the current research work of these doctoral students. Each doctoral student will summarise their research work on a poster, which will be displayed for the period of the conference. We hope you will take the opportunity to view their work, offer any comments, and engage with them about their research studies.

A Message from the IFIP TC3Chair

Sindre Røsvig

Chair IFIP TC3

IFIP (International Federation for Information Processing) is the leading multinational and apolitical organization in Information and Communications Technolgies and Sciences. It is recognised by United Nations and other world bodies representing more than 40 countries/regions all over the world. The core activity of IFIP is run by its over 100 working groups and 13 technical committees linking together professionals from academia and industry; from science, policymaking and practitioners. The education committee, labelled TC3 have four working groups:

WG 3.1: Informatics and digital technologies in School Education
WG 3.3: Research into Educational Applications of Information Technologies
WG 3.4: Professional and Vocational Education in ICT
WG 3.7: IT in Educational Management

The aims are to establish and maintain liaison between national and international individuals and organisations fostering cooperative action, collaborative research and information exchange including interdisciplinary work and networks. This also includes identifying subjects for research and projects that will support future developments.

The conference strives to meet these challenges by offering different ways of working from paper presentations including discussions to symposia highlighting important and emerging topics.

At this conference the four working groups of TC3 are represented and invites professionals that want to take part in future work and activities to wave interest by attending the annual meeting of the relevant group (see the programme). Empowering the learners for life in a digital age is not only the title of the conference but a goal that is a challenge for years to come.

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How to become a member of a WG?

During OCCE.2018 all WGs of TC3 will have their annual meeting. You are invited to participate as a guest, be informed about the work and get in contact.

A Message from the editors of the post-conference book

Dear IFIP OCCE 2018 conference participant,

Following the conference, a range of presented papers will be published in a post-conference book. Details of the process for submitting papers have already been sent out by the chairs of the conference. During the conference, you will hear more from us as editors about the process that follows the conference.

At this time, we can say that we are delighted that the international scientific publisher Springer will publish this post-conference book. It is planned that the book will be released in late 2018 or early 2019. Details of how you will gain access to the book will be sent out to you following the conference.

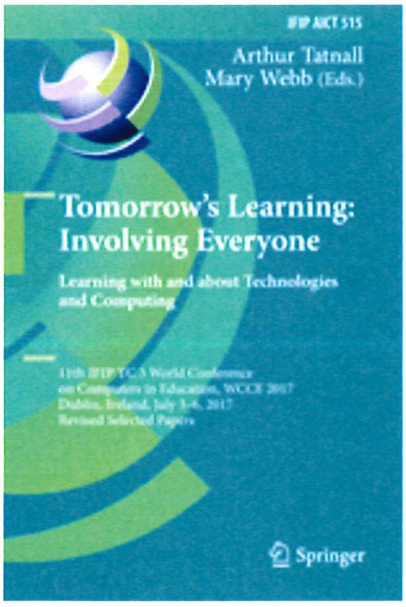
If you have any questions about the process following the conference, about papers, or the book, then please do email or ask us.

With kind regards,

Don Passey and Rosa Bottino
Editors of the post-conference book

Contact:
Don Passey: d.passey@lancaster.ac.uk
Rosa Bottino: bottino@itd.cnr.it

See and order the post-conference book 2017:



Tatnall, Arthur, Webb, Mary (Eds.)

Tomorrow's Learning: Involving Everyone. Learning with and about Technologies and Computing

11th IFIP TC 3 World Conference on Computers in Education, WCCE 2017, Dublin, Ireland, July 3-6, 2017, Revised Selected Papers

Details of the book can be found here:

https://link.springer.com/book/10.1007/978-3-319-74310-3

We need to address the omnipresence of digital technologies, their increasing accessibility and power to shape action and perception, through the development of learners' understanding and application of creativity, computational thinking, media literacy and digital citizenship. This endeavor is not simply about adaptation to a new technology and its associated culture. It is a big challenge for education systems.

This session will give you an overview about ideas, projects and strategies how digital education is implemented in the Austrian education system. Among all the projects currently running in our country we have selected projects which might be of interest to an international audience. We hope this we be a starting point for a friutful discussion though the whole conference.

Austrian projects session has two parts. First we start with a plenary session where seven projects will be presented. Afterward we will give the chance for personal talks with the presenters within the framework of the Austrian Projects Forum.

Martin Bauer
Head of department IT/4, IT-didactics and digital media

Federal Ministry of Education, Science and Research

eEducation Austria -digital competences for all

The primary goal of the initiative eEducation Austria of the Federal Ministry of Education, Science and Research is to advance digital and ICT-based competencies throughout all schools in Austria - starting from Primary schools to Upper Secondary - digital education for all!

Digital Competences for all!
The initiative eEducation Austria of the Federal Ministry of Education, Science and Research promotes the gain of competencies needed to use technology consciously and productive for individual development and to ease access to current and future occupational fields.

eEducation network
Schools which see the importance of the topic to get their organisation as well as class work digitally fitare invited to become a member of the eEducation Austria network.

Working with digital media
Center of all activities of the eEducation initiative is the meaningful use of digital media in all subjects as well as an increase of digital and informatical competences of students.

Johann Stockinger
Senior Researcher

Austrian Computer Society

ECDL – Computing and Rocotics Module

Austria is one of the first countries who carries out the new ECDL module "ECDL Computing". This module sets out essential concepts and skills relating to the use of computational thinking and coding to create simple computer programs. As programming language Python is used. First pilot schools are currently in the process to pass the new module.

In cooperation with the ministry of education (BMBWF) we are also certificating teachers in Austria in ECDL Computing – the certificate for the teachers is paid by the BMBWF. OCG is working on automatic testing methods for Python code which will be implemented in Moodle. Besides the ECDL Computing certificate OCG is also developing a block-based coding certificate based on scratch and Snap!.

Another certificate which is in development at the moment is EDLRIS (European Driving License for Robots and Intelligent Systems) It is a cooperation between several partners in Austria and Hungary and supported by the European Commission. OCG is one of the Austrian partners. In EDLRIS we propose to establish a standardized training and certification system for young people in the areas of robotics and AI. We try to deploy the programming language Python in EDLRIS as well in order to create synergies with ECDL computing.

Astrid Leeb

Education Group

Education Group - Professional Support for Teachers

A professional support is a prerequisite for a successful integration of ICT in schools. Education Group is a leading centre for innovation in education with longtime expertise in pedagogics, technology and media. It is both a provider and a producer of educational media and engages in media education by providing teaching materials on media literacy, by offering seminars/workshops on the use of media in the classroom or by conducting research on the usage of media by children and young people.

Due to the fact Education Group was founded almost 30 years ago, it has built up excellent relations with policy makers, teacher training institutions, schools and educators and has always aimed to pick up trends regarding the use of technology in education.

For example, Education Group is responsible for lernplattform.schule.at, one of the world's largest Moodle-servers, and maintains the biggest educational server in the German-speaking world (more than 80.000 e-content resources on about 40 subject portals). Education Group runs a media on demand service (mainly targeted at Upper Austrian schools) offering about 2.600 educational films, about 1,3 million audio files, 800 videos produced by Education Group's "BildungsTV" and much more – most of them come with teaching materials.

Wolfgang Rauter
Researcher at the Department of Interactive Media and Educational Technologies

Danube University Krems

The Seamless Learning Project
Improving the quality of Austrian educational resources through the training of school book publishers' employees

The Austrian project "Seamless Learning" implements a training programme for staff select employees of Austrian school book publishers.

The purpose of the programme is to enable students to develop competencies and eventually develop high-quality educational resources for a digital age based on a reliable business model. By qualifying a comparably small group of companies which cover a major share of the Austrian school book market, the project will have a major impact on the Austrian school and educational system. This talk will give you an overview about the project idea, challenges face(d) and opportunities beyond the project lifetime.

Markus Hohenwarter

School of Education at Johannes Kepler University Linz

GeoGebra -
A free math apps that created a global community.

This project was started over 15 years ago with a master's thesis that wanted to join math apps for geometry and algebra in one combined tool. Today, GeoGebra is a global community of teachers and students who have already shared more than 1 million interactive open educational resources on www.geogebra.org.

Marlene Miglbauer

University College of Education Burgenland

Deputy Head of Virtuelle PH

Virtuelle PH

The Virtuelle Pädagogische Hochschule (VPH) is a service centre maintained by the Austrian Federal Ministry of Education and has been attached to the Pädagogischen Hochschule Burgenland since 2011. Next to providing
professional development to teacher trainers, teachers and pre-service teachers in Austria, a major focus is supporting University Colleges of Teacher Education in implementing blended learning into their teaching portfolios. The various formats (online courses, webinars and self-study moduls) offered by the VPH are solely taught online and cover aspects which are essential for and relevant to becoming digitally-competent teachers.

Gerhard Nussbaum
ViceCEO and CTO

KI-I
Competence Network Information Technology to Support the Integration of People with Disabilities

AsTeRICS and 4D-Joystick

A vast number of people with disabilities are supported by Assistive Technologies (AT) which improve their quality of lives. AsTeRICS is a free and Open-Source construction set for assistive technologies (AT). It allows the creation of flexible solutions using a large set of sensors and actuators. Tailored AT to the specific needs of a user with disabilities is with the help of AsTeRICS possible.

Another kind of AT solution is the innovative 4D-Joystick. It allows users with disabilities to remote control non-trivial toys like RC models (airplanes, boats, cars, drones, helicopters, etc.) with the mouth. Moreover the 4D-Joystick can be used as a computer input device, a Playstation controller and a music instrument in combination with AsTeRICS.

PANEL 1

Implementation Strategies for ICT in Edcuation

Panel:

Co-Chairs: Raymond Morel - IFIP
Anton Knierzinger - AT

Members: Bent Andresen - IFIP
Kleopatra Nikolopoulo - GR
Davide Storti - UNESCO
Stefan Längle TEAVET Project

Abstract:

The strategies for implementing ICT, digital media, computational think and all the other aspects needed to prepare education for the digital age are manifold and of different success. In the session we will discuss the situation from a global perspective based on examples of good practice presented by the panelists. Content, didactic approach, means of integration into school and influence of education on the impact of technology in our society are aspects to be discussed. We will speak about the role and the importance of teachers in the process and we will try to find the bottlenecks and present success stories.

The target of the session is to identify the most important factors of success and to find the suitable ways which can lead to what is stated in the title of the conference „Empowering Learners for Life in the Digital Age".

Austrian Panels is a series of sessions within OCCE.2018 dealing with the topics which the Austrian government will be introduce into the Austrian EU Presidency in the second six month of 2018. From the results of this panels in combination with expertise within IFIP TC3 position papers will be produced and provided to the decision makers.

PANEL 2

ICT and Vocational Education

Panel:

Co-Chairs: Jaana Holvikivi - IFIP
Wilfried Nagl - AT

Members: Ronald Bieber - OCG
Dr. Sabine Huber - INTEL

Abstract:

Today, young people face a challenging situation. Whilst they have the opportunity to benefit from powerful digital technologies which open up new learning opportunities they also need to deal with handling and making sense of such devices in their professional life.
Digital technologies also enable young people to re-invent their world and society through being active creators and producers rather than passive consumers of knowledge and information. At the same time, the job market is shifting and young people now require a range of digital skills to meet employers' needs. There is currently a lack of clarity regarding what those skills should be when digital technology will be part of nearly all of our work.

We will discuss ICT in vocational education seen not only as challenge for schools with technical or commercial background, not only the demand coming from industry but as a a personal chance for our students and a societal challenge because education can be seen as the mechanism to trigger the impact of technology in our society.

Austrian Panels is a series of sessions within OCCE.2018 dealing with the topics which the Austrian government will be introduce into the Austrian EU Presidency in the second six month of 2018. From the results of this panels in combination with expertise within IFIP TC3 position papers will be produced and provided to the decision makers.

PANEL 3

Inclusion and Equity Issues with Adaptive Technologies

Panel:

Co-Chairs: Amina Charania - India
Klaus Miesenberger - AT

Members: Don Passey - IFIP
Paul T. Nleya - Botswana

Abstract:

ICT is the key technology of the future. Equal accessibility is the key and accepted foundation for better inclusion and equity in the information society for the broadest range of users including those with disabilities using the improving potential of adaptive technologies. Accessibility to digital technology is accepted as a fundamental human right, best expressed in the UN-Convention on the Rights of People with Disabilities signed and approved by more than 160 countries) and following this implemented in national law.

Inclusion and equal accessibility have also big potential for improved business and socio economic impact in an ageing society. And science and technology provide viable and proven technologies, methods, techniques and standards for implementing accessibility.

But the resons of inequity towards digital technology are various and the implementation of accessibility is lacking behind due to missing awareness, education and incentives. Also the availability, adaptivity and personalisation of Assistive Technologies, which is to be driven by the service sector for people with disabilities, is lagging behind. Iclusion and equity issues have to be discussed when we see digital technology as a means to create a more just world.

This panel intends to address this gap between potential and uptake of technologies supporting inclusion and wants to come up with a set of recommendations.

Austrian Panels is a series of sessions within OCCE.2018 dealing with the topics which the Austrian government will be introduce into the Austrian EU Presidency in the second six month of 2018. From the results of this panels in combination with expertise within IFIP TC3 position papers will be produced and provided to the decision makers

22,61,47

ID 22

How to Improve Children´s Understanding of Code?

A Preliminary Study using the Jigsaw Method for Computer Programming in Elementary School

Sayaka Tohyama, Yugo Takeuchi

Abstract:
We examined how to use the jigsaw method as collaborative learning to improve elementary school children's understanding of code and how to assess it. Fourteen students participated in our workshop using the jigsaw method and learned programming for two hours.

They assigned one of three sample codes to be the 'expert', and then each expert of the three discussed making a maze game using the sample codes. We conducted a subjective assessment, and two types of objective assessments to evaluate how the students correctly predicted the codes using a combination of loops and conditionals using natural language or programming language. The results showed that half of the students correctly predicted the function of the codes after the workshop.

Furthermore, little advantage suggested when the students were asked using programming language than natural language even though the difficulties of the problems were almost the same. A protocol analysis suggested the effect of collaboration because one group eventually corrected the bugs during discussion even though they initially thought the bugs were caused by troubles of Scratch, and one of the boys answered correctly only in the post-objective assessment. The limitation of the assessment methods to evaluate the collaborative learning was discussed

Keywords:
programming, elementary school, jigsaw method, understanding

Presenter: Sayaka Tohyama JP

22,61,47

ID 61

Personality-based Group Formation

A Large-Scale Study on the Role of Skills and Personality in Software Engineering Education

Amir Mujkanovic, Andreas Bollin

Abstract:
Extensive research confirms the benefits of group work in various domains. There has, however, been little consideration to rigorous formation of groups, especially project teams, in software engineering disciplines to improve the outcomes of these groups. Previous studies show that the outcome of groups will be affected by a number of different factors, such as the context in which these groups interact, the characteristics and the behavior of each individual and the group composition.

Now, this research evaluates the extent to which it is possible to enhance the group outcomes by systematically reconstructing the groups of students and therefore raise the overall outcome level of a software engineering lecture at two Universities, the Alpen-Adria University of Klagenfurt and the Technical University of Koöice. An empirical experiment has been carried out involving 69 groups and 140 individuals. The results of this experiment were then compared with historical data of 961 groups (approx. 2,400 students) on group outcomes over a period of 12 years. The findings show statistically significant improvements of the outcomes for those groups that were systematically constructed.

These results could enable business leaders and educators to systematically form their groups for improving the outcomes of these groups

Keywords:
Software Engineering, Systematic Group Formation, Improving Group Outcomes

Presenter: Andreas Bollin, AT

22,61,47

ID 47

Multivocal Challenge toward Measuring Computational Thinking: Bebras Challenge vs Computer Programming

Yoshiaki Matsuzawa, Kazuyoshi Murata, Seiichi Tani

Abstract:
Towards the establishment of an evaluation platform of Computational Thinking(CT), in this paper, we tried Bebras Challenge coined by Dr. Dagiene as a measurement tool of CT skills. This paper presents a triangle examination which includes three kinds of testing methods (programming testing, traditional paper testing, and Bebras Challenge).

Approximately one hundred and fifty non-CS undergraduate students participated in the examination as a part of an introductory programming course. The result indicated a weak but positive correlation (.38-.45) between the three methods. Additional qualitative analysis for each task in Bebras showed that requirement of algorithm creation and interpretation, and explicitness of the description, are the two critical factors to determine a high correlation between other testing methods

We conclude with our research showing a clear correlation between the Bebras Challenge and the actual programming, although we could not find any evidence that our course overall succeeded in developing the students' CT skills.
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Keywords:
Programming, Literacy, Computational Thinking, Bebras Challenge

Presenter: Yoshiaki Matsuzawa, JP

ID 24

Collaboration platform for public and private actors in educational games development

Jaana Holvikivi, Leenu Juurola, Maija Nuorteva

Abstract:
This paper describes innovation platform development for co-creation of se-rious games. Innovation platforms offer modes of collaboration for schools, universities, citizens, and companies.

The main actors of this project are three universities and two science centres in Finland. Several modes for col-laboration have been tried in order to discover permanent structures that would benefit various stakeholders. Interests of different stakeholders have been analysed in order to find conditions for successful co-creation. Prob-lems that prevent efficient collaboration have been identified, which are pre-dominantly financial issues.

Moreover, some more game specific issues have been discovered: the understanding of use of games in education and peda-gogical goals and methods are not necessarily shared between game develop-ers and educators. Game developers seek to create games that are entertain-ing whereas educators want tools that support curriculum goals and enhance learning. However, the idea of

In particular, the co-creation in science centres has started successfully, bringing small start-up companies and school students together around educational application development where science centres act as facilitators. Recommendations for best practices in universities are drafted in order to find efficient ways of implementation.

Keywords:
serious games, co-creation, innovation platforms, games firms

Presenter: Jaana Holvikivi, FI

ID 34

An investigation of the importance of haptics for promoting understanding of difficult concepts

Mary Webb, Megan Tracey, William Harwin, Ozan Tokatli, Faustina Hwang, Ros Johnson, Natasha Barrett, Chris Jones

Abstract:
This paper reports on a study which investigated whether the addition of haptics (virtual touch) to a virtual reality (VR) simulation promotes learning of key concepts in biology for students aged 12 to 13.

We developed a virtual model of a section of the cell membrane and a haptic enabled interface that enables students to interact with the model and to manipulate objects in the model. Students worked collaboratively in pairs on activities, designed to support learning of key difficult concepts.

Findings showed that students were very positive about using the system and believed that being able to feel structures and movements within the model assisted their learning. Results of pre-and post-tests of conceptual knowledge showed significant knowledge gains but there were no significant differences between the haptic and non-haptic condition.

Keywords:
Haptics, virtual reality, conceptual understanding, cell biology, science learning

Presenter: Mary Webb, GB

ID 74

Students' Conducts during a Digital Game-Based Museum School Visit

Eric Sanchez, Sylvia Mueller, Nicolas Kramar, Antoine Widmer, Elsa Paukovics

Abstract:
This paper deals with a preliminary empirical study carried out during a museum school visit. The study aims to understand the influence of a game on studentsí conducts in the museum. We address the use of digital games for personalizing experiences in museums and for fostering visitorsí interactions with the museum exhibition.

The paper describes the design-based methodology and the collaborative design and testing of a digital game dedicated to help young museum visitors to address the consequences of their relationships with nature and to understand the concept of Anthropocene. Students were videotaped and the data collected enabled for the identification of different conducts and situations depending on the gameplay performed by students.

Keywords:
Gamification; Game-Based Learning; Museum School Visit; Anthropocene; Nature Museum

Presenter: Eric Sanchez, CH

ID 41

Writing e-Exams in pre-university college

Mathew Hillier, Nathaniel Lyon

Abstract:
This study examined student´s expressed strategies, habits and preferences with respect to responding to supervised text based assessments.

Two trials of a computerised examination a system took place in an Australian Pre-University college in 2016 and 2017. Students in several classes studying Geography and Globalisation completed a sequence of practice and assessed work. Data was collected using pre-post surveys about their preferred writing styles, habits strategies in light of their choice to type or handwrite essay and short answer exams.

Comparisons were made between those that elected to handwrite and those who chose to type the exam were conducted with several areas being significant. The performance (grades), production (word count) of the typists and hand-writers were also correlated and compared.

Keywords:
e-Exams, writing strategies, student perceptions, affordances

Presenter: Mathew Hillier, AU

ID 62

Students' Perception of e-Assessment

A Case Study from Germany

Bastian Küppers, Ulrik Schroeder

Abstract:
In order to verify common findings in the literature regarding the conception of e-Assessment among students, we carried out our own survey based on common findings. Our survey enhanced over the already existing findings by adding new facets and carrying out the survey spanned over multiple institutes of higher education.

The achieved results are promising such that students seem to be open minded regarding e-Assessment, which is in line with the findings in the already existing literature. However, there are open points that have to be resolved reliably in order to convince the students completely of e-Assessment.

Keywords:
Computer-based Assessment, e-Assessment, BYOD, Cheating

Presenter: Bastian Küppers, DE

ID 75

Hanging Pictures or Searching the Web: Informing the design of a decision-making system that empowers teachers to appropriate educational resources to their school's infrastructure

Nikoleta Yiannoutsou, Nuno Otero, Wolfgang Mueller, Stalo Neofytou, Miltos Miltiadous, Thanasis Hadzilacos

Abstract:
In this paper we report on work in progress in designing a decision-making system that aims to support teachers in the process of appropriating to their practice, innovative scenarios that employ the use of ICT in teaching and learning. To this end, we break down educational scenarios into micro-activities, and we connect them to required and alternative infrastructure. This way we may offer alternative micro-activities equivalent to the initial scenario.

We argue that micro-activities are a unit of analysis of educational scenarios that is compatible with the role of teachers as designers who select, decompose, combine, enact and revise different pieces of resources.

Furthermore, we draft how micro-activities can be connected to the ontology of a knowledge-base and inform the design of a decision-making system for teachers, which will support them to search, select and appropriate educational scenarios and/or micro-activities to their practice.

Keywords:
Educational scenarios, micro-activities, educational innovation

Presenter: Nikoleta Yiannoutsou, CY

ID 33

Teachers' perspectives on object-oriented programming environments for secondary education

Riko Kelter, Matthias Kramer, Torsten Brinda

Abstract:
Teaching and learning programming is a challenge. Although several programming IDEs have been proposed for class, there seems to be more dissent than consensus which tools are preferable over others.

This paper investigates teacher's perspectives on popular object-oriented programming (OOP) IDEs in Germany. The environments investigated are: BlueJ, Scratch, Greenfoot, Eclipse, MIT App Inventor, Processing IDE and Alice. Based on prior research a catalogue of IDE-features supporting the learning process of students was constructed. Upon these criteria, an online-survey was conducted with computer science teachers in North Rhine-Westphalia, Germany. In the survey the participating teachers evaluated the selected IDEs adequacy for teaching OOP.

The findings support the results of prior research conducted with students, stressing the importance of a simple and user-friendly GUI as well as the option to visualize classes and objects. Contrarily to prior studies, the results also show that teachers don't see the editor equally as important as students do and that there is no consensus about the role of the area of application for choosing an IDE.

Also, student-friendly debugging messages as well as a step-by-step execution of programms were identified as important features. Although no IDE excelled at every criteria, the clear favorite was BlueJ.

Keywords:
Educational programming environments, Teaching and learning programming, object-oriented-programming

Presenter: Riko Kelter, DE

Investigating Learner's Behaviours when Interacting with a Programming Microworld

An Empirical Study Based on Playing Analytics

Fatima Djelil, Eric Sanchez, Pierre-Alain Muller

Abstract:
In our attempt to support Object-Oriented Programming (OOP) learning to beginners, we designed a novel microworld called PrOgO. PrOgO is based on a 3D constructive game metaphor for describing OOP basics, such as the concept of ìobjectî, its properties and its relationship to the concept of ìclassî, as well as their implementation (coding). In this paper, we describe an empirical work based on the use of PrOgO by beginner students.

We investigated studentsí behaviours when they interact with the programming concepts represented simultaneously in a code editor, and in a graphical 3D visual scene. The study is based on the collection, analysis and reporting of data about players (playing analytics).

A Principal Component Analysis and an Agglomerative Hierarchical Clustering of the data collected, enabled for the identification and the characterization of four different groups of students on the basis of their behaviours.

These behaviours are considered to have different values from a learning perspective. In particular, the study shows that a group of students spent a lot of time playing with PrOgO and has addressed most of the programming concepts both within the 3D scene and the code editor.

Keywords:
Programming Microworlds; Game-Based Learning; Playing Analytics; Object-Oriented Programming; PrOgO

Presenter: Fahima Djelil, FR

ID 50

Exploratory Study on the Effort Perceived by In-service K12 Teachers from Scientific Areas not Specialized in CS and Complete CS Novices

Monica Banzato, Paolo Tosato

Abstract:
Due to the shortage of IT teachers on Italian schools, the teaching of Computational Thinking is carried out by in-service K12 teachers from scientific areas not specialized and novices in computer science (CS).

It is crucial to investigate not only the training of teachers in digital skills, but also how their beliefs, attitudes and behaviours can affect, in detail, their implementation in the classroom. From these premises, the present exploratory study investigates the self-efficacy beliefs, intrinsic motivation and perceived effort of a group of 46 teachers who, on a voluntary basis, engaged in a 20-hour workshop on CS teaching.

The results show a significant improvement in self-efficacy, despite their perception of strong effort to master the subject.

Keywords:
Teacher Training; Computer Science Education; Self-efficacy; Intrinsic Motivation; Perceived Effort

Presenter: Monica Banzato, IT

ID 76

Reflecting on educational support for learning computing among socially disadvantaged youths

How did it work in terms of human development in a developed country?

Toshinori Saito

Abstract:
This paper discusses a research into impacts of educational support for learning computing among socially disadvantaged youths living in a mid-sized provincial city in a developed country, focusing on how the educational support works in terms of human development among disadvantaged youths. Based on the focuses, the author had joined a group's activity of helping social participation of disadvantaged youths and engaged in supporting learning computing.

We found that (1) autonomous participation in learning computing occurred among the youths repeatedly; (2) exercising programming led the youths into fun of thinking computationally; (3) the youths were more active and autonomous when the author participated in exercising programming as a co-learner rather than a teacher; (4) the youths' computing capacity enlarged their expected roles in the group.

The findings suggests that such support will work as an equity-promotion factor for disadvantaged youths to participate as active citizens in a current society by creating choices of learning computing by themselves and of utilizing computing ability for their career. Institutional factors affecting the sustainability of such support need to be investigated by following research.

Keywords:
Computational thinking, educational support, human development, digital equity, digital agency

Presenter: Toshinori Saito, JP

76, 5 73

ID 5

Who's teaching the teachers?

Viewing the ICT content of a teaching degree through the eyes of pre-service teachers

Amber McLeod, Kelly Carabott

Abstract:
The myth of the 'digital native', pedagogical beliefs about ICT and its place in education, and the reality of a teacher as an ICT role model each contribute to the attitudes school students develop about ICT. All Australian teachers, regardless of discipline, are required to incorporate ICT in their lessons.

The way pre-service teachers (PSTs) are educated has a direct impact on their ability and desire to teach digital competence to school students. Using 250 first year PSTs' experiences and expectations as a lens, teaching degrees at an Australian university were investigated, using a mixed methods approach, to find out whether the ICT content was appropriate to prepare graduate teachers to implement the national curriculum. Findings indicated that the teaching degrees did not meet all PSTs needs. PSTs wanted more explicit instruction in the practical and pedagogical implications of using ICT in the classroom, and some even wanted training to navigate the university's online systems.

These findings indicate that assumptions implicit in universities about digital competence are invalid. Recommendations include suggestions that universities review their expectations of PST digital competence and consider including both embedded and explicit methods of teaching ICT in teaching degrees.

Keywords:
Initial teacher education, digital competence, pre-service teachers, information and communication technology

Presenter: Amber McLeod, AU

76, 5 73

ID 73

A Teaching Process Oriented Model for Quality Assurance in Education - Usability and Acceptability

Elisa Reci, Andreas Bollin

Abstract:
The lack of standards to objectively assess the quality of teaching opened a new path of research. Teaching involves a lot of different tasks and activities that should be looked at, so, consequently, when talking about the quality of teaching, it makes sense to look at teaching as a process and to assess its maturity.

This contribution briefly looks at existing approaches, and also introduces the idea of a teaching maturity model (TeaM) for school and university teachers. As such a framework, even though it is helpful from a measurement perspective, might not be acceptable by teachers. In this paper, a study for testing the TeaM model in respect to its usability and acceptability with informatics lecturers at the Alpen-Adria-Universität Klagenfurt is presented.

The results show the interest of our teachers in the model, but also some of the impediments that have to be dealt with when applying the model on a larger scale.

Keywords:
CMMI, teaching quality, maturity model, higher education

Presenter: Elisa Reci, AT

ID 23

Transformative Computational Thinking in Mathematics

A comparison by student age

Andrew Fluck, Christopher Chin, Dev Ranmuthugala

Abstract:
The Calculus for Kids project showed how Year 6 (age 12 years) students could master integral calculus through the use of multi-media learning materials and specialist mathematics software.

When solving real world problems using integral calculus principles and the software to perform their calculations, they demonstrated ability commensurate with university engineering students. This transformative use of computational thinking showed age-extension because the students were enabled to redefine the curriculum by accessing content normally taught to much older children.

To verify this was not an accidental finding, further work was undertaken with a relatively smaller cohort of (n=44) Year 9 students.

The results were similar to the earlier findings with an effect size of 24 (Cohens d) recorded. The article explores the implications of these new findings, and the potential application to other subject areas and student age groups.

Keywords:
Transformative uses of computational thinking, integral calculus, students

Presenter: Andrew Fluck, AU

ID 56

Computational Thinking on the Way to a Cultural Technique

A Debate on Lords and Servants

Andreas Bollin, Peter Micheuz

Abstract:
Based on a thorough literature review and on personal expertise in different areas of computer science (education) fields, we reflect and debate on Com-putational Thinking from different perspectives. One is that of an Austrian teacher who is confronted with a curriculum for a new subject called Basic Digital Education, with Computational Thinking as an explicit part of it. The other view is that from a reflective software engineer with a holistic perspective on Computational Thinking and concrete ideas about its limita-tions. The debate concludes with an agreement on computational thinking as a cultural technique and a mutual approach to a refined working definition.

Keywords:
Computational Thinking, Computer Science, Life-Long-Learning, Engineering, Curriculum Development

Presenter: Andreas Bollin, AT

23, 56, 69

ID 69

A Case Study of Undergraduate Student's Perception of Creativity in Computer Animation in Taiwan

Jo-YU Lee, Mary Webb, Sue Sentence

Abstract:
The aim of this research was to investigate Taiwanese undergraduate student's perception of creativity when engaging in computer animation.

A stimulus for this research was that in the current knowledge economy, many countries are focusing on developing creativity to compete with rivals in the global market, and to respond to the increasing importance of creativity in education, the Ministry of Education (MOE) published a White Paper on Creative Education in 2000, with the aim of building Taiwan as a Republic of Creativity [1].

Keywords:
Creativity, Amabileís (1996) componential model of creativity, computer animation, undergraduate student, Taiwan

Presenter: Jo-YU Lee, TW

ID 40

Student experiences with a bring your own laptop e-Exam system in pre-university college

Mathew Hillier, Nathaniel Lyon

Abstract:
This study investigated student's perceptions of a bring-your-own (BYO) laptop based e-Exam system used in trials conducted at an Australian Pre-University college in 2016 and 2017.

The trials were conducted in two different subjects, in Geography and Globalisation. Data was gathered using pre-post surveys that comprised qualitative comments and Likert items. Student's perceptions were gathered relating to the ease of use of the e-Exam system, technical reliability, suitability of the assessment task to computerisation and the logistical aspects of the exam process. Many of the typists were taking a computerised supervised test for the first time.

A divergence of opinions between those that typed and those that hand-wrote regarding student's future use intentions became more prominent following the exam event.

Keywords:
e-Exam system, assessment, student perceptions, acceptance

Presenter: Mathew Hillier, AU

40, 53, 66

ID 53

The application of anchoring vignettes in the analysis of self-assessment of ICT skills:

A pilot study among Czech secondary school students

Hana Vonková·, Miroslava Černochova, Hasan Selcuk, Jan Hrabák, Katerina Králová

Abstract:
This paper presents pilot study findings of a research project about the application of anchoring vignettes in the analysis of Czech upper secondary school students' self-assessment of ICT skills. The pilot study was conducted in December 2017 among N=166 respondents from four different types of upper secondary schools. Anchoring vignettes, which are brief texts describing hypothetical people who illustrate a certain level of the trait of interest (e.g. ICT skills), is a method implemented to identify response scale differences in survey questions and to adjust the self-assessments caused by response scale differences.

Methodologically, as there are only few examples of the application of this method in the self-assessment of ICT skills and also in educational research, this pilot study has enabled the researchers to test how comprehensible a questionnaire with a set of vignettes was for the upper secondary school students.

This enhanced research method based on anchoring vignettes will be used for the main study in spring 2018. The pilot study findings confirmed the high variability of the use of scale for respondentsí self-assessments and vignettes.

Keywords:
Information and Communication Technology, Self-assessment, the Non-parametric Approach of the Anchoring Vignette Method, Upper Secondary Schools

Presenter: Miroslava Černochova, CZ

ID 66

Curriculum Reforms for Embeded Digital Literacy in Kenya Schools

Curriculum Development Status

Maina WaGĩokõ, Louisa Kadzo

Abstract:
The curriculum reforms in Kenya is advocating for seven competencies to deepen the learning. Digital Literacy (DL) as one of the competencies in which over 170,000 tecahers across the country for grade 1 to 3 were prepared. The study explored at which DL was embedded in curriculum delivery. Schools were sampled across counties with a differentiation on type of school (Mixed, Boy, Girls) and catchment areas (urban, semi-urban, rural).

The data collection involved document analysis, school and lesson observations and self-administered surveys. The data was analyzed against the expected outcomes of the courses to determine the level and frequecy of implementation. The findings indicated that that DL were being implemented at different levels and frequency across the schools. The implementation was found to be influenced by the level of understanding of the DL abilities as well as by the support the educators were receiving at the school from the school leadership, peers and the mentors.

The student learning outcomes indicated a developing state to DL. There is need to facilitate deep learning of the DL abilities during the educator preparation. Secondly facilitative supportive structures and demand for accountability are key. Finaly there is need to mainstream embedding in curriculum delivery.

Keywords:
Transfer of principles, Impact, Digital Literacy

Presenter: Maina WaGĩokõ, KE

Motivation and mobile devices' usage at school: Pupilsí' opinions

Kleopatra Nikolopoulou

Abstract:
This study aims to investigate junior high school pupils' opinions on motivation and mobile devices' usage at school. The sample consisted of 179 pupils aged 13-15 years old, in a state experimental school in Greece.

The majority of pupils believe that mobile devices (e.g. mobile phones, tablets) are an incentive for learning, mainly because these help in searching for information, they are interesting, they help pupils in understanding the concepts and in completing the school assignments. The school subjects for which many pupils would be more interested, in case mobile devices were used in the classroom, were physics, mathematics and history.

The examples of learning activities (or functions) with mobile devices in the classroom, as stated by pupils, were mainly those pupils are familiar with (searching the internet, using the calculator, the stopwatch and the dictionary). Implications for school practices are discussed.

Keywords:
mobile devices, motivation, mobile learning, pupilsí perceptions, adolescents

Presenter: Kleopatra Nikolopoulou, GR

2, 9, 81

ID 9

Digital disruption in youth education in Denmark

Bent Andresen

Abstract:
This paper summarises the major findings resulting from a three-year, regional case study at 19 upper-secondary schools in Denmark, during which the teachers were allocated the time and opportunity to experiment with the use of digital technologies in 1:1 settings to benefit students' work.

The research objectives included investigating the ways in which teachers use digital technology to provide feedback that has a positive influence on 1) students' academic learning outcomes, and 2) their perceived self-efficacy. The research findings indicate a general shift in focus at these schools from summative to formative evaluation.

This shift has been inspired by the past twenty years of educational research, which has substantiated the idea that traditional forms of evaluation (with or without marking) often have a demotivating influence on some students; whereas formative forms of feedback have a much more positive influence.

The research provides evidence suggesting that teachers regularly strengthen students' learning efforts and perceived self-efficacy by using digital technology to provide differentiated formative feedback to students, who have the greatest need for it when engaged in independent learning activities.

Keywords:
Technology enhanced learning, digital disruption, upper secondary education, formative feedback, learning outcome, perceived self-efficacy

Presenter: Bent Andresen, DK

ID 81

A Personal Informatics Approach for Academic Internet Self-efficacy in a South African University

Dean von Schoultz, Kerry-Lynn Thomson, Johan van Niekerk

Abstract:
Accessing a myriad of information through the Web has profoundly and fundamentally changed the way we interact with and assimilate information and knowledge. From scarcity to excess information comes the need for control as Web use has inherent risk. Mitigating these risks may require habitual self regulation. Information, as the principle substance of education, needs to be managed at an individual level especially when faced in abundance.

Typically, higher education institutions use the Web to provide students with information. If students are to successfully develop the skills required of an educated individual they need to develop the skills necessary to navigate this information and allow the positive benefits of abundant information to materialize. These skills are particularly sparse in South African universities. Personal Informatics advocates the observation and reflection of an individual's own data towards self improvement. Applying these principles and technologies may provide a viable mechanism for nurturing and bolstering students' ability to manage their information intake and learning behaviours when using the Web in an academic environment.

This paper confers the initial results of an investigation into facilitating a personal informatics approach in a higher education environment by presenting technological and ethical challenges.

Keywords:
Higher Education, Personal Informatics, Internet Self-efficacy

Presenter: Dean von Schoultz, ZA

ID 21

Innovation in language teaching and learning: What do we need to make a MOOC for language learning genuinely innovative?

Sharing work in progress experiences as a MOOC developer at NTNU, Trondheim, Norway

Veruska De Caro-Barek

Abstract:
By sharing experiences from the process of making a Massive Open Online Course in Norwegian as a second Language at the Norwegian University of Science and Technology, this paper aims to raise awareness about the need for improved technology solutions with a critical look at how course developers can build more innovative and interactive language MOOCs within the frame of self-instructed courses using new convergent technologies such as WebRTC.

Keywords:
MOOC, Language teaching and Learning, Oral interaction, WebRTC technology.

Presenter: Veruska De Caro-Barek, NO

ID 20

The Role of Audiovisual Translation in Mediating Foreign Language Learning

Activity Theory Perspective

Rasha AlOkaily

Abstract:
This is a case study of a specific learning environment in the Intensive English Language Program characterised by technical, spacial, temporal, and motivational restrictions that impede students' progress. Activity Theory was used to describe the situation, and to design an intervention in the form of a new activity system.

A dubbing project was designed and implemented in the Listening and Speaking course. It utilised students' mobile devices in an anywhere, anytime type of learning, and their native language and cultural background as a starting point to engage them in a collaborative effort that led to the production of eight dubbed videos.

The resulting videos were entered in an internally organised video competition which added a further motivational element to the project. To evaluate the project's effect on students' perceptions and motivation, data was collected using 5 focus group interviews. Results show high levels of motivation, increased learning, increased confidence and sense of achievement and pride in their work.

Keywords:
Audiovisual Translation, Dubbing, Activity Theory, Language Learning, Technology Enhanced Learning

Presenter: Rasha AlOkaily, IQ

21, 20, 79

ID 79

Disabled children's digital use practices to support formal learning.

Sue Cranmer

Abstract:
There is evidence to suggest that many children's lives have been transformed through engagement with digital technologies, such as computers, laptops and mobile devices for learning, leisure, social networking and development of digital literacy skills. Nevertheless, limited research has considered how disabled young people use technology. This is a serious omission given the importance of digital participation for all young people. In response, a participatory research study was designed which investigated disabled young people's digital use practices for learning.

Young people with visual impairment and their teachers were interviewed in mainstream schools in England within the context of inclusive education policy; results were analysed using social practice theory. Results were mixed. Benefits were found to include general digital learning practices and discrete digital accessibility practices in order to access the curriculum. Whilst young people were generally positive about uses, digital accessibility practices often carried an extra task load due to the need to work around barriers that could sometimes make them feel self-conscious and stigmatised.

The paper concludes with a call for further research to improve how disabled young people are supported with digital technologies and to guide teachers to embed more inclusive digital pedagogical designs in their practice.

Keywords:
Disabled children, inclusion, inclusive digital pedagogy, digital technologies, social practice theory.

Presenter: Sue Cranmer, GB

ID 68

A Semi-Automated Approach to Categorize Learning Outcomes into Digital Literacy or Computer Science

Stefan Pasterk, Max Kesselbacher, Andreas Bollin

Abstract:
Computer science related curricula, standards and frameworks are designed and implemented in many countries to incorporate informatics education in schools, already starting with kindergarten and primary education.

A recurring point of discussion addresses the focus of those educational models concerning the different fields of computer science, so the topics related to the scientific subject of computer science, and digital literacy, the set of skills and competencies needed in everyday life in the digital age. In this paper, we present a semi-automated approach to categorize learning outcomes of computer science related curricula into one of those two categories.

Categorization is performed with linguistic metrics computed for nouns and verbs of representative curricula of each category. The categorization is compared against classifications of nine experts of computer science teaching and research.

The results show that a correct categorization of 70% of all learning outcomes and 90% of learning outcomes uniformly classified by the experts can be achieved.

Keywords:
curriculum, computer science, digital literacy, natural language processing, comparison

Presenter: Stefan Pasterk, AT

68, 51, 29

ID 51

Cultivating computational thinking through data practice

Djordje Kadijevich

Abstract:
This paper examines how one component of computational thinking (CT) may be cultivated across several school subjects. After summarizing the research context regarding defining, cultivating, and assessing CT, this examination focuses on data modelling using interactive charts. It considers main activities and their underlying skills, and outlines what kind of support should be given to modelers, especially novices, in assisting them to complete this modelling as easily as possible.

It also considers what kind of computational environment should be used, one in which CT components may additionally be fostered, which learning paths may be followed in doing that, and how modelers' progression along this path may be assessed. Implications for teacher professional development are included..

Keywords:
Computational thinking ï Data modelling ï Interactive charts ï K-12 education ï Teacher education

Presenter: Djordje Kadijevich, CS

ID 29

What does sharing mean on an Enterprise Social Media Platform - informing or information-overload?

Halvdan Haugsbakken

Abstract:
Over the last decade, the use of Social Media Enterprise Platforms has become commonplace in corporations and public organizations. Social Media Enterprise Platforms are argued to bring a range of benefits that can simplify and enhance the internal division of labor in organizational life, like simplifying work processes, internal communications and reduce internal organizational barriers.

Such benefits can be obtained on the premise that organizational members participate on an enterprise platform and are actively engaged with an online sharing culture, which can be used for enhancing knowledge sharing. However, this study challenges the assumption that sharing on Social Media Enterprise Platforms can bring benefits. In contrast, the paper examines the challenges in making sense of the meaning of the practice of sharing.

To show this claim, the paper explores how a Norwegian County Authority implemented an Enterprise Social Media Platform and how a group of employees tries to make sense of the practice of sharing by reflection on action. The research results show that the employees interpreted sharing as an informing practice, resulting in information-overload and disengaged users.

Keywords:
Sharing, Enterprise Social Media Platform, public organization, Norway

Presenter: Halvdan Haugsbakken, NO

ID 27

Social Networks as Learning Delivery Platforms: Academic Achievement and Attitudes of Students

Yaacov J Katz

Abstract:
Social networks are technology-based applications that enable network members to communicate for mutual benefit. Research evidence has indicated that social networks can serve as learning delivery platforms that contribute to positive student learning.

In the present study three similar groups of students enrolled in an "Introduction to Ethics" course, were exposed to either Facebook-based, WhatsApp-based or Twitter-based delivery of ethical concepts to their smartphones. On conclusion of the course, students were examined on ethical concepts. They also responded to a questionnaire that examined user-friendliness, learner motivation and learner satisfaction associated with the social networks they experienced.

Results indicate that WhatsApp students attained a higher level of achievement than Facebook students who, in turn, attained higher grades than Twitter students. Additional results indicate that WhatsApp and Facebook students held more positive impressions of user-friendliness and learner motivation related to their delivery platforms than Twitter students. WhatsApp students also held more positive impressions of satisfaction with their delivery platform than Facebook students who maintained more positive feelings of satisfaction than Twitter students. Thus, WhatsApp, and to a lesser extent, Facebook, are associated with enhanced achievement and positive feelings toward their delivery platforms with Twitter students lower on academic achievement and affective variables.

Keywords:
WhatsApp; Facebook; Twitter; Achievement; Affective Variables

Presenter: Yaacov J Katz, IL

ID 42

Robust networked e-Exams with Moodle

Mathew Hillier, Andrew Fluck

Abstract:
This session will present our latest research into the development of a resilient e-Exam system that is capable of working without a network for most of the exam session, including the conclusion of an exam, without loss of data. Furthermore, the technology approach takes advantage of the Moodle learning management system quiz module as a means to provide an electronic workflow for assessments while still being able to construct rich, complex assessment tasks using authentic 'software 'e-tools of the trade'.

This session represents the next phase in the evolution of the Australian developed bring-your-own laptop Live Linux USB based e-Exam platform presented at the 2017 World conference on computers in Education 'eExam Symposium'.

Keywords:
e-Exams, networking, resilience, offline, authentic assessment

Presenter: Mathew Hillier, AU

ID 55

Practice of Blended Learning of Next Generation Agricultural Human Resources Development Using Wearable Cameras and Drone Cameras

the "WAZA" Method

Keiji Emi, Shinzo Kobayashi

Abstract:
We have established an effective method for next generation agricultural human resources development by using wearable cameras and drone cameras. This is blended learning. We will report about the practices.

Keywords:
Blended Learning, Agricultgure

Presenter: Keiji Emi, JP

Using digital storytelling in online course design to challenge funnel participation in MOOCs

Halvdan Haugsbakken

Abstract:
Over the last decade, low completion rates among online learners have established into a fundamental challenge in MOOCs. In the MOOC research literature, the matter is addressed as 'funnel participation' and among other casts light on how MOOC course creators design online courses. This challenge calls for thinking differently about what types of means and online pedagogies course creators use to motivate learners to engage into online learning activities and learning processes.

This paper addresses this issue by looking at how online course creators can use the concept of narrative cognition and digital storytelling in the designing of MOOCs. To exemplify the topic, this concept paper reports on a research project where the aim is to use digital storytelling in the designing of a MOOC intended to enhance the digital competence of teachers.

The core idea is narrating the 'real challenges and experiences' of a language teacher in a Norwegian high school who attempted to use digital technologies in her classroom practice. By embedding the teacher's classroom experiences as a case with an interchangeable use of sociological and organizational perspectives on use of technologies as part of the MOOC course design, such can create the means for learners to identify closer with digital learning material.

Keywords:
Digital storytelling, course design, digital competence, MOOC

Presenter: Halvdan Haugsbakken, NO

ID 44

Designing a MOOC Action-Task-Force

Halvdan Haugsbakken, Inger Langseth

Abstract:
Although the research literature on online courses, such as MOOCs, has proliferated, surprisingly few studies have explored the organizational approach to a generic institutional strategy for supporting educators when developing online courses in higher education (HE).

The goal of this paper is, therefore, to describe and conceptualize the outline of an infrastructure for organizing the production of online courses in continuous and further education. Central to the infrastructure is the Action Task Force (ATF), a network consisting of employees with complementary competences (c.f. technical, pedagogical and multimodal) that can coach, mentor and support educators through the entire online course production process.

In this article, we outline the design of the online course production process in the ATF. The design is stepwise and collaborative and aims to contribute to a seamless and quality assured strategy that caters for the various goals that content creators may have within the scope of the strategic goals in the organization.

Keywords:
MOOC, organizational design, network, coaching

Presenter: Halvdan Haugsbakken, NO

ID 71

A Learning Analytics Approach in Web-based Multiuser Learning Games

Towards a learner-centric analytics

Matthias Ehlenz, Thiemo Leonhardt, Ulrik Schroeder

Abstract:
As technology changes, learning games adapt to target audience and available devices. Analytics methods have to keep up with the development to keep the learner in-focus. This work briefly presents the Multitouch learning game framework designed to implement cross platform educational games with support for cooperative, collaborative and competitive settings.

It shows the adaption of a user-centered learning analytics data model, the learning data context model, to fit the circumstantial requirements of multi-user settings on a shared device in games implemented using the multitouch learning game framework. A first field study has been conducted and the results, challenges and lessons learned are discussed.

Keywords:
Game-Based learning, learning analytics, Multitouch, Educational Games, Learning Context

Presenter: Matthias Ehlenz, DE

ID 37

Learning Computational Thinking: Analysing instructional videos

Chris Shelton

Abstract:
Although many countries have integrated 'Computational Thinking' into their school curriculum, the term itself is still unfamiliar to many school teachers. As there are a range of definitions and understandings of the meaning of computational thinking, teacher educators frequently need to introduce and explain the term to both novice and experienced teachers.

To support this, a number of organisations have produced instructional videos to introduce computational thinking to teachers. In this workshop, we will analyse a selection of educational videos designed to introduce aspects of computational thinking to school teachers, highlight some of the implicit messages contained within these, and compare and contrast the definitions they provide.

Keywords:
computational thinking, pedagogy,

Presenter: Chris Shelton, GB

ID 65

Motivation Towards Learning Computational Thinking

Tertiary Education Case Study

Ryszard Gajewski

Abstract:
The paper presents an educational case study investigation of motivation towards learning computing and computational thinking in tertiary education.

In the first part of the paper background of the study is presented why it was necessary to try to measure motivation. The second part describes three motivation surveys known in the literature - Motivated Strategies for Learning Questionnaire (MSLQ), Academic Motivation Scale (AMS) and Model of Academic Motivation Inventory MUSIC.

The next part describes a survey in which Model of Academic Motivation Inventory was used. Statistical results of MUSIC Inventory are presented and answers to one of five open-ended questions are discussed. Preliminary cluster analysis is performed which is the part of ongoing research.

Final remarks include the open question 'Is it possible to increase students' motivation and if yes how to do this?

Keywords:
motivation, learning, computing, computational thinking

Presenter: Ryszard Gajewski, PL

37, 65, 36

ID 36

A Cross-agency project, for Occupational Therapists and Further Education students with language and learning difficulties and disabilities, based on Healthy Eating recipes, undertaken at Lambeth College, south London, using Scratch 2.0 to develop computational thinking and sequence skills

Lawrence Williams, Lloyd Mead, Paul Sebuliba, Beth Mead

Abstract:
This Case Presentation builds on the success of an earlier cross-agency Healthy Eating project (using PowerPoint, published by NFER, and online by MirandaNet in 2007), which was devised with the practical support of National Health Service nutritional experts (NHS).

The aim of this continuing project is to develop Further Education (FE) students' awareness of healthy eating needs, in tandem with the new UK curriculum imperative of developing computer coding skills, now called Computing. As part of their Life Skills course, Lambeth College FE students with learning difficulties and disabilities (LLDD) followed the NHS healthy recipes in their cookery lessons, played related Scratch 2.0 games devised specifically for them by a Year 6 student, aged 10-11, and successfully coded their own versions of a spaghetti recipe, using Scratch 2.0, designed for future use by Lambeth cookery students, on the Interactive White Board in the College kitchen.

As part of the project, the FE students also successfully developed their spoken and recording skills using a sound-into-text application. The project explored the possible advantages and applications of some of this material for use in the work of Occupational Therapists in Kingston and Richmond, London, which we hope will be further developed using the planned HTML5 version of Scratch, from August 2018.

Keywords:
cross-agency, learning difficulties, occupational therapists, healthy eating, Scratch 2

Presenter: Lawrence Williams, GB

ID 72

The idea of a common European framework of reference for informatics

Daniel Siebrecht, Kathrin Haselmeier

Abstract:
A European framework of reference for informatics has to take into account the communication between informatic-didactical approaches and the language-background.

On the one hand, a more detailed investigation of content categorisation has to be done, e.g. analysing K-12 framework or European national documents; on the other hand methodological considerations should be inspired by the properly conceived Common European Framework of Reference for languages, published by the European Council.

Keywords:
informatics, framework, Europe, informatic-didactical, education

Presenter: Daniel Siebrecht, DE

72, 64, 45

ID 64

Inclusive education - assistive and adaptive technology provision in developing countries.

The case of Botswana primary and secondary schools.

Paul T. Nleya

Abstract:
This paper reports work in progress regarding assistive and adaptive technology provision in developing countries using the Botswana context. Survey findings on how Botswana primary and secondary schools harness available digital technologies to provide innovative learning environments and experiences for students with Special Educational Needs (SEN) are reported.

Relevant literature on policy and levels of assistive and adaptive technology provision for students with SEN is briefly provided. A checklist was used to assess the level of provision of both assistive and adaptive technologies at the schools. The findings show that attitudes towards special needs education have changed significantly, and that there has been some significant growth regarding SEN provision at both primary and secondary school levels since 2004.

The findings also report low but growing levels of assistive and adaptive technology provisions at both the primary and secondary school levels.

Keywords:
Digital technologies, Special Educational Needs, adaptive technology, assistive technology and innovative learning environments.

Presenter: Paul Nleya, BW

72, 64, 45

ID 45

Cross-curricular Digital Literacy Strategy

A Learner and Teacher Project

Manuel Reisinger, Barbara Sabitzer

Abstract:
Digital literacy is required in nearly every future job and will now be obligatory in Austrian secondary education. In order to achieve best results it will be necessary to provide lesson plans for teachers, which help them to teach digital literacy in an appropriate way.

A learner and teacher cooperation at a secondary school in Linz wants to develop and present best practice lesson plans for future cross-curricular teaching of digital literacy and various other school subjects.

Keywords:
digital literacy, informatics, cross-curricular teaching

Presenter: Manuel Reisinger, AT

ID 35

Rethinking learning in the digital age: Implications for the Learner

Introduction:
In this symposium, we will present findings from the EDUsummIT (Education Summit on ICT in Education) 2017. EDUsummIT is a global knowledge creating community of researchers, policy-makers, and practitioners who are committed to supporting the effective integration of ICT in education. Collaborating with several international organisations including UNESCO and IFIP, EDUsummIT so far has been held five times, in The Hague (2009), Paris (2011), Washington D.C. (2013), Bangkok (2015), and Borovets (2017). There were around 100 participants in each EDUsummIT, and thematic working groups (TWG) were set up prior to the Summit with participants collaborating online to undertake research on pertinent topics in the field of ICT in education; and each TWG produces a discussion paper to be further developed during the EDUsummIT. TWG findings were published in journals (special issues) and presented at national and international conferences after each Summit. The next EDUsummIT will be held in Quebec City, Canada, in September, 2019.

In this symposium, there will be five presentations. The first presentation will discuss the evolution of EDUsummIT as a knowledge building community and provide a summary of the major findings and recommendations of the nine thematic working groups of EDUsummIT 2017, in the form of a Call to Action. In the following four presentations members from four TWGs will present a summary of the findings of their research. These four thematic working groups are:

TWG2: Informal learning with technology
TWG4: Digital agency to empower equity in education
TWG5: Formative assessment supported by technology
TWG9: Supporting sustainability and scalability in educational research initiatives: Research informed practice

Presenters:

Amina Charania, IN
Margaret Cox, GB
Miriam Judge, IR
Kwok-Wing Lai, NZ
Cathy Lewin, GB
Don Passey, GB
Barry Quinn, GB
Toshinori Saito, JP
Roger Sherman, US
Mary Webb, GB

Chair: Kwok-Wing Lai, NZ

Summary findings of EDUsummIT 2017

Kwok-Wing Lai, Joke Voogt, Gerald Knezek

Abstract:
The Education Summit on ICT in Education (EDUsummIT) is a unique model in knowledge creation. Being designed as a community of researchers, practitioners, and policy makers aiming to integrate information and communication technology research into practice, it is a sustained global community designed primarily to create new knowledge. At the EDUsummIT 2017, nine thematic groups with approximately 100 people from 31 countries spent several months prior to the Summit working on their topics of research online, and then attended a two and a half day meeting in Borovets, Bulgaria, to discuss, revise and extend their research papers [1, 2]. These nine thematic working groups were:

TWG1: Education systems in the digital age: The need for alignment
TWG2: Informal learning with technology
TWG3: Professional development for technology-enhanced learning leaders
TWG4: Digital agency to empower equity in education
TWG5: Formative assessment supported by technology
TWG6: Developing creativity in teachers and learners
TWG7: Learning from national policy experiences
TWG8: Upbringing in a digital world: Opportunities and possibilities
TWG9: Supporting sustainability and scalability in educational technology initiatives: Research informed practice

During EDUsummIT 2017 the TWGs have developed a Call to Action which highlighted the key findings and recommendations of the TWGs, to researchers, practitioners, and policy makers. In this presentation we will discuss the key findings of the Call to Action specifically related to student learning.

Integrating formal and informal learning with technologies: Issues and challenges

Kwok-Wing Lai, Cathy Lewin, Amina Charania, Barry Quinn, Roger Sherman

Abstract:
This presentation is based on the findings of the Thematic Working Group 2 discussions both before and during EDUsummIT 2017 [1,2].

In this presentation we will first discuss the challenge of defining informal learning. Then we will discuss the pedagogy, research, policy, and technology challenges and issues in integrating formal and informal learning. Finally, we will argue from the learner's perspective that integrating formal and informal learning should be an

empowering process, aiming to enable the learner to become self-directed, creative and innovative, and take learning to a deeper level. While the teacher plays a key role in supporting and facilitating this process, other stakeholders including the parents, family, friends, and community members should also play a role. Our group has developed a conceptual model to represent this empowering process (refer Figure 1). We believe this model will be useful in facilitating further discussions within and between communities of researchers, policy makers and practitioners on the integration of formal and informal learning.

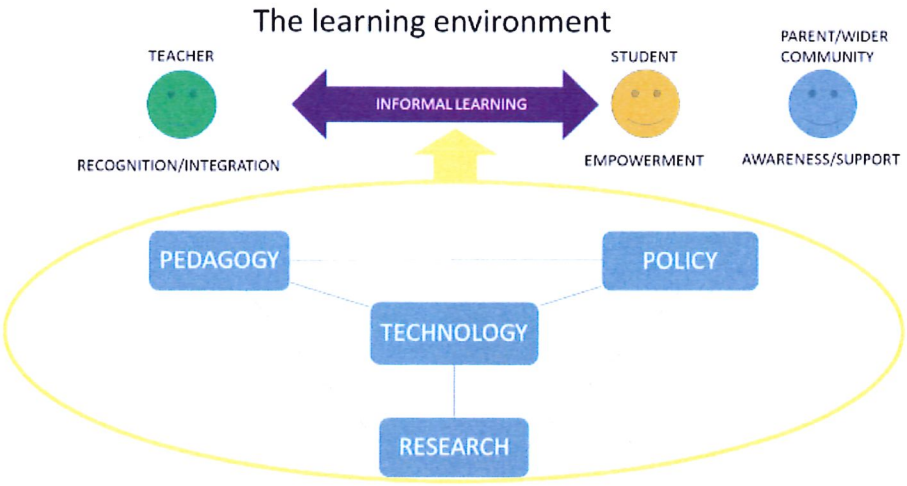

Figure 1. A systemic perspective on the facilitation of informal learning.

Digital agency in education – a key for empowering equity

Don Passey, Miri Shonfeld, Lon Appleby, Miriam Judge,
Toshinori Saito, Anneke Smits

Abstract:
This paper focuses on a major issue that faces all those concerned with the future of equity in education – the need to develop digital agency (DA). DA is concerned with empowering individuals, in their interactions with digital technologies and resources, to be producers as well as consumers; to take control of but also to be accountable for their digital actions and activities. Increasingly, digital resources are available to us, but the increasing range of accessible resources and access to these highlight our engagement with those resources as consumers. Education has an important part to play in supporting the complementary focus that enables producer action and activity, which enables an important focus of control. The paper defines DA through its three component parts – digital competence, digital confidence, and digital accountability.

How DA might be introduced across education is a matter of urgent concern. Recent curriculum developments in a number of countries have focused on introducing programming and coding into schools, engaging pupils from young ages in these activities. There is an argument that this implementation is concerned with introducing

a focus on producer actions and activities. However, the context in which this is happening, and the particular practices that are used for those programming and coding actions and activities, need to be carefully considered if DA is to be achieved. The paper will consider how some example cases have introduced elements of DA into educational practices, and the implications these cases raise for the wider introduction and development of DA.

Challenges for IT-enabled formative assessment of 21st-century skills

Mary Webb, Doreen Prasse, Mike Phillips, Djordje M. Kadijevich, Charoula Angeli, Allard Strijker, Ana Amelia Carvalho, Bent B. Andresen, Eva Dobozy, Hans Laugesen

Abstract

In this paper, which is based on outcomes from Thematic Working Group 5 discussions at EDUsummIT 2017, we examine opportunities for formative assessment provided by IT and the challenges which these opportunities present. We address some of these challenges by examining key aspects of assessment processes that can be facilitated by IT: datafication of learning; feedback and scaffolding; peer assessment and peer feedback. We then consider how these processes may be applied in relation to the assessment of horizontal, general complex 21st century skills (21st CS), which are still proving challenging to incorporate into curricula and to assess. Our analysis has enabled us to make recommendations stakeholders such as teachers, policy makers, learning designers, researchers, and industry partners. Particularly with regard to 21st CS, a significant challenge for the design of formative assessment is to find a good balance between automated assessment, i.e., highest possible adaptivity to the individual characteristics of the learner, and the active and "constructivist" role of learner and teacher. When making use of feedback information, a highly restricted space for interpretation and decision-making could be counterproductive with regard to the learning benefits concerning 21st CS, which tend to be complex constructs. In this context, it is relevant to also consider potential unintended consequences of feedback, for instance with respect to the learners' experience of autonomy and competence. Here the value of peer feedback, as discussed earlier, needs to be considered as an alternative or in conjunction with automated assessment and assessment analytics.

While there is currently much interest and some progress in developing learning/assessment analytics for assessing 21stCS, the complexity of assessing such skills, together with the need to include affective aspects means that using IT-enabled techniques will need to be combined with more traditional methods of teacher assessment as well as peer assessment for some time to come. Therefore learners, teachers and school leaders must learn how to manage the greater variety of sorts and sources of feedback including resolving tensions of inconsistent feedback from different sources.

How can educational technology research outcomes be sustainable and scaled to multiple contexts?

Douglas Agyei, Margaret Cox, Sarah Howard, Therese Laferriere, Punya Mishra, Dale Niederhauser, Lynne Schrum, Jo Tondeur, Joke Voogt

Abstract

Although a positive impact of technology interventions on educational practice and student outcomes has been shown in many previous research settings, the use of technology in classrooms and schools is still often superficial [2] and not meeting the potential of technology as envisioned by reformers in education and researchers in the field [3]. However, when technology projects have been implemented successfully in educational practice and shown valuable impacts, sustainability within similar contexts is not guaranteed, let alone scaling the initiative to other wider contexts.

This presentation builds on the discussions of the EDUsummIT 2017 Thematic Working Group 9 (TWG9) and the summary report that captured the outcome of those discussions [5]. The goal of TWG9 was to help inform policy and practice by providing insights into key factors that contribute to scalability and sustainability of educational technology integration and impact.

Sustainability, meaning regular and long-lasting renewal and appropriate use of technology and scalability; and the capacity to reach others and disseminate ideas, are key characteristics for successfully integrating technology in education. As technology innovations sustain and spread into new contexts, they mutate and change to address, and fit with local needs and contextual demands. This "reinvention" process creates a tension between user-adaptation and fidelity-of-innovation implementation across contexts. To understand and foster sustainability and scalability of technology integration a thorough understanding of the variability of contexts is needed. In TWG9 we agreed that therefore agency of and collaboration with key stakeholders is a prerequisite for successfully sustaining and scaling technology innovations. Thematic Working Group 9 at EDUsummIT 2017 highlighted the necessity of aligning research approaches, scalability and sustainability, which resulted in the formulation of the following three challenges:

- Challenge 1: Establish productive partnerships among all stakeholders to advance capacity building for technology use in schools.
- Challenge 2: Identify research approaches that are sustainable and scalable and/or that support sustainability and scalability.
- Challenge 3: Scale technology integration based on impact found in the research literature rather than isolated politically-driven policy initiatives.

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Advances in Conceptualizing, Developing, and Assessing Computational Thinking

Introduction:
Computational Thinking (CT) has garnered much interest in recent years following Wing's [1] argument that CT is an essential analytical thinking process that all students should develop alongside basic numeracy and literacy. As a consequence of this renewed focus on CT, many countries have incorporated CT into their new curricula specifications, usually as a key component of their Computer Science curriculum. However, questions remain regarding the nature, detailed definition, purpose and ways of developing CT. Webb et al. [2] argued that CT is an essential element of a Computer Science curriculum because, as indicated by the Royal Society, CT is about recognising aspects of computation in the world that surrounds us, and applying tools and techniques from Computer Science to understand, reason and solve problems in relation to both natural and artificial systems and processes [3 p. 29]. This definition emphasises the close relationship between Computer Science and CT. CT is not dependent on programming: the more recent definition from Wing's group emphasises the thought processes in getting to the stage of formulating solutions but not necessarily implementing them: "Computational Thinking is the thought processes involved in formulating problems and their solutions so that the solutions are represented in a form that can be effectively carried out by an information-processing agent." https://www.cs.cmu.edu/~CompThink/ . Nevertheless, being able to implement the results of a CT process through programming enables students to evaluate their thinking. Therefore, Webb et al. [2] argued that the Computer Science curriculum is the best place for introducing CT, which can be used and further developed across many curriculum areas.

At the same time, many have emphasised the ubiquity of CT and its value across many disciplines and have examined ways in which computational thinking in schools can be developed without a strong underpinning of Computer Science. This approach is fueled by the identification of core sub processes of CT such as: abstraction; decomposition; pattern recognition and writing algorithms, which can easily be examined and developed without reference to Computer Science or computers. The proliferation of developments of CT has led Denning [4] to argue that the fuzzy definitions and over-claiming in relation to the widespread benefits of CT are causing problems for teachers in teaching and assessing CT. Therefore, Denning proposed returning to previous definitions, grounded in Computer Science and emphasising models of computation, e.g.: Aho [5] stated: "We consider computational thinking to be the thought processes involved in formulating problems so their solutions can be

represented as computational steps and algorithms. An important part of this process is finding appropriate models of computation with which to formulate the problem and derive its solutions."

Therefore, CT and its position in the school curriculum is a subject of controversy. When considering the rationale for CT in school curricula, there are several possible positions, listed below. Perhaps some compromises between these three positions may be possible but at the same time, there remain untested claims such as the scope for transferability of skills, as well as controversy over the nature of CT.
CT is an essential prerequisite to programming and being able to design and write computer programs is an essential 21st-century skill. Many disciplines require elements of computation and programming. Furthermore, being able to write programs is a useful skill for managing various aspects of an individual's daily life. Such a rationale may go further in claiming the value and transferability of the problem-solving skills involved in programming to solving problems in other subject areas and daily life more generally.

CT involves the thinking skills required for solving problems. These skills are not only useful in relation to Computing but can be applied to solving problems in a range of situations in everyday life. Therefore CT is an essential and basic life skill which can be compared to literacy and numeracy.
CT is essential to Computer Science and therefore is an essential element in the Computer Science curriculum. Basic skills and understanding of Computer Science, including CT, are necessary for all, given the important developments in relation to Computer Science and new technologies.

In this symposium, we will explore the position of CT in schools from several different perspectives. First from the perspective of young children learning through programming a robot and how elements of CT can be developed and assessed. Second through examining the basic skills and concepts of CT that are comparable with basic skills and concepts in mathematics. Third through examining some of the most basic concepts of CT and programming and how they may be introduced to young children. Fourth through examining the theoretical relationship between constructs in CT and problem-solving generally. Finally three papers examine the analysis and decision-making in Israel, Austria and USA regarding designing CT into their curricula.

These papers and associated discussions will consider the following main questions

1. What is the nature of CT in computer science learning?
2. How should CT be developed?
3. How can the acquisition of CT be observed among novice learners?
4. What do we know about the interface between CT in Computer Science learning/thinking and other subject areas?
5. How does CT relate to other forms of thinking especially in STEM subjects?
6. What are the key challenges for incorporating CT in curricula?
7. What are the key challenges in developing CT more widely?

Keywords: computational thinking, programming, problem solving, curriculum

Presenters:

Mary Webb, GB
Charula Angeli, CY
Christine Bescherer, DE
Ivan Kalas, SK
Amelie Labusch, DE
Yaakov Katz, IL
Peter Micheuz, AT
Maciej M. Syslo, PL
Joyce Maln-Smith, US

Chair: Mary Webb, GB

Scaffolding Pre-Primary Education Children's Computational Thinking during Learning with the Blue-Bot

Charoula Angeli

Abstract

The study investigated the development of children's computational thinking during learning with a Blue-Bot, and two different scaffolding techniques that provided external memory support during the educational robotics activities. According to Grover and Pea (2013), and Selby and Woollard (2013), researchers have come to accept that computational thinking, as a thought process, utilizes the elements of abstraction, generalization, decomposition, algorithmic thinking (sequencing and flow of control), and debugging. Due to the young age of the children, the focus of the current investigation was on the development of those aspects of computational thinking that were more related to the development of algorithmic thinking and debugging. It was hypothesized that external memory support systems would play a significant role in the development of children's computational thinking, because the Blue-Bot does not provide a visual representation of the commands that are used to program it, weakening this way their ability to remember and reflect on their algorithm. Within this context, the study also sought to examine gender differences and whether the two types of scaffolding differentially affected boys' and girls' computational thinking. Data were collected for each child individually in three research sessions.

During the first session, the children were first engaged in free exploration with the Blue-Bot, and subsequently in various problem-solving tasks about directionality and sequencing. During the second phase, one group of children learned with Type A scaffolding and the other with Type B. Type A involved the use of laminated command cards that children used as materials to create a physical sequence of commands. The children then used the sequence of cards to program the Blue-Bot. The children who learned with Type B were encouraged to think out loud about an algorithm while the researcher jotted down the commands mentioned. Then, the children used the researcher's notes to program the Blue-Bot. During the third session, both types of scaffolding were removed, and children were again engaged with different problem-solving activities with the Blue-Bot. The statistical analyses showed that there were no statistically significant differences in the development of computational thinking skills between boys and girls. However, there was an interaction effect between Type A and B of scaffolding and gender indicating that girls learned better using the researcher's

notes, while the boys learned better with the cards. Implications for teaching computational thinking in pre-primary education will be discussed.

Computational Thinking Basic Concepts

Christine Bescherer

Abstract
What is the equivalent to the basic arithmetic skills or mathematic concepts in computer science?

Nearly everybody will agree that doing 'real mathematics' without having learned the basic skills and concepts of numbers, addition, subtraction, multiplication and division in primary school would not be possible. In addition, the knowledge of these basic arithmetic skills and concepts are considered necessary for everybody (i.e. NCTM, 2000) to take part in our world. There are studies, which show the relation between i.e. basic or advanced counting skills and the mathematics achievement further grade (i.e. Nguyen et al, 2016).

If computational thinking is really one in a set of reading, writing and arithmetic (Wing, 2006), what is its equivalent of knowing the letters/numbers, spelling/counting, composing sentences/operating with numbers? What are the basic skills and concepts - and therefore the related mental models/competencies - everybody should possess to understand computational thinking or even to become a computer scientist later on?

The paper proposes to identify some of the basic CT skills and concepts from descriptions of the elements of computational thinking (i.e. Grover & Pea, 2013; Voogt et al., 2015, Weintrop et al, 2016) in analogy with identification processes used in mathematics education.

Identifying and supporting elementary computational concepts

I. Kalaš, A. Blaho, M. Moravčík

Abstract
Our recent design research projects (including ScratchMaths[i] and Thomas the Clown, see Benton et al., 2017; Moravčík, Kalaš, 2012) indicate that programming can be implemented as a *key instrument for developing computational thinking* (CT), especially in its elementary (i.e. pre-primary and lower primary) stages. However, it remains unclear and debated by different schools of researchers and educators, what exactly educational programming is, what are elementary aspects and constructs of programming and what are their cognitive difficulties. Actual computing (or informatics) curricula for primary stages often list *sequence*, *selection*, and *repetition* as basic and introductory computational constructs to be addressed in primary programmes of study (see National curriculum in England). However, ScratchMaths (SM) project with its

extensive and systematic interventions for grades 5 and 6 confirms that it is advisable to design other complex interventions for even lower primary grades that would engage and address several constructs and practices to be experienced earlier than *sequences* or *repetitions*.

Therefore, in our current development we set out for identifying early and elementary concepts that would adopt similar pedagogical framework to SM and provide productive and systematic pre-SM experience for pupils of grades 3 and 4 (aged 7 to 9). We have been developing a series of gradated programming environments tied together by Emil, a virtual character to firstly be directly navigated by pupils through different situations, later being programmed to solve problems in contexts built of digits (and numeracy developing tasks), letters (and literacy developing tasks), coins (and financial literacy developing tasks) etc. The final intervention for Y3 consists of 12 lessons (with other 12 lessons currently being developed for Y4), three programming environments, a workbook for pupils and a PD material for general lower primary teachers. In Y3 we focus on exploiting several powerful ideas including (i) experiencing the sense of order (in objects and in actions), (ii) coping with static and dynamic constraints, (iii) exploring and mastering control, (iv) planning solutions, (v) working with plans as objects of pupils' thinking, and (vi) extending basic 'vocabulary of actions' of Emil.

We always work with the whole class, encouraging pupils to work and learn by exploring in pairs, with frequent common discussions on the carpet. Pairs of pupils solve short sequences of (sometimes open-ended, sometimes unsolvable, often with multiple solutions) small tasks, with no feedback from the software environment. They keep "records" of their strategies on the paper worksheets which later they bring into common discussions. Even before moving to explicit programming tasks (in the sense of constructing external representations of future behaviours, see Blackwell, 2002), we noticed that in their worksheets pupils started developing their own system to record the steps of their solutions – so that they could later present their strategy to other children. We use these situations as the first and authentic steps leading to planning sequences of future moves and actions of Emil, an object to control, and identify with.

Computational Thinking and Problem-Solving – Two Sides of the Same Coin?

Amelie Labusch, Birgit Eickelmann, Mario Vennemann

Abstract
While computational thinking is gaining relevance as a 21st century problem-solving competence [1], little is known about the congruence between computational thinking and general problem-solving. Since knowledge about the theoretical and empirical relationship between the two is of immense importance for the development of computational thinking as a (cross-)curricular competence, this contribution considers a national extension to the IEA-study ICILS 2018 (International Computer and Information Literacy Study) which refers in the scope of an international option to computational thinking with computer-based test modules and questionnaires for

Grade 8 students, teachers, school principals and IT-coordinators [2], [3]. The German national extension, referred to in this presentation, adds to the international study by applying additional instruments towards different aspects of problem-solving.
While it is often taken for granted that this congruence will be large [4] empirical studies on the relationship between computational thinking and general problem-solving are still pending. While some studies have indicated a correlation between single components of computational thinking such as debugging and general problem-solving abilities [5] or between programming abilities and general problem-solving abilities [6], the congruence between competences in computational thinking and problem-solving is virtually unexplored, especially when it comes to using a sound empirical data basis. Yet it is frequently assumed that computational thinking is similar to programming, a misleading reduction Voogt and colleagues [1] attribute to the situation that a number of "studies or discussions of theory [use] programming as their context" (p. 716). If computational thinking is to be taught as a cross-curricular competence, we contend that it should be something that "everyone, not just computer scientists, should be eager to learn" [7] and that it therefore also has also to be considered from a cognitive perspective [8]. In other words, computational thinking could be seen as a way of thinking and solving problems [9] but the congruence of the constructs is still to be explored. The presentation therefore elaborates on this and addresses the following research questions:

Where do intersections between computational thinking and problem-solving in general arise and how could they be modeled on a theoretical level?
Which data basis and research approach are appropriate for an empirical examination of the theoretical understanding?

What kind of results will be obtained in such a research process?
With regard to the first research question, it follows from the above that problem-solving and cognitive abilities are two areas which overlap with computational thinking and where congruence exists in problem definition, problem decomposition, and pattern recognition and matching [10], [11]. In the case of the second research question, studies to explore the overlaps between computational thinking and problem-solving need to test both areas. This approach is taken in the German national extension to ICILS 2018, which uses computer-based tests to measure the computational thinking competences of Grade 8 students and applies paper-based tests to assess the same sample's problem-solving and cognitive abilities [12]. In addition, the national extension also collects data on students' self-perceived competences in both domains. As far as research question 3 is concerned, the ICILS 2018 study will provide new insights and a more detailed understanding of how students learn computational thinking by integrating analyses on students' backgrounds as well as information on students' learning and school variables. First results will be published in 2019.

In short, this presentation aims to establish a starting point for an in-depth understanding of computational thinking from both a theoretical and an empirical perspective by researching its overlaps with a general understanding of problem-solving.

Computational Thinking in Israeli Elementary and Junior High Schools: From Doubt to Determination

Yaakov Katz

Abstract

Since the introduction of computer technology into elementary and junior high schools in the Israeli state school system in the 1970s, there has been an ongoing controversy in Israel about the specific aims of the use of technology in education [1]. There were those in the Ministry of Education who felt that the major goal regarding the use of technology in the elementary and junior high school system primarily necessitated the mandatory mastery of computer literacy. Computer literacy was purported to ensure that all students mastered basic computer applications that would facilitate word processing, presentation of assignments in different subjects to teachers, familiarity with email and web browsers so as to ensure communication skills and access to relevant databases and other techniques designed to replace traditional hand written assignments, chalk and talk presentations, regular snail mail correspondence, and use of library reference books in the process of acquiring knowledge.

According to this traditional perception, technology served solely as an important auxiliary learning accessory limited to mastery of technological techniques that facilitated students' efficient learning. Almost no attention was paid to the possibility that mandatory study of computer science could lead to a fundamental contribution to the improvement of cognitive processes and enhancement of learning in different subject domains. When it became clear that the use of technology as an educational accessory was not significantly contributing to fundamental cognitive processes, researchers began examining the potential contribution of technology to enhanced cognitive processes that would lead to a significant improvement of student learning. The disappointing results [2] achieved by Israeli students in the international TIMSS and PISA and national Meitzav assessments served as an additional catalyst for the educational authorities to find alternative innovative possibilities that would facilitate cognitive enhancement and improved student learning.

Results of research studies have increasingly indicated the possibility that the mandatory study of computer science, which includes exposure to computational thinking skills [3] such as abstraction, algorithmic coding, analysis of data and problem-solving design, in elementary and junior high schools could potentially lead to the enhancement of cognitive processes, resulting in improved learning standards in different subject domains and contexts. Thus, computer science, may well be an educational platform that contributes to the improved actualization of cognitive potential and to improved learning achievement of students in the different subjects Thus, in 2016, the determination of the relevant authorities in the Israel Ministry of Education, to bring about improvement in the learning achievement of Israeli students, led to the introduction of a new computer science curriculum for elementary [4] and junior high schools [5] in the hope that the new curriculum will provide an opportunity for students to benefit from the development of the cognitive processes and enhanced learning achievement.

Computational Thinking in the New Austrian National Curriculum for Lower Secondary Education

Peter Micheuz

Abstract:
"Basic Digital Education" is the name for a new subject which will be introduced in all Austrian lower secondary schools beginning with the schoolyear 2018/2019. There is one curriculum covering four years of lower secondary education (age-groups 10-14 years) and encompassing eight main topics:

- Social Aspects of Media Change and Digitization
- Information-, Data- and Media Competence
- Operating Systems and Standard Applications
- Media Design
- Digital Communication and Social Media
- Security
- Technical Problem Solving
- Computational Thinking

Obviously these topics stand for a very broad curriculum wherein at first sight Informatics (computer science) does not play a prevalent and visible role. Media pedagogy and digital literacy are apparently better represented than core Informatics in the disguise of CT (Computational Thinking). This term has not been translated into the German synonym "Informatisches Denken" and appears in the curriculum originally as the "global trademark."
All topics of the curriculum are divided into two further subtopics and detailled competence descriptions. So does the main topic CT which is split into a basic and advanced level.

Computational Thinking	Basic Level	Advanced Level
Working with Algorithms	Pupils - name and describe everyday processes - use, build and reflect codes (e.g. secret writing, QR-Code) - reproduce distinct instructions (algorithms) and carry them out - formulate distinct instructions verbally and in written form	Pupils - discover similarities and rules (patterns) in instructions (algorithms) - discover the importance of algorithms in automatic digital processes (e.g. automated proposal of potentially interesting information)
Creative Use of Programming Languages	Pupils - produce simple programs or web applications with appropriate tools in order to solve a problem or to complete tasks - know different programming languages and production processes	Pupils - master basic programming structures (decision, loops, procedures)

It is not difficult to predict that this proprietary Austrian definition of CT formulated by the curriculum committee will lead to controversial, though fruitful (inter)national discussions among didacts and especially among teachers who have to interpret and to teach this content. Moreover, it is no secret that a majority of Austrian teachers who will or have to implement this part of the curriculum within lower secondary level does not have a theoretical and, what is even more important, a practical background of CT at all. Accordingly, there will be an extraordinary requirement for professional development in CT-related pedagogy for many Austrian teachers. Other big challenges for a sound and sustainable implementation of CT are due to organizational constraints and (limited) conditions at the schools which can decide autonomously between an independent subject, an integrative approach or particular mixed forms between both.

A way of developing computational thinking through all the school years

Maciej M. Sysło

Abstract:
In [1] we have described how using a combination of unplugged approach and computer applications we introduce children aged 5-12 to problems such as the Konigsberg Bridge problem, classical math themes such as the Tower of Hanoi and binary numbers and concluded that children were introduced "to some concepts in computing which are certainly abstract and demonstrate that they are capable to work with abstraction and to apply computational thinking (CT)".

Moreover in the presentation [2] we addressed the question: how to motivate and engage students to learn/study/use/develop computer science competencies through 12 years in school, e.g. learning programming which, as in the case of using any "language", requires constant practice? To this end, we demonstrated "How to introduce order through 12 years" – searching and sorting appears in all known to the author national CS curricula. Lesson plans were shortly described there by specifying: problem situation to be discussed and solved, lesson main goals, CS concepts introduced, teaching and learning methods (such as abstraction, decomposition), and supporting tools (such as robots, computer applications, educational software, programming environments).
We now very shortly describe how and in what situations CT is developed through all the 12 school years as an effect of realization of our national CS curriculum.
(1) In K-3: CT does not explicitly appear as a term (e.g. in lesson plans for teachers), however children/students and teachers develop its meaning and understanding through properly chosen problems/projects (e.g. Sudoku). It is the first stage when the main focus is on modeling situations via decomposition and abstraction. Simple computer applications in a virtual environment are used.
(2) In 4-6: Solutions to problem situations are built within a programming environment, however using not only a programming language (like Scratch or Logo), but also environments like the Hour of Code or code.org in which students learn how to formulate solutions for computers using particular programming constructs.

Regardless of the environment, students learn that computer programs are abstract objects of situations which are modeled.
(3) In 7-8: Environments of programming languages are used – continuation of using Scratch, but then a smooth transition to textual language like Python or C++ (for those who participate in CS contests) comes. However: the main focus is on developing algorithms not just to writing programs – students learn that programming is a tool and programs are final products of the problem-solving process. They also learn all stages of "running a program": testing, debugging, analyzing programs' behaviour for various data.

(4) High School: Students solve more complex problem situations (coming from other school subjects, like mathematics, physics, science) and develop more advanced algorithms and data structures. At this stage of CS education, we find also an opportunity to explain to students what, for instance, dynamic programming (included in the CS curriculum for HS) has in common with computer programming. Originally, in 1940-50's the term "programming" was used to denote methods for finding optimal (the best) available solutions in the precisely defined situations. Today, although learning and teaching take place in technologically different situation, writing a computer program is the last stage of problem solving, and programming supported by CT concerns the whole process of solving a problem to get the best solution, where "best" usually depends on many conditions defined and accepted during this process.

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Framework on Computational Thinking from a Disciplinary Perspective

Joyce Malyn-Smith

Abstract:
This paper describes progress towards the development of a Framework for Computational Thinking (CT) from a Disciplinary Perspective. It shares an initial set of 5 elements to guide instruction and assessment of CT within disciplinary learning once students have developed core CS skills needed to apply CT in various contexts. The work aims to build on these core skills connecting computational thinking developed in school with the tasks often performed in highly sophisticated STEM work environments, and raises new questions about the nature of CT instruction and assessment within disciplinary classrooms. The work focused on these questions: What do computational thinking-enabled students of science or mathematics, engineering need to know? What do they need to be able to do? Do our current

assessments of CT adequately measure CT within disciplinary learning? If not, what is needed?

A select group of 54 US CT researchers and practitioners reviewed literature, analyzed research findings and CT classroom practices, and organized examples of CT integration activities across grade spans (K-2, 3-5, 6-8, 9-12) and disciplines (science, mathematics, engineering, social studies, humanities, arts, etc). Analysis yielded 10 themes that appeared to describe what students were able to do with CT that they were less able to do without CT. These were reviewed against CT practices found in sophisticated STEM workplaces. Five elements emerged bridging learning and working at the human-technology frontier - Using computational thinking for:

- Understanding (complex) systems
- Innovating with computational representations
- Designing solutions that leverage computational power/resources
- Engaging in collective sense making around data, and
- Understanding potential consequences of actions.

Based on the review and analysis of the current state of CT assessments against the five elements grounding this new framework, new questions arose about assessment of CT within disciplinary learning and about the role of applied computational thinking and computational sciences in disciplinary curricula.

It is hoped that this paper will provoke dialog to extend the work of educators advocating for an underpinning of CS for all - to consider how students should be applying CT within disciplinary contexts at various grade spans to build their capacity to succeed in work at the human-technology frontier.

ID 25

A professional development programme in reference to Laurillard's conversational framework for supporting teachers in the design, development, and implementation of CSCL activities

Rasha Essam

Abstract:
The purpose of the proposed design-based research will be to design and implement a professional development programme in reference to Laurillard's (2012) conversational framework to support and motivate teachers to design and implement computer supported collaborative learning activities for teaching Arabic as a foreign language.

Qualitative data collection methods such as semi-structured interviews, observations, and qualitative questionnaires with open-ended questions will be used for collecting data from 11 teachers in an American university in Cairo. This project aims to assist instructional designers who design and implement professional development technology programmes for teachers in higher education in general and foreign language teachers in specific.

This study will attempt to contribute to the body of knowledge with regard to technology enhanced learning design by providing new design principles for training teachers relating which learning elements were enhanced according to Passey's (2011) learning framework

Keywords:
design, conversational framework, support, needs, motivation

Presenter: Rasha Essam, EG

ID 48

Teaching Computer Science with Games

Toward Knowledge Institutionalization

Maud Plumettaz-Sieber

Abstract:
In the canton of Fribourg (Switzerland) we carry out a design-based research on the use of Prog&Play, a game dedicated to teach the programming to 15-16-year-old pupils in high School.

Our thesis work focuses on modeling debriefing as a process aiming at the institutionalization of knowledge. We also want to address the products of this process and the respective roles of the teachers and the pupils.

Keywords:
Institutionalization, computer didactics, computational thinking, game-based learning

Presenter: Maud Plumettaz-Sieber, CH

ID 49

Spontaneous Speech using Skype

From Language Learners to Language Users – how using online video calling can support spoken language in Modern Languages classrooms in England - a longitudinal study.

Cathy Brady

Abstract:
Numerous studies show the potential benefits of Computer Mediated Communication (CMC) on second language (L2) oral proficiency, but fewer focus on using technology offering *classroom* opportunities to support oracy (Lin, 2014).

This study examines the use of CMC for pupils in their final year of high school in England talking to (similar aged) pupils in France in real time over a period of 6 months. Students use a weekly session to 'skype' their partners and talk one-on-one. Their conversations are recorded using screen capture software.

Keywords:
CMC, Spontaneous target language, Motivation

Presenter: Cathy Brady, GB

ID 52

The Impact of the Teaching Process on the Quality of Teaching

Elisa Reci

Abstract:
The traditional forms for addressing the quality of teaching, such as students' evaluation, feedback, peer evaluation and inspectors are seen as subjective. This has opened a path for research for some assessment models which relies on standards.

For instance: the AQRT model to assess the teacher teaching practices; the TEQAS model to assess the teacher education; the CEM model to assess teachers quality based on students outcomes; the competence based model to assess the teacher quality through assessment tests; the National Education Association using a standard - based learning and assessment system to show how student learning standards can be connected with teacher education and assessment; the Competence based model for teachers how to teach; the " Angebots - Nutzungs - " Model for assessing quality based on teacher - student interaction (results, feelings, environment); And, there are maturity models that address the quality of teaching by assessing and improving either the curricula or course design.

On the other hand, Chen et al state that a better quality of teaching is achieved when managing and assessing the teaching process as a whole, rather than focusing on one teaching factor.

Keywords:
CMMI, teaching quality, maturity model

Presenter: Elisa Reci, AT

ID 58

Computing Curriculum Policy
The implications for Teachers in English Secondary Schools

Eleanor Overland

Abstract:
This thesis explores the recent changes in the National Curriculum for computing in England and the views of teachers on the impact this has had: in their own classroom, on how they frame the subject and their practice.

This paper draws on teachersí perspectives on computing curriculum development within their own setting. The interviews have been explored using Bernsteinís code theory to identify dominant discourses in computing curriculum implementation.

Keywords:
Computing curriculum, teacher perspectives

Presenter: Eleanor Overland, GB

ID 59

Programming in new environments: challenges and the future of innovation.

The Internet of Things (IoT) start with the students

Elisabete Pires

Abstract:
This project targets students in professional courses in which project-based learning (PBL) strategies are already in use, but where is there is a need for more extensive study and a more complete and organized assessment of the results and skills involved in student-centered strategies. Particularly in this scope of students.

Keywords:
programming, computer sciences, Project-Based Learning, robotics, professional courses

Presenter: Elisabete Pires, PT

ID 63

Paths of reflective selection of digital resources to teach geometry by elementary teachers

Marisol Santacruz

Abstract:
We present some results from a research project that studies how elementary teachers selected digital resources to teach geometry and the reflections they make about this process. To analyze the selection of resources we use the idea of 'paths', that is, documentary traces in the practice of teachers. We present the case of four teachers. Our results show how the selection of digital resources implies a mobilization of the teachers.

Keywords:
Selection of digital resources, reflection by teachers, teaching of geometry.

Presenter: Marisol Santacruz, CO

ID 67

Analysis and Comparison of Computer Science Curricula and Project Content in Primary and Secondary Education

Stefan Pasterk

Abstract:
Computer science is playing an increasingly important role in schools and lessons. Due to the many different school systems and organizational structures, a number of curricula, educational standards and competency models for CS in primary and secondary schools have emerged in recent years. In addition to the official offers at schools, many other activities and materials are made available through projects and initiatives of universities or third-party providers.

Comparisons and the search for intersections between curricula and projects due to the obvious differences are a complex task for which a possible solution based on graphs is proposed in this project. In this study selected curricula and projects are represented in form of graphs. This happens by establishing dependency relations between individual elements like learning objectives, educational standards, or competencies within one educational model or project. By using natural language processing and machine learning techniques, a semi-automated approach will be developed to determine dependency relations.

It will be used to generate a general model, combining elements from the individual, selected educational models to a single graph. This enables a comparison of the interdependencies between different curricula and their connections to third-party projects.

Keywords:
curricula, computer science, comparison, graph-based

Presenter: Stefan Pasterk, AT

ID 70

Source code as informatical form of representation

Didactical analysis of textual in contrast to graphical programmes

Daniel Siebrecht

Abstract:
Three modi of informatical representation, concerning to a certain level, have to be distinguished: diagramme (iconic level), text (symbolic level), formalism (symbolic level). The source code as form of informatical representation is a genuinely informatical, textual-symbolic representation, appealing primarly to automata; secondarily human beings are recipients.

The specific automaton-orientated intentionality [6] and its ambigousity lead to remarkable challenges for designing teaching and learning processes in Informatics. From a generally didactical perspective genuinely informatical forms of representation fill an empty gap in educational contexts; other subjectsí forms of representation are either related to or adapted from Informatics, which seems to be an seldomly focussed potential, nevertheless without being able to get at compilable textual modi of representation.

Keywords:
Informatics, representation, type of text, source code

Presenter: Daniel Siebrecht, DE

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Impressum:
Published by the Austrian Computer Society (OCG) on behalf of the
International Federation for Information Processing (IFIP)
Wollzeile 1, 1010 Wien, Austria
Druck: REPAneo, Hauptstr. 10, 4040 Linz