MEMO: Summary of Project Seminar

Conceptual framework for increasing society's commitment in ICT: approaches in general and higher education for motivating ICT-related career choices and improving competences for applying and developing ICT

Accommodation and seminars in Kalev Spa, address: Aia 18, Tallinn, Phone: +372 6493370

14th November 2013

Introduction – project, partners, overview of outcomes (Margus Pedaste)

Margus began the seminar by announcing a website for our project (http://ict.ut.ee or http://ikt.ut.ee). It should become a convenient place to highlight and disseminate our work to a wider audience. An introduction to the collaborators working on the project was made by Margus and the people present at the seminar briefly talked about their backgrounds. There was optimism expressed by people at the seminar that this project fosters a stronger sense of collaboration among Estonia's higher educational institutions for research and development and in addition to improving Estonia's ICT sector has potential for making European wide and international impact.

In the introductory presentation Margus talked about our progress so far: identifying key dependent and independent factors of interest, a review of international ICT interventions, first data collection and analysis from student applicants to IT institutions, and second data collection from beginning IT students in the curriculum. He then discussed some main issues involved with ICT career choices and drew attention to the high rate of dropout and incompletion of ICT studies in Estonia. An important aim of this project should be to identify the changes that happen to students during their studies that cause dropout from the ICT field. Our longitudinal data will give us valuable data to decide what interventions can possibly correct this situation.

Review of international research on ICT use in education (Leo Siiman)

Leo presented a review of international interventions applied for affecting students' ICT-related attitudes, knowledge, and skills. In general, rigorous quantitative research on ICT interventions is rare and the majority of the research tends to be qualitative. However, analyzing studies that presented empirically tested interventions showed that changes to computing pedagogy were promising for recruiting and retaining more ICT students. In particular three categories were described: (1) visual programming environments to teach introductory computer programming, (2) inquiry learning activities to engage students in computing, and (3) integration of interdisciplinary knowledge in computing classes. The international interventions show that it is important to look at how Estonian educational institutions teach and introduce ICT knowledge to students.

What do we know about CS students in UT? (Margus Niitsoo)

Margus presented quantitative data on computer science (CS) students at the University of Tartu. In addition to first-year student data from last year he showed trends in admissions and dropout over multiple years. These initial results and analysis were influential in starting our current project to study the dropout problem in more detail. Margus showed that both time spent for studying and prior score on the mathematics state exam correlated with exam scores in computing classes. It was also pointed out that some interventions to change CS curricula can improve first-year retention data of students, but the long-term graduation rate may not improve because students simply drop out in later years. Therefore it is very important to find interventions that have long-term benefits and be wary of results that only provide short-term data.

Why are students interested in studying Information and Communication Technology? Results from admission and ICT students' introductory questionnaire. (Külli Kori, Heilo Altin)

Külli and Heilo presented the data collection results from applicants and first-year ICT students at the University of Tartu, Tallinn University of Technology, and Estonian Information Technology College. The first collection of applicant data showed that there are more candidates applying for spots at the universities than available positions. The competition is about 2.56. Questionnaire data allowed us to distinguish by inductive content analysis 14 categories describing why students choose to study ICT. When comparing accepted versus non-accepted candidates, only four categories showed statistically significant differences in frequency: labour market, field development, suitability, and other. A second data collection of beginning ICT students was also performed. A factor analysis showed that three main factors influencing students to study ICT are: (1) personal contact with IT, (2) salary/labour market (no personal contact), and (3) continuation of IT-related studies.

An important question that arose out of the data collection was how to improve the response rate of students on the questionnaires. At present some departments had significantly higher percentages than others. Therefore we need to ensure that the process for obtaining questionnaire responses is optimized across all departments.

Work done in Estonia for increasing society's commitment in ICT (Eno Tõnisson)

Eno presented an overview of ICT/CS education in Estonia. He noted that a recent Praxis report, http://www.praxis.ee/fileadmin/tarmo/Projektid/Innovatsiooni_poliitika/IKTtoo/Executive_summary.pdf, shows current needs for professional development of Estonian ICT workers. The report quotes a problematic area in higher education as "We primarily lack professionals who are able to develop software at an advanced level and people who can administer databases and systems."

The overview showed that it is important to select qualified students who will complete their university studies in ICT. However, preparation of ICT skills and awareness of ICT opportunities should begin at the secondary school level. The National Curriculum for secondary schools places ICT classes as optional. But if more teachers had training and competence in teaching ICT skills then there could be a possibility to prepare students at the secondary level and decrease the ICT dropout rate at universities due to insufficient academic ability. We don't have systematic information on the use and outcomes of ICT teaching at the secondary school level in Estonia.

Practical example about school and industry collaboration in ICT sector (Doris Põld, Jüri Jõema)

Doris presented the work of ITL in uniting Estonian ICT companies to promote Estonia's development towards an advanced information society. More qualified ICT specialists are needed in the Estonian ICT sector. Several successful projects have been used to promote IT awareness and increase the number of youth interested in IT. Especially important have been school visits to popularize ICT with youngsters and programs to support IT-related afterschool activities.

During discussions it was mentioned that a challenge for further expanding the reach of ICT to students in schools was persuading teachers to adopt new technology to teach traditional subjects. Sometimes teachers may not feel confident in applying technology in the classroom and thus the current focus has been on extracurricular activities to expose students to new ICT innovations. Digital competency for all teachers in schools would help spread ICT technology quicker to students.

Educational robotics in Estonia (Heilo Altin, Ramon Rantsus)

Heilo presented on the use of educational robotics in Estonia as an effective intervention to introduce young students to ICT activities. He also emphasized that when working with general schools it is of upmost importance to persuade teachers that they can manage the learning process when using robotics. Special workshops for teachers have been shown to be effective and motivate teachers to apply robotics in their classrooms. In discussions it was mentioned that the robotics intervention should be made more visible to society and supported through our educational research results.

Robotic Teaching and Learning Concept (Raivo Sell)

Raivo presented on the connections between robotics, electronics, and mechanical engineering. He showed that there is a logical progression from a beginner playing with robots to an expert in electronics and mechatronics engineering. Some useful learning kits are the Lego Mindstorm NXT, Arduino, and Robotic HomeLab kit. Starting with simple experiences and immediate results motivates students to continue to pursue more advanced knowledge. Raivo also pointed out that teachers require training interventions to learn how to apply methodology and pedagogic collaboration to start teaching effectively with robotics.

Programming in school computer club: Scratch & Python (Tauno Palts)

Tauno presented on a project, www.progetiiger.ee, for teaching the programming languages Scratch and Python to secondary students in Estonia. Motivation for this project arose because ICT lessons are not compulsory in the Estonian school curriculum and there is lack of qualified teachers in programming. The project began with initial teacher training and provides free software, free learning materials, and free training. Research will investigate motivational aspects of teachers to learn simple programming and hence become sufficiently competent to improve the level of ICT preparation of secondary Estonian students.

Work done by our partners for increasing society's commitment in ICT (Dimitris Alimisis, Tomi Jaakkola, Wouter van Joolingen)

Our foreign partners provided valuable insights on ICT education from the point of view of their national curricula. Dimitris highlighted the importance of teacher professional development as crucial to making changes in ICT education, since the confidence and attitudes of teacher with ICT technologies will determine how well they motivate students towards ICT career choices. However, he warned that new technologies can reinforce old ways of teaching and learning and therefore training teachers in effective methodology is essential. He also recommended exploring new interventions with small-scale studies.

Tomi presented an overview of the Finnish ICT educational situation. He noted that the Finnish national curriculum provides only broad guidelines to schools and therefore allow teachers freedom to develop their own individual initiatives as to how ICT knowledge is taught in lessons. However, many teachers use ICT to prepare lessons but not during lessons. They don't know how to use ICT tools in a meaningful way during classroom lectures. At the higher educational level more than 90% of ICT students work while studying and only about 50% eventually graduate. However, many who do not graduate still go to work in the ICT industry. Therefore it appears that formal higher education credentials are not highly valued or considered as enhancing the resume of candidates who apply for ICT jobs in Finland. Is this also true in Estonia? How can the ICT degree become more prestigious and worthwhile for employers?

Wouter presented on ICT in the Netherlands. He pointed out that informatics at secondary schools is a voluntary subject with a non-standardized curricula. He also mentioned that teacher training at technical universities usually leads to jobs at higher education institutions and not at secondary schools. In terms of teaching methodology with ICT, the aims should be to make educational outcomes easier and more fun. ICT tools can strongly support inquiry learning skills in students. The combination of ICT skills and domain knowledge in other subjects can be achieved through game designs, modeling, and visualizations.

15th November 2013

The second day of our seminar reviewed the project questions and methodology, discussed the role of partners and project timeline, summarized project expectations and plans, and discussed communication and dissemination of project results. Some key points are mentioned below.

Project plans

New questions, based on the first data collection results, will be introduced. Some questions may cause misunderstandings in students (e.g. how well do you rate your theoretical/practical skills) and we should check with international questionnaires to see how to rephrase ambiguous questions so that ICT students will be able to clearly answer them.

Should we expand the questionnaire to collect even more detailed information? For example, collect academic capability and motivational data.

Right now there is a challenge to get high response rates from students. Perhaps this is because not enough students attend lectures. Could applying the questionnaire before or after exam be more effective? Can an online questionnaire be effective? What motivates students to fill-out the questionnaire? The timing of the questionnaire is also important to maximize the response rate.

We plan to interview students (current students, former dropouts, individually, in focus groups). How to execute the interviews at different institutions? Standards will be developed so that the interview data will be consistent and follow the same procedure at each location.

How to collect useful information from general schools? (e.g. interview teachers, questionnaires for teachers) What are the challenges for ICT teacher training programs?

In terms of building momentum to seek out future international funding opportunities, what ICT issues are most important to our international partners that are also relevant in this Estonian project? A preliminary comparative analysis between Estonia and foreign institutions can show justification for a larger-scale European wide initiative.

We want to perform data mining analytics on the data that will be gathered. What capabilities do each of the institutions have in data mining analysis?

Communication and dissemination

A final important aspect of this project is to inform and influence key policy makers. We want to disseminate materials in an interesting way for the public. Our website (http://ict.ut.ee or http://ikt.ut.ee) is the first example.

NB! Please check that the partner list on the webiste (…/ict/partners) includes all colleagues who are participating in this project.

To reach higher level officials we considered an indirect approach where we first discuss with members of the board of university directors, ICT teachers groups, and/or other influential channels to release recommendations and statements based on our work. Then we approach policy makers directly. At the present time the most influential policy makers to consider are at the Ministry of Education and the Ministry of Economic Affairs.

At the research level we should make a list of keys conferences and journals where we think our work will make an international impact and attract potential collaborators. Those who have good suggestions where to publish or which conferences to attend should let us know by writing a list of recommendations and sharing it via Dropbox or our project email list (projekt.iktharidus@lists.ut.ee).