Vygotsky's Zone of Proximal Development in Connection with Technology-Enhanced Learning Environments

Technology-enhanced learning environments (TELEs) that support social interaction between teachers and learners are common in engineering higher education institutes. TELEs are often equipped with professional hardware and software, which not only enable learners to gain access to variety of learning instruments, but also allow learners to practice with authentic equipment and design tools. Furthermore, teachers can use TELEs and scaffolding principles to organize teaching in several ways that are beyond traditional classrooms. This paper discusses the potential of TELEs to shape the zone of proximal development (ZPD) of learners such that they could do harder learning activities than would otherwise be possible in less conducive environments. In addition, an example of a conducive TELE is presented that might have enlarged ZPD of learners, and, as such, may partly explain good learning outcomes obtained. The illustrations in this paper may help teachers to gain better understanding of the benefits of environment creation as well as to organize learning episodes that are suitable for ZPD-based thinking.

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ASJC Scopus subject areas: Education

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JUFOID=8743
Research output: Scientific - peer-review » Conference contribution

Pedagogical Content Knowledge in Product Development Education

Engineering education at university faces challenge concerning the efficiency in producing results in learning. Engineering Education will be exposed to globalisation resulting in tough competition between the service providers and individual contributors. This study focus on capturing and discussing teachers’ pedagogical content knowledge on product development education. Currently there are no holistic approaches presented from teacher knowledge viewpoint. The next steps how to develop this knowledge of product development teaching further by focusing on the continuous learning process.

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Organisations: Mechanical Engineering and Industrial Systems, Research area: Design, Development and LCM, University of Tampere
Authors: Juuti, T., Rättyä, K., Lehtonen, T., Kopra, M.
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Research output: Scientific - peer-review » Conference contribution

Survey of health informatics education in Finland in 2017

The European Union and the USA collaborate in developing the skills of the application of information technology in the health care workforce. A part of this activity is a project which studies the gaps in the present education and proposes methods of filling these gaps. The objective of this paper is to identify the existing IT related education to the health care
work force in Finland. A secondary objective was to get an impression of the experience and attitudes of the members of this workforce about health IT education.

This paper presents the results of the survey of how information technology is educated to the students of the health care professions in Finland in the year 2017. In addition to literature search including also the study guides of many major health care professional education organizations, 24 telephone interviews of health care professionals in different fields in Finland were made.

The results show that although basic information technology education is often available at every level of education, it is expected that the health care professionals learn to use the health information systems during their training periods or later in working life. The interviews showed that the given education varied considerably and some of the personnel had received no or only a little education on IT during studies. As the amount and quality of on-the-job information technology education varies, many health care professionals are not able to fully benefit from the information systems if their general feeling is that they just “survive” from daily activities with them.

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Authors: Tolonen, J., Värrri, A.
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Research output: Scientific - peer-review › Article

EU*US eHealth Works to Improve Global Workforce Development
For the past several decades, healthcare organizations and providers in the United States, the European Union and other countries around the globe, have advanced the digital transformation of healthcare to help increase quality, safety and efficiency. Health information technology/eHealth enables healthcare workers and providers the opportunity to maximize their care delivery, ultimately resulting in better outcomes for patients, consumers and society.

The core of any healthcare system is its workforce. Therefore, healthcare systems require a robust supply of highly skilled professionals who are proficient in eHealth/health IT to use, operate and maintain the digital services, which are an increasingly essential part of their infrastructure. Some of these professionals are front-facing care providers such as doctors, nurses, pharmacists and other caregivers and need “eSkills” to achieve and sustain success in their work. Others are on the extended healthcare team, such as clinical informaticists, health information sta?, biomedical engineers and researchers, employ eHealth on a daily basis where the use of ICT (information and communications technology) is critical. Furthermore, some healthcare sta? that may not be traditionally thought of as using ICT in their work, such as pastoral care workers (clergy), environmental workers, or nutritional sta?, who are also more frequently relying on digital services and technology to manage their daily tasks.

To take on these expanded duties, all workers within the healthcare environment must be trained in eHealth, preferably before they even receive their first job. Therefore, the development and advancement of a healthcare workforce equipped with eHealth skills is vital to the present and future state of healthcare. This eHealth enabled workforce will assure that systems keep working functionally, that clinical workflows are incorporated into technology, and that healthcare is delivered in a manner that is safe, secure and quality-infused.
This paper will discuss the ways in which the EU*US eHealth Project, in cooperation with its Consortium members and a large stakeholder community, will work to measure, inform, educate and advance development of a skilled eHealth workforce throughout the European Union, United States and globally, with the goal of creating a legacy of digitally empowered health care professionals now and in the future.

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Ministry of Education publication type: D2 Article in professional manuals or guides or professional information systems or textbook material
Authors: Blake, R., Shaw, T., Blake, A., Hübner, U., Kaye, R., Schug, S., Thye, J., Värri, A.
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ASJC Scopus subject areas: Computer Science (miscellaneous), Health Professions(all)
Electronic versions:
Eu-us-ehealth-workforce-development
Links:
http://urn.fi/URN:NBN:fi:tty-201711232249
Research output: Professional › Chapter

**Minivirtuaalilaboratorio käänteisen luokkahuoneen oppimisvälineenä**

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Authors: Pyrhönen, V.
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Research output: Scientific - peer-review › Letter

**Affective experiences and student engagement in higher education**

**General information**
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Information Management and Logistics, Research group: Novi, Language Centre, Managing digital industrial transformation (mDiT)
Authors: Helander, N., Boedeker, M., Hellsten, P., Jussila, J., Mylläriemi, J., Tukiainen, M.
Publication date: 13 Sep 2016

**Host publication information**
Integrating mobile orienteering to team forming activity in a software engineering course

One of the most important skills software engineers need when entering work life is working in teams, including communicating, collaborating, as well as coordinating work in a team. This paper presents a team building activity aiming to support the first phases of team formation with a mobile orienteering activity. Created tasks at orienteering checkpoints were related to communication, collaboration and work division. Students were enthusiastic about the activity and expressed in their group reports on the activity that it supported the team building activity well, helped break the ice and supported agreeing the ways of working. Students also liked getting out of the classroom. The approach seems promising and we will investigate in the future similar type of activities in the first phases of team formation as well as will explore further integrating physical activity to the exercise sessions.

General information
State: Published
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Organisations: Department of Pervasive Computing, Research area: User experience
Authors: Väätäjä, H., Ahtinen, A.
Publication date: Sep 2016

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Research output: Scientific - peer-review » Conference contribution

I feel great - university students affective experiences on learning and teaching

According to Kolb [1], experience is the source of learning and development. This is a statement that serves as the starting point of this study. We argue that the role of affective experiences cannot be overlooked when evaluating university learning and teaching. In the present paper, we will study students' affective experiences in higher education setting, specifically in engineering education in a technological university. The perceived affective experiences are empirically analysed through a mystery shopper data set, which was gathered in the case university by a group of students. The study bases theoretically on affective experiences framework, more familiar from the consumer behaviour research stream. The aim of the study is to analyse what kinds of affective experiences students recognise when studying in a technical university and further to elaborate, how these affective experiences could be used to increase student engagement and the students’ motivation to learn. The study provides an innovative approach to university learning and teaching by applying mystery shopper method and affective experience approach from more business-oriented disciplines. The contribution to education science is the increased understanding of the role of affective experience in learning.

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Organisations: Language Centre, Department of Information Management and Logistics, Research group: Novi, Managing digital industrial transformation (mDIT)
Authors: Tukiainen, M., Helander, N., Hellsten, P., Jussila, J., Mylläriemi, J., Boedeker, M.
Number of pages: 8
Pages: 4453-4460
Publication date: 4 Jul 2016
Computer-supported collaborative learning: Praxes in new cell-oriented configurable PC-classroom

Currently, technology-enhanced learning environments are a research hotspot in engineering education. Universities invest in modern environments equipped with the newest audiovisual hardware, computers and web-technologies. These environments support learner-centred model of education, which highlights active role of learners, learning-by-doing, and collaborative learner autonomy in a democratic atmosphere. Therefore, traditional teacher-led classrooms can be transformed to more diverse and more creative environments in which teachers and learners have relatively different roles compared with the traditional classroom.

In this paper, we present layout, construction and hardware of our newly developed technology-mediated, configurable, and cell-oriented PC-classroom, which play a key role in our teaching development. We exemplify how the classroom has helped us to improve our automation science and control engineering education. To be more specific, we have adopted the well-known concept of computer-supported collaborative learning (CSCL), which concerns how students can learn together with the help of computers. We also demonstrate how redefining and redesigning the nature of activities occurring in modern learning environments can improve the effectiveness of contact teaching, and hence, allow learning episodes to be more impactful compared with the traditional teacher-led classroom. We would like to pinpoint that redefinition and redesign have allowed us, as teachers, to take the position of a facilitating guide, or mentor, which work in close cooperation with students, and thereby, is able to strengthen the knowledge level of students through intellectual face-to-face discussion as well as through technology-supported communication.

Furthermore, our new classroom has enabled hands-on, competitive, cyber-physical attack-defence events to be conducted, which improve our automation security training. The events have invited participants from industry and academia, but most importantly, they have involved students. During the events, we have offered opportunities for students to make demonstration-of-skills to the participants from business. As a consequence, the new environment has enabled acts of openings for university-business cooperation in terms of education and recruit, free of charge. To our experience and according to student feedback, our redefined ways of conducting teaching has improved student motivation as well as increased their timely investment towards learning activities, which has eventually translated to...
better grades and overall satisfaction.

General information
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Ministry of Education publication type: A4 Article in a conference publication
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Authors: Pyrhönen, V., Seppälä, J., Salmenperä, M.
Number of pages: 9
Publication date: 2016

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ASJC Scopus subject areas: Education
Links:
Research output: Scientific - peer-review › Conference contribution

Enhancing old laboratory experiment using flipped learning: Towards self-regulating collaborative groups in blended learning environment

This paper demonstrates how learning outcome of a traditional student laboratory has been improved using blended and flipped learnings in a cost-effective way. The innovation process was based on four important elements: the subject matter, educational theory, redefinition of the roles of teacher and students, and technology-driven utilities intended for education. Also, prelab activities were refurbished in order to better prepare students for the actual experiments. Teaching and learning relationship was redesigned to support learner-centred model of education, and on-site activities occurring in the laboratory room were reformulated to advance self-regulation and learner autonomy. As a consequence, the role of teacher is steered towards mentor-like activity, and hence, a teacher-mentor can use his own expertise to strengthen the knowledge level of students via on-site professional facilitation.

To be more specific, prelab activities were delivered using a virtual laboratory and a teaser video. The main role of the teaser video is to allow a remote visit to the physical laboratory room before students actually enter there. The teaser video delivers interesting visual information of the laboratory equipment when it is fully operational, and hence, students can identify causal connections of all devices affecting the physical system from anywhere at any time. The virtual laboratory, on the other hand, enables students to observe several physical quantities and their curvatures which cannot be observed nor displayed by the physical devices in the laboratory room. Furthermore, the open-ended nature of the virtual laboratory also enables students to use it as a subject for their own active research. The teaser video and virtual laboratory help students to develop intuition, and they also strengthen students’ preparation in a timely fashion manner. As a result, more time is released for active on-site student collaboration and teacher facilitated intellectual discussion. Interestingly, the virtual laboratory is key to establish highly collaborative and activity-based learning environment inside the laboratory room. Finally, it is shown that the new implementation of the laboratory work significantly reduces implementation costs.

General information
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Authors: Pyrhönen, V.
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ASJC Scopus subject areas: Education
Links:
Self-regulation and competence in work-based learning

This chapter discusses the connection between self-regulation and competence in both formal and informal contexts of vocational and professional education. The goal is to show that self-regulation has a theoretical linkage to a multifaceted and holistic approach to competence and that self-regulatory abilities play a role in the development of vocational competence. Different theoretical approaches to self-regulation and competence and the link between the two concepts are discussed. We argue that self-regulation plays an important role in the development of competence, as it is needed to acquire competencies, unified sets of knowledge, skills and views. Self-regulation acts as an indirect factor between competencies and direct formal, non-formal and informal learning processes (e.g. vocational studies, leisure time activities and work) aimed to develop them. In this chapter, we present results of empirical studies on self-regulation and competence to support this argumentation. Several studies with vocational skills competition competitors show that strong self-regulatory abilities are related to successful competition performances. Also results from a study with Finnish in-service air traffic controllers indicate a link between vocational excellence and self-regulative action. Our conclusion is that self-regulatory skills should be taught in addition to the vocation-specific skills in competence-based vocational and professional education.
STACK assignments in university mathematics education

Students' learning process can be assisted and diversified with the help of e-learning tools and virtual environments. In Tampere University of Technology, the aim is to utilize software that delivers assignments, checks students' answers and gives feedback to the students, in the mathematics courses. The software that has been used is called STACK, which can be integrated into Moodle. STACK assignments have been created as a part of the STEM education material bank Abacus.

Written feedback can be generated in STACK assignments as necessary. Feedback guides the students to identify their errors and revise them. It can also motivate the students to try again after giving a wrong answer.

This study concerns the use of STACK in TUT mathematics courses. Especially we are interested in:
- how do the points gathered and the time of the last submission in STACK exercises correlate with the exam grades?
- when and for how long do the students solve the STACK assignments?
- how does the activity in STACK differ between honours and engineering mathematics students?

In STACK assignments, the students were able to give their answers in Moodle. For each lecture week, they had one week to solve and return the answers. All the student activity related to the STACK assignments was saved in the Moodle logs. Data was analysed with Matlab by the means of educational data mining.

We observed that the activity in STACK was the greatest near the deadline. We also found that, on average, the better the grade, the earlier the students gave their final answers in STACK. Additionally, the honours mathematics students made their submissions earlier: many of them considered STACK exercises as a good way to revise the subjects considered in the lectures, while engineering mathematics students mostly rehearsed with STACK near the deadline.

According to the survey polls, students found the STACK exercises as a nice and efficient way to rehearse and learn mathematics. Especially, the instant feedback was mostly appreciated. However, some of the students felt writing the answers with a computer unappealing, but generally this aspect was not considered a problem.

MYSTERY SHOPPERS RECOGNISING KNOWLEDGE SHARING BARRIERS IN HIGHER EDUCATION

This study focuses on the knowledge sharing barriers in the space between learning and teaching in higher education as reported by mystery shoppers. There is surprisingly little context-specific research on learning and teaching in a knowledge intensive community like a university from the perspective of knowledge management (KM). Discussing learning and teaching within KM is based on considering students controversially as customers or stakeholders. Thus including them more meaningfully in assessing and developing teaching practices, or knowledge flow, seems justified. The specific aim of this paper is to first recognise possible knowledge sharing barriers and then categorize such barriers emerging from the material into three larger domains, namely, individual barriers, technological barriers and organisational barriers.

There were 45 students from all faculties participating in a mystery shopper project in a Finnish university of technology. They observed their learning experience for six weeks in order to supplement data from other sources, to add a student voice on the process of developing learning and teaching in higher education.

The research approach represents qualitative content analysis in which knowledge-sharing barriers were recognised from the qualitative mystery shopper data. The results identify teaching practises that contribute to creating knowledge sharing barriers. More detailed and almost real-time contextual activity sampling is suggested as a method for further study and also an avenue for instant feedback for teaching staff. The results will provide data on current knowledge practices and
learning processes in a technical university in Finland.

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Supporting Learning with Wireless Sensor Data

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Ministry of Education publication type: A1 Journal article-refereed
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Authors: Multisilta, J., Perttula, A.
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