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Tuija Vanttinen & Seija Aalto (ed.).



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Preface

Kyminlaakso University of Applied Sciences (Kyamk) and Mikkeli University of Applied Sciences (Mamk) have extended their cooperation over the years. This joint publication is one result of the cooperation and provides a window into the research and development activities at these two higher education organizations. Learning and teaching at the universities of applied sciences has been changing in recent years. There has been more focus on learning instead of teaching.

Mamk and Kyamk have invested significant resources in curriculum development in 2009 and 2013/2014. Both universities focus on competence-based curricula. Kyamk has developed a Learning and Competence Creative Ecosystem (LCCE®) in which external organizations, learning/teaching, and the university work together to create new knowledge, both for students and for workforces. Mamk's aim is to integrate teaching and working life more closely with real-life cases in varying environments. A further aim has been towards innovative and cooperative learning.

This book contains different theoretical views, research, and practical experiments with teaching and learning that Kyamk and Mamk have completed in recent years. Part 1 offers some theoretical aspects on pedagogy at the universities of applied sciences. Director of Education Tuija Vanttinen (Mamk) and Head of Department Matti Kilpiäinen (Mamk) build a preliminary model for Mamk's pedagogically managed learning environments. Principal Lecturer Natalia Kushcheva (Mamk) compares European and Russian Master-level double degree programs in the Bologna process framework. Evidence-based practice and clinical decision-making using simulation pedagogy in nursing is the focus in the article written by Principal Lecturers Paula Mäkeläinen (Mamk) and Leena Uosukainen (Mamk).

Part 2 focuses on pedagogical research at Mamk and Kyamk. Team Leader, Senior Lecturer Heidi Wass (Kyamk) points out how a team organization can promote an innovative learning community at Kyamk. The use of simulation in paramedical education and patient safety is the theme in Senior Lecturer Hannu Salonen's (Kyamk) text. Senior Lecturer Kati Vapalahti (Mamk) reports from her study concerning argumentative problem solving through online and face-to-face role-play discussions in a social work degree program. Team Leader Ari Lindeman (Kyamk) and Principal Lecturer Minna Veistilä (Kyamk) have studied Master's theses written in 2011 and 2012 at Mamk and Kyamk. Their focus is on interdisciplinarity in thesis-writing.

Part 3 includes examples of pedagogical experiments at Mamk and Kyamk. Project Manager Kari Dufva (Mamk) writes on pedagogical aspects, using Moodle, and laboratories in a solar challenge racing team. Mirva Pilli-Sihvola (Kyamk), Coordinator of Online Teaching, claims that by promoting teachers' competence, it is possible to develop the quality of online learning. Principal Lecturer Merja Mäkelä's (Kyamk) article focuses on developing engineering competences using web-based learning methods.

Universities of applied sciences need to create new pedagogical practices for learning and teaching. This change in teaching requires a new attitude from teachers at universities of applied sciences and society as a whole. We believe that this publication is useful to all who are interested in developing learning and teaching at universities of applied sciences.

We would like to thank all the professionals for contributing to this publication and sharing their expertise.

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PART 1

THEORETICAL PERSPECTIVES ON PEDAGOGY AT THE UNIVERSITIES OF APPLIED SCIENCES

1

TOWARDS PEDAGOGICALLY MANAGED LEARNING ENVIRONMENTS AT MIKKELI UNIVERSITY OF APPLIED SCIENCES

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Introduction

“In theory there is difference between theory and practice. But, in practice, there is not.”
(modified from Jan L. A. van de Snepscheut)

Playing is the work of children. It can be said that learning and teaching is a game shared by students and teachers and it is thus their common work, or work which can be like a shared game. The vision for the future could be that learning environments are shared by students, teachers, RDI staff and external organizations to support reciprocal learning. Thus, a university of applied sciences is a real working environment, which is an antecedent and developer of fields. Is it possible that such a brave vision can be realized when all universities of applied sciences detach their school-like institutional culture, which is supported by an environment that has taken decades to build?

This article describes a pedagogically managed learning environment model, which could structure the development of learning and working environments that support better learning, teaching and pedagogical development to the vision above. The concept of a learning environment also includes working and teaching environments – it is a common learning process as described in the vision above. The role of future learning environments is to be a place to produce learning instead of a place of instruction (Ibrahim & Fadzil 2013).

The background of the model is the work done by Alexandra den Heijer and Roger Schank. Alexandra den Heijer is a Dutch architect who studied learning environments at Dutch universities for her doctoral dissertation (den Heijer 2011). Roger Schank is an American artificial intelligence theorist, cognitive psychologist, learning scientist and educational reformer. E-learning and virtual learning environments will be revolutionary tools for reforming future schools. This article focuses on learning environments as defined by den Heijer (2011) and Schank (Fielding 2013). E-learning environments are not discussed in detail, although the meaning of those will be enormous in developing learning environments.

According to Kotila (2012), real-life learning and development environments can be a solution to the pedagogical challenges facing universities of applied sciences. We need learning and teaching spaces and equipment which support common knowledge-building and interaction as a learning community. Besides, real estate, buildings and classrooms are the second largest cost factor for universities of applied sciences.

From the point of view of Mikkeli University of Applied Sciences (Mamk), the curriculum reforms (2005, 2007, 2012) have been processes that feature the transformation of pedagogy. During the curriculum reform in 2007, one goal was to integrate teaching and working life more closely (Komonen 2007). An important aim is curriculum reform, which transforms Mamk’s pedagogy into work-based learning with a strong focus on real-life cases. Pedagogical solutions and learning environments are an effective means of improving the quality of learning and teaching at universities of applied sciences, thereby boosting regional development and improving the competences that graduates have.

The aim of this article is to bring theoretical ideas of learning environments at universities of applied sciences to the practical context of pedagogical decision-making concerning learning, teaching and curriculum planning at Mamk. The framework in this article is functional campus management with a focus on the relationship between learning and teaching spaces, which are pedagogically managed.

This article begins by briefly describing how learning and working environments are defined and how den Heijer (2011) specifies the determinants of a functional campus. In chapter four, some key elements of pedagogically managed learning environments are described in Schank's framework. Chapter four focuses on a preliminary model of work-based and pedagogically managed learning environments. Some conclusions for further development are presented at the end.

1 Learning and working environment

The definition of a learning environment as a concept varies and there is no widely shared understanding of the concept of a learning environment (Tenno 2011, Kuuskorpi 2012). The narrowest definition of a learning environment is a physical classroom and formal learning, which happens in a school building. The broadest definition includes the entity of formal and informal learning when learning occurs in the school and outside of the school. In other words, a learning environment is a place, action or situation where learning happens. (Kuuskorpi 2012.) At universities, personnel and students normally learn and work in common environments.

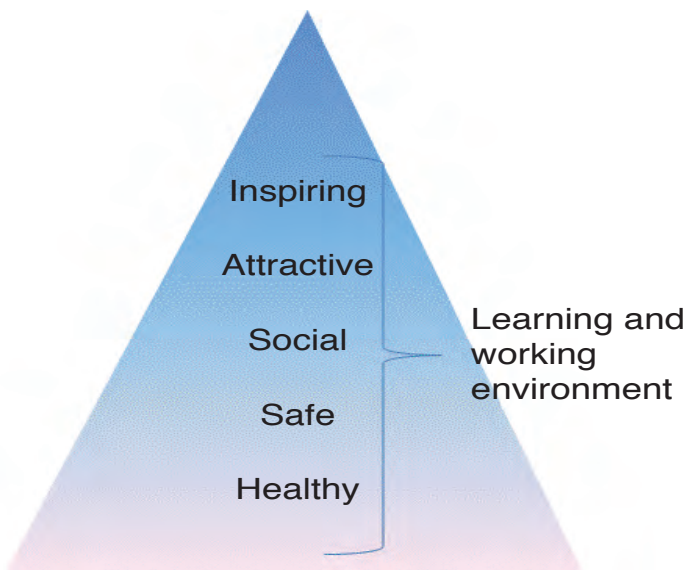


Figure 1. Maslow's hierarchy of needs in a learning and working environment context (den Heijer 2011)

According to den Heijer, learning and working environments also affect individual needs and students' expectations. She refers to Maslow's hierarchy of needs and claims that for knowledge workers the atmosphere on campus and quality of the workplace will become a more important feature of the decision-making process for recruitment (see Figure 1). Learning and working environments must facilitate opportunities for personnel and students to develop their abilities as best they can. (den Heijer 2011.)

2 Functional campus management and learning and working spaces at universities

The basic function of a campus environment is to shelter people and their belongings. It also provides a functional framework within which human activities can be carried out. These activities are socially determined and thus the environment provides social meaning. (den Heijer 2011.) Alexandra den Heijer's research focuses on campus management from the Dutch perspective. She claims that the situation is the same throughout the world. With more than a hundred million students – a number that will grow to 200 million by 2025 – in higher education all over the world, there is a vast number of campuses, university buildings and workplaces to manage. (den Heijer 2011)

Den Heijer (2011) defines campus management from four perspectives: strategic, financial, functional and physical (see Figure 2). Functional campus management is the key point when we think about the main tasks of a university. It is important to the future of universities of applied sciences because their objectives depend mainly on human resources – specifically, the knowledge and actions of the academic staff and students.

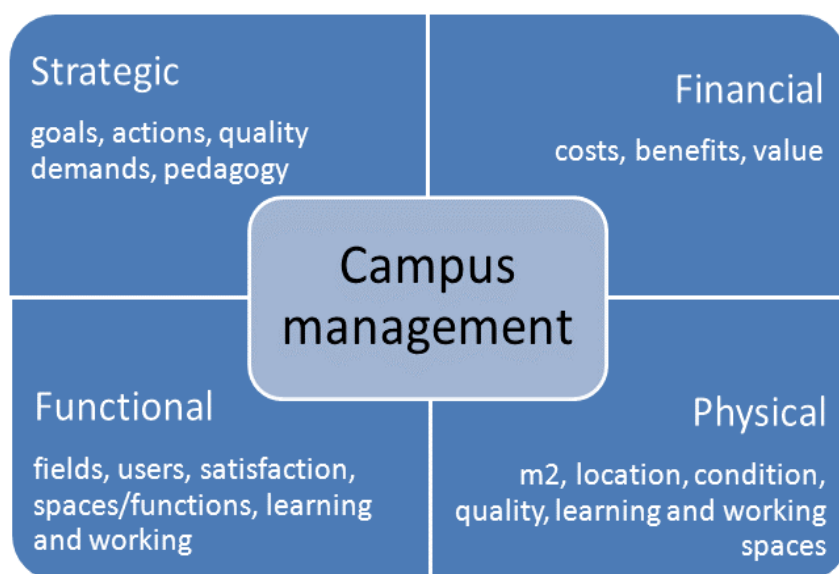


Figure 2. Campus management (according to den Heijer 2011)

A functional campus can be defined by the spaces at universities. In den Heijer's (2011) evaluation of Dutch university campuses, 33% of usable floor area was used as office space. The remainder of the space was used as follows:

- Learning and teaching spaces (e.g., laboratories): 21%
- Other learning and teaching education spaces: 16%
- Support: 10%
- Storage: 12%
- Restaurants: 4%
- Sanitary spaces: 3%
- Residences: 1%

The other variable in defining a functional campus is time. Den Heijer uses two different indicators to measure the use of space: the frequency rate and the occupancy rate. The frequency rate indicates hours of use versus hours available, measuring the use of time. The occupancy rate indicates the used capacity versus maximum capacity. At UK universities, the frequency rate based on opening hours from 9am to 5pm was approximately 50% for teaching spaces. Den Heijer states that university buildings are, in general, relatively inefficiently used. There are opportunities for extending opening hours and usage during the evening, at weekends and outside the autumn and winter semesters. (Den Heijer 2011.)

Den Heijer (2011) also draws an interesting picture of the campus of the future. She says that the future campus will be a city: univer-city. The function of campuses will broaden to include the following:

1. Academic functions for education and RDI
2. Residential functions, housing for students and staff, hotels
3. Related businesses, places for partners linked to the university's academic goals and supporting processes
4. Retail and leisure services, sports, culture, catering and shops
5. Infrastructure, IT services, parking, etc.

(Den Heijer 2011, 454)

However, the most important factors in functional campus management are the strategic goals, structures and processes of learning and working, such as the fields, programs and curricula. The next chapter focuses on pedagogically managed learning environments based on Roger Shank's classification. The aim is also to broaden den Heijer's concept of functional campus management towards a pedagogically managed learning environment.

3 Towards pedagogically managed learning environments

The development of learning and working environments requires a transdisciplinary and multiprofessional approach. In this chapter, Shank's ideas of learning and den Heijer's theoretical aspects from the field of architecture are combined to describe an environment that includes views from educational sciences, thus enhancing knowledge of pedagogically managed learning environments. In pedagogical discussion,

the concept of pedagogical leadership is defined as the capability of a leader to supervise employees towards the vision and common goals of an organization (Taipale 2004, Raasumaa 2010). Pedagogical leadership therefore refers to human resources management. In this article, pedagogical management refers to all of the activities used to develop learning environments in order to use the available resources efficiently and effectively according to universities' pedagogical visions and goals.

Roger Schank's approach to learning is based on John Dewey's theory of learning by doing. One method for expanding learning by doing is e-learning, which revolutionizes the use of real cases in higher education (Educom Review 1995, Schank 2002). According to Schank the most efficient way to learn is by doing and by failing in the most suitable environments. The structures of learning environments are described by the ways of doing: interactive, active and focused. One third of learning should happen in real social interaction (interactive), one third on the internet and by computers (focused) and one third by doing in real life environments (active). Schank defines the concept of "gardens" as places where a learner's understanding can develop through various experiences, enabling the learner to find meaning for learning. These places are outside of school buildings and classrooms. (Fielding 2013). Figure 3 shows the environments classified by Schank's concepts at university of applied sciences. These environments are also the spaces where academic staff work and teach.

This demonstrates that it is not possible to clearly separate learning and working environments from each other – interactive environments include elements from focused environments and vice versa. The next chapter describes the learning and teaching environments in Figure 3 in more detail, remembering the intertwining nature of learning environments.



Figure 3. Learning spaces at university of applied science according to Schank (Fielding 2013)

3.1 Interactive and active learning environments

Interactive and active learning environments can be quite similar: Mamk's restaurants are real contexts even though they are on campus. Den Heijer (2011) has described this evolution in her research (see page 4). However, real practical training environments are crucial for students and also for teachers. "Gardens" are the key element in learning by doing.

According to Schank, interactive, social learning spaces are places where real interaction is possible, such as school-like environments and the home. Factories, hospitals, laboratories and playgrounds are also active learning environments. (Fielding 2013.)

School-like learning environments are and can be interactive by nature. The added value to learning is real-life presence and communication. Spaces are ordinary classrooms, rooms for small groups and self-directed learning, restaurants, spaces within libraries, laboratories and simulation spaces.

Kuuskorpi (2012) divides learning spaces in school buildings into spaces that support reflection, creativity and interaction. Reflection is possible when there is a small number of students and a personal working place. Studying in large student groups contributes interaction in spaces which are flexible and modifiable (see table 1). Virtual learning tools can promote interaction in large group learning situations (cf. Minerva-tori)

Table 1. Key features of reflective, creative and interactive learning spaces (Kuuskorpi 2012)

	Number of students	Way of learning	Way of processing	Type of working space
Learning space supporting reflection	1–2	Individual or pair	Personal	Personal
Learning space supporting creativity	3–6	Small group	Group	Flexible
Learning space supporting interaction	20–40	Large group	Democratic group	Flexible and modifiable

Classrooms will also be needed in the future. In Finland, and at Mamk, school and university real estate has been built over a period of decades and a huge amount of money is invested in constructing new buildings and renovating old buildings. According to Kuuskorpi's (2012) study, primary school staff and pupils value traditional classroom spaces. However, recent research is changing the concept and perception of classrooms as learning environments: spaces and furniture should be optional and they have to be flexible and modifiable. Thus, the classroom of the future is based on functionality, interaction and diversity (Figure 4). Such a space enables teachers to work in new ways: two or more teachers can work together simultaneously using common and group-focused learning methods. (Kuuskorpi 2012.)

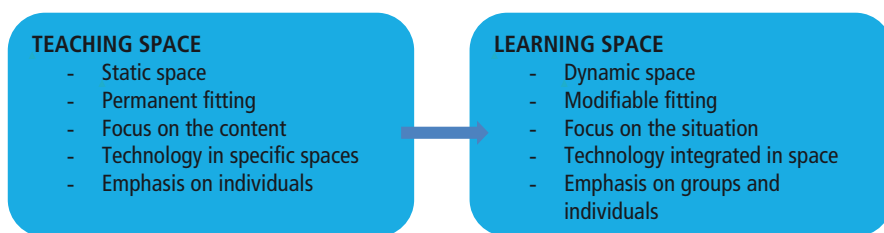


Figure 4. From passive teaching spaces to dynamic learning spaces (Kuuskorpi 2012)

Laboratories are available, especially at universities of applied sciences, which focus on practical knowledge and skill. Many of these laboratories were built in the 1960s and 1970s. The main function of these learning environments has been and still is to give students the knowledge and skills they encounter in real working life. Students practice some limited professional skills with equipment located at the university. Some of those environments are nowadays also used to provide services: Mamk has an environmental laboratory, Fiber Laboratory and a welfare service centre called EliXiiri. The newest learning environments at Mamk are the restaurants Talli, DeXi and Kasarmina, which provide meals for staff, students and external clients (c.f. Mentula 2010). Students also use these premises for their studies and practical training in multi-professional teams.

Practical learning environments offer possibilities for the most active learning. They are essential in education at universities of applied sciences. Act 546/2012 for the UAS sector (Finlex 2013) expands the autonomy of universities of applied sciences by defining the scope of practical training in degrees as at least 30 study credits. Students will therefore have greater opportunities to experience training in a real working position. The close integration of **RDI activities** with learning and teachers' work gives rise to a variety of environments in which students can study and practice. They are also crucial when students' knowledge as a human resource is engaging with the region and its development.

Simulation learning environments have developed along with information technology. The crucial aim in these environments is to bring real-life phenomena to learning. In Finland, and also internationally, simulation is used extensively in health care education. **Spaces for small groups and self-directed learning** vary considerably. Corridors, restaurants, yards and libraries are common places. One feature of all of these environments is the need for internet access.

Internet access is needed for **focused learning environments**. The key features of these environments are access to the internet and the use of various e-learning spaces such as Moodle, Facebook and Twitter. The rapid spread of smartphones and tablet computers has raised the demand for the use of social media in higher education. The latest discussion concerns massive open online courses (MOOCs) and flipped classrooms. These drivers also affect our perception of learning. Learning should be active and collaborative, and work-based at universities of applied sciences. (cf. Lonka 2013.)

The next chapter briefly describes the Mamk campus and education development. The ultimate goal is the conclusions drawn from the work of den Heijer and Schank in the context of the pedagogically managed learning environments at Mamk.

4 Work-based and pedagogically managed learning environments – a preliminary model for Mikkeli University of Applied Sciences

Work-based pedagogy has changed teaching and learning at universities of applied sciences, including at Mamk, in several ways. Recent pedagogical tendencies have emphasized learning in authentic cases (e.g., Kuoppala 2013). Project learning and Living Lab methods are used widely at universities of applied sciences (see Kotila & Mäki 2012). Furthermore, the perception of learning environments has changed and many innovative campuses and learning environments have been established.

Mamk is one of the 24 universities of applied sciences in Finland. It has education in seven different fields of study, research and development activities, and services for companies and individuals in the region. Mamk has 4500 students on youth and adult degrees on the Mikkeli and Savonlinna campuses and 400 staff. Every year, 900 skilled students graduate from different fields. Higher education was established at Mamk in 1991 in the field of technology. Since then, there have been several changes in education and Mamk's campus structure has changed from seven campuses to two campuses (Figure 5). The main campus is located in Mikkeli in an old barracks. The first buildings, which were taken into use in the late 1960s, were inherited from the Savo Brigade's mortar company (Vahteristo 1994). The newest buildings are from the 21st Century, built for health care, social work and humanities in 2011. For several years, Mamk has had the strategic goal of providing students with better opportunities to study from other programs and enabling staff to interact, thereby promoting an innovative and development-focused learning and working community.

Legislation of UASs is changing at the beginning of 2014. The new legislation will considerably increase the autonomy of UASs regarding education provision. Act 351/2003 for UASs includes the same duty: UASs *shall provide higher education for professional expert jobs based on the requirements of working life and its development*" (Finlex 2013). Thus, the demand of work-based education and pedagogy still remains. Work-based pedagogy enables learning in and of real-life situations. According to a sociocultural learning view, things first exist outside of a learner in reality. A learner reflects reality by experiences and interaction. (cf. Enkenberg 2000). Work-based pedagogy also challenges students' learning processes, the teacher's profession and co-operation with external organizations.

Mamk's strategy 2017 was revamped in June 2013. One of Mamk's primary missions is to promote regional expertise and development. Mamk aims to be a collaborative university for students and the region. This means flexible solutions for the learning process and close connections between learning, RDI and external organizations. In addition to the learning environment, extracurricular activities and on-campus sport facilities will also be taken into consideration. The guidelines in Mamk's strategy 2017 for pedagogical development are quality, new ways of learning, continuous development of staff, and collaborative learning and working. Work-based peda-



Figure 5. Development of Mamk's campuses and education 1989 – 2014

gogy is based on real cases and it is carried out in close co-operation with external organizations. Mamk's strategy 2017 and the assumptions above are the basis for the preliminary model for work-based and pedagogically managed learning environments (Figure 6).

The model consists of three basic learning environments:

1. The campus learning environment: campuses for collaborative, interactive and active learning in Mikkeli and Savonlinna, including all of the buildings and facilities there, restaurants, libraries, etc., and RDI
2. Online study environments: all of the facilities that enable collaborative and focused learning
3. Practical learning environments: work places, offices, hospitals, etc., all of which make it possible to learn actively

The above-mentioned environments can appear in a variety of combinations. Learning and working processes at UASs are complicated and nonlinear, meaning that the environments often intertwine.

The model has three important elements: application of knowledge; dialogue between students and teachers from different fields, working life representatives and entrepreneurs; and real cases (see Kuoppala & Hytinkoski 2013). Gibbons (1998) points out that knowledge in universities should be produced in the context of application across the disciplines. Such knowledge is intended to be useful to the region, population, industry or government, or society more generally. Knowledge thus produced is always produced under an aspect of continuous negotiation and dialogue: it will not be produced unless and until the interests of the various parties are addressed. These are the key features of knowledge application produced in dialogue. (Gibbons 1998.) The result and the aim is to build community knowledge that is public and accessible to all community members through contributions to collective knowledge spaces. Thus ideas and knowledge have a life beyond the individual mind and can be continually accessed and improved. (Hong & Scardamalia 2014.)

The basic assumption of learning in the model is learning through real case studies. Real case studies refer to all learning opportunities that are not “from the book”. They can originate from various real-life sources (RDI projects, work, discussions in a café or restaurant on campus) and their scope can be narrow (e.g., a single patient) or broad, lasting several months (e.g., developing a new product or model for working life). Real case studies may arise wherever there is a problem to be solved or an interesting new idea to be refined.

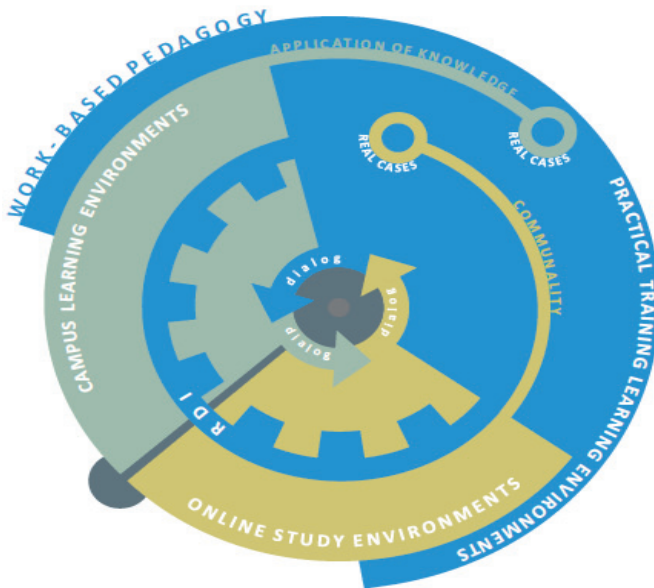


Figure 6. Preliminary model for work-based and pedagogically managed learning environments at Mikkeli University of Applied Sciences

Conclusions

As mentioned at the beginning of this article, “*In theory there is a difference between theory and practice. But, in practice, there is not.*” (Modified from Snepscheut). The following are some brief ideas for further development of the preliminary model in order to eliminate the difference between theory and practice.

Mamk aims to be the university for students and the collaborative community where competent motivated staff are a key success factor in creating an innovative way to develop the expertise, viability and wellbeing of its region (Mamk 2013). The ideas and model described in this article could be discussed and further developed collaboratively for the basic processes (learning, RDI, service production) in management and leadership with partners from external organizations and when reforming learning and working environments. In education, the model can be used in many ways: when revamping curricula and when completing modules and credits together with students. The effect of e-learning on campus functions and structures should be considered and discussed more precisely in further work.

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2

KNOWLEDGE TRANSFER BASED ON COMPARABILITY OF RUSSIAN AND FOREIGN MASTER DOUBLE DEGREE PROGRAMS

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Abstract

This research has been conducted on the basis of the author's personal working experience and previous publications in Russian and international journals.

Double degree programs are an increasingly important global trend. In the context of the modernization of Russian higher education, solving the problem of high-quality training of specialists capable of competing successfully on the labor market, as well as the successful integration of Russia into the international educational space, the problem of developing double degree educational programs in Russia is becoming increasingly important. In the early stages of joining the Bologna process, Master's programs in Russia mainly took into account narrow specialization, but as universities aim to prepare professionals in interdisciplinary areas, they are becoming more focused on questions of the international labor market. In this regard, the question of comparability between programs provided by foreign and domestic universities is becoming very important.

The question of finding effective mechanisms to ensure the quality of education and the criteria for its evaluation occurs in the context of the comparability of both international and educational programs of the various institutions of higher education in Russia. Comparability provides the appropriate course content, the number of academic hours devoted to class and independent student work, and similar assessment systems in Russian and foreign universities. When curricula are comparable, students have the opportunity to attend the most interesting and popular courses in various Russian and foreign universities in accordance with the qualifications they receive. This condition implies a significant increase in students' academic mobility.

1 Introduction

Russia joined the process of creating a European area of education at a time when Europe had accumulated nearly five decades of experience of cooperation in this field. That is why our country is of particular interest today in the education integration process, considering milestones and driving forces for selecting the principles and methods of implementation for establishing the regulatory framework and tools, success factors, and the basic laws of reform.

More double degree programs have been created at European universities in recent years due to increased support from the European educational community. Compliance with the basic objectives of the Bologna process (comparable degrees and programs, a multi-level system of education, academic mobility, quality, recognition of diplomas, competitiveness, and attractiveness of education) made the idea of creating double or joint degrees one of the priorities of the European educational policy. It also provided a notable impetus for their development in Europe in recent years.

Although Russia provides free education for all its citizens as guaranteed by the Constitution, admittance into post-secondary higher education institutions is extremely competitive. Because the Russian governmental sector is responsible for regulating the educational system, it places strong emphasis on earning degrees in technologi-

cal and scientific fields of study, and students wishing to major in these fields require exceptional talent for this study area, as well as excellent grades, in order to be accepted into a Russian university.

Russia is currently in the process of switching its traditional higher education degree model to one that is much more compatible with Western-type academic degrees. In 2003, Russia signed the Bologna Declaration, which paved the way for the government to enact a law that removed its old, five-year degree model to one that resembles the Western degree system – the four-year Bachelor's degree followed by a Master's degree.

More and more universities worldwide are implementing joint and double degree programs in an effort to internationalize their campuses, increase global visibility, and foster greater collaboration with partner institutions. The growth of joint and double degree programs indicates that higher education institutions are increasingly seeking deeper partnerships with their international counterparts than those offered by traditional study abroad programs.

2 Internationalization of Education

One of the possibilities for a young person to achieve their desired success in a future career, maybe in a multinational company or an international project, is to get an education or to complete training in a foreign country. The number of students enrolled to study at foreign schools has grown intensively since 1975. This can be explained by the increasing interest in the development of academic, cultural, social, and political ties between the two countries. Internationalization of the labor market for highly qualified specialists gives them the opportunity to take advantage of educational services in their own countries and abroad. In absolute terms, the number of students in tertiary education abroad has grown worldwide, almost doubling since 2000 (Fig. 1).

Enhancing student mobility has become a top priority for countries around the world, stimulating a global conversation about best practices, trends, and future plans. While traditional study abroad programs or direct enrollment in foreign institutions remain by far the predominant option for students wishing to gain international experience, more higher education institutions are seeking ways to firmly embed international experience in their study programs. Often this goes hand-in-hand with a greater effort to offer more reliable mobility frameworks and to reduce perceived mobility risks such as credit transfer problems or a prolonged time to graduation.

While joint and double degree programs largely evolved in Europe, the interest in curriculum cooperation and collaborative study programs has since spread to all regions of the world. A growing number of higher education institutions, governments, and funding agencies worldwide have engaged in developing their respective strategies and policies with regard to joint and double degree programs.

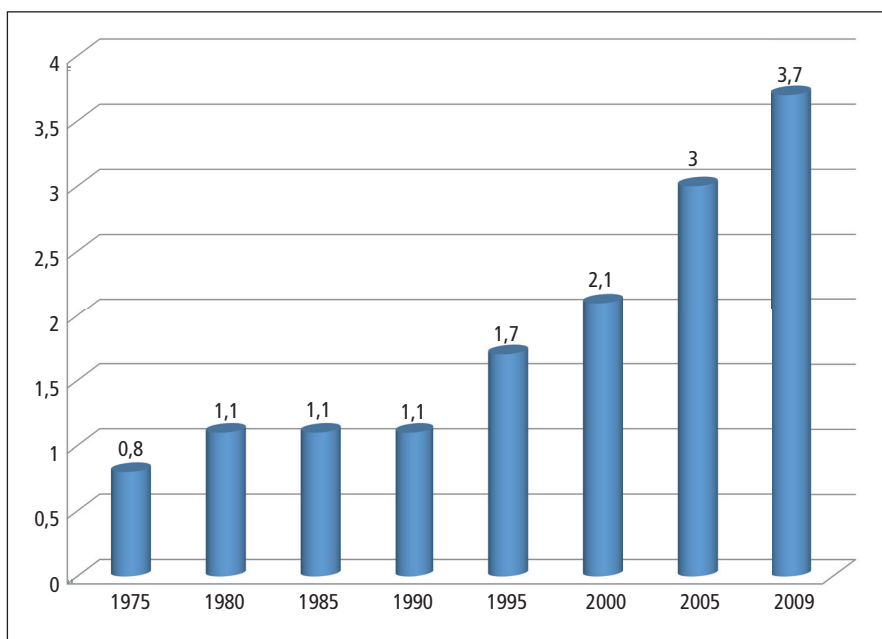


Figure 1. Increasing internationalization in tertiary education 1975-2009 (mln)
(Source: OECD and UNESCO Institute of Statistics)

2.1 Terminology

The term “joint” or “double” degree may be used in variations in different contexts or different countries. Sometimes these terms refer to programs that combine degrees in two academic disciplines yet are carried out entirely within one and the same higher education institution. Though efforts are made by a number of higher education institutions to provide clear definitions of collaborative degree programs, they typically still show some variation.

2.1.1 International joint degree programs

International joint degree programs are study programs collaboratively offered by two (or more) higher education institutions located in different countries. They typically feature a jointly developed and integrated curriculum and agreed credit recognition. Students typically study at the two (or more) partnering higher education institutions (i.e., a home institution + one institution abroad). Upon completion of the study program, students are awarded a single degree certificate issued and signed jointly by all of the institutions involved in the program (IIE, 2011).

2.1.2 International double degree programs

International double degree programs are study programs collaboratively offered by two (or more) higher education institutions located in different countries. They

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2.2 European-russian collaborative double degrees

Universities and university colleges are increasingly looking beyond their own campuses to keep pace with a rapidly globalizing world, according to a study published in 2010, which focused on the double degree programs between universities in Russia and countries of the European Union. The study showed that there are currently 238 double degree programs at 73 universities in Russia, conducted with the participation of European universities in the field of higher education. The greatest number of universities implementing double degree programs with European partners were concentrated in the Central (24 universities, 33% of the total) and Northwestern (16 universities, 22%) Federal Districts (Tempus, 2010).

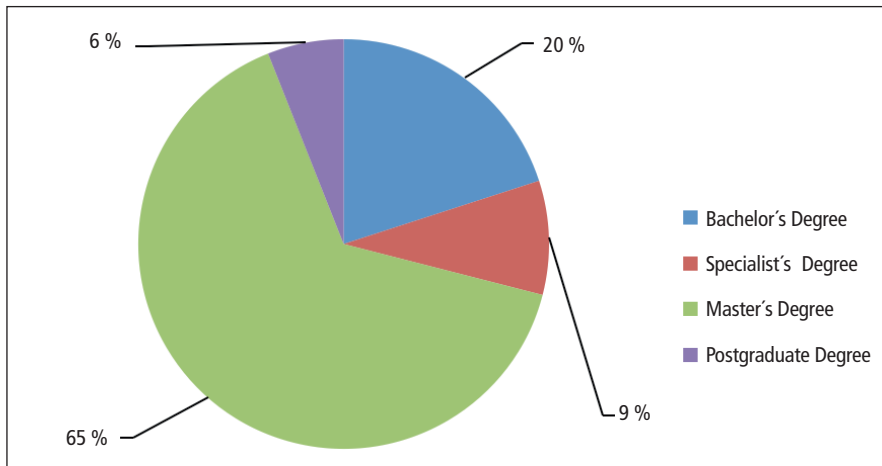


Figure 2. Distribution of double degree programs by level of education (Tempus, 2010)

As expected, the bulk of double degree programs (65%) are in Master's programs, as well as in Europe, which is understandable: it is the level that is most academically free from formalities. 9% of students trained in a Specialist's Degree (5 year program) associated with Bachelor's Degree at a European university. The smallest proportion (6%) are double degree programs at the postgraduate level, which is also understandable: postgraduate and PhD levels do not match (Fig. 2).

In terms of the number of agreements establishing double degree diplomas with Russian universities, French universities are the absolute leaders with 89 programs. This exceeds the result of their nearest "competitor", Germany, by more than 50% (Germany has 53 programs). The United Kingdom ranks third with 40 double degree programs. Finnish universities are also actively involved in projects of inter-university cooperation with Russia. There are currently 22 double degree programs (mainly with universities from the Northwestern Federal District in Russia) (Fig. 3).

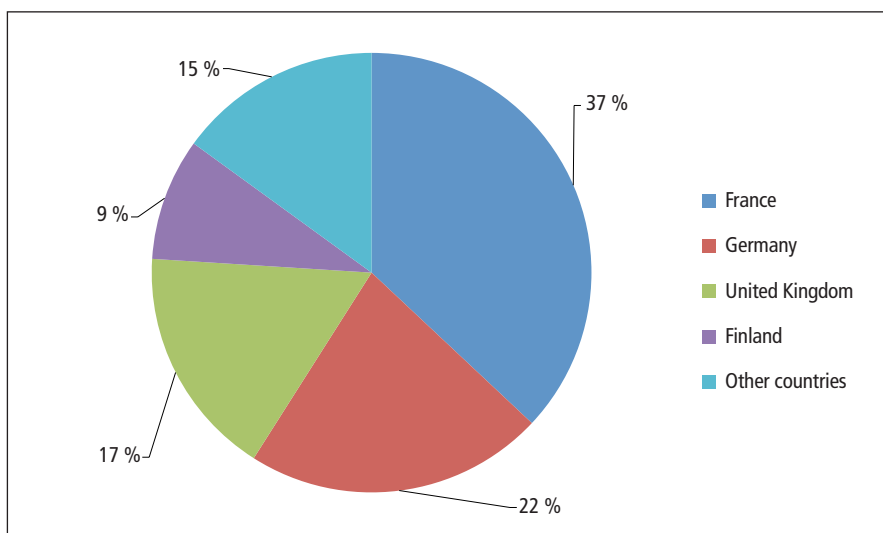


Figure 3. European countries lead in the number of ongoing double degree programs with Russia (Tempus, 2010)

The results of the study (Fig. 4) show that business and economic fields and subjects represent a significant proportion of all programs offered and directed. These fields account for 45% of the 238 double degree programs identified, which corresponds to the situation in Europe. Such interest in double degree programs in the field of economics and management could probably be explained by the fact that in the 1990s, when those programs were created, they were very “exotic” for Russian scientific knowledge. Moreover, among the managerial and economic specialties, the highlights are management, economics, and international management.

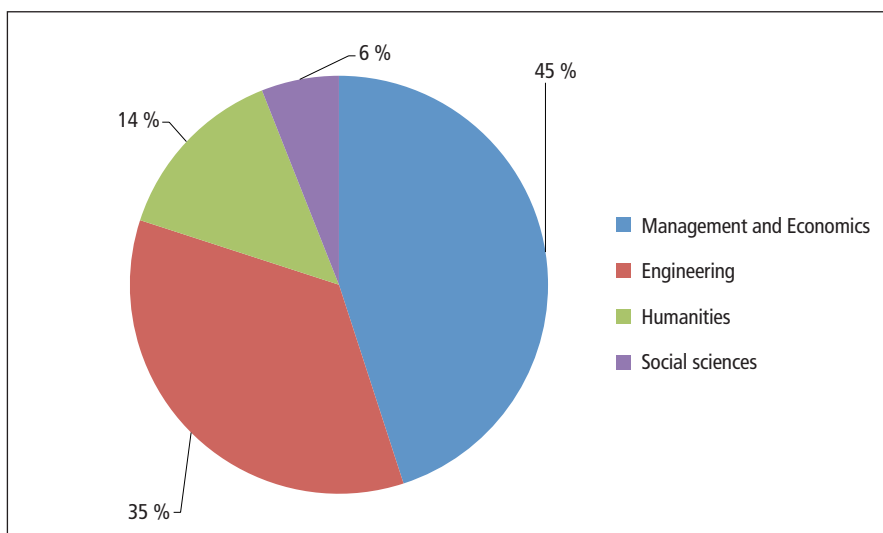


Figure 4. Distribution of double degree programs by areas of specialization (Tempus, 2010)

The same picture can be observed worldwide. A study entitled *Joint and Double Degree Programs in the Global Context*, conducted by the Institute for International Education (IIE), found that double degrees are far more common than joint degrees, with 84% of respondent universities offering double degrees and only 33% offering joint degrees. Most of the programs are taken at the Master's level, except for universities in Australia and the US, which offered joint and double degrees mostly at the doctoral and undergraduate levels respectively. The most common subject was business management followed by engineering. Social sciences, physical sciences, and life sciences were also top choices (IIE, 2011).

3 Problems in comparability

In all the basic documents of the Bologna Process the main vector of development for higher education programs, including programs for double and joint degrees, was defined as “*the harmonization of their architecture*” (Bologna and Sorbonne Declaration) by all countries through three cycles of higher education (Bachelor – Master – Doctor).

Basic requirements for the qualifications of the three cycles are formulated in the Dublin Descriptors and the European Qualifications Framework (EQF, Dublin Descriptors, 2004).

There is still no specific Russian legislation relating to the development of international training programs. The concepts themselves (“joint educational program”, “double degree program”, “validation”, “franchising in education”) are not defined in the law. This presents many difficulties and problems. On the one hand, this is not an obstacle to the development of double degree programs. On the other hand, participants act in accordance with national legal rules governing the awarding of diplomas and qualifications, and try to meet the requirements of both countries.

Implementing the Russian Federation's current legislation on double degree programs is the most complex area, causing Russian and foreign universities many difficulties. Specificity of double degree programs with Russian universities could relate to the following:

- Features of their occurrence (could be continued cooperation in the framework of international programs, franchising, validation)
- Features of the Russian educational system and possibilities of degrees recognition
- Lack of funding for double degree programs
- The problem of comparability of learning and living conditions for foreign students
- Language problems

3.1 Duration of study programs

According to the most recent Russian law “*On Education in the Russian Federation*” and the third generation of State Federal Educational Standards for Higher Professional Education, the duration of Master's programs must be two years (FZ-273,

Table 1. Duration of study programs in tourism and hospitality in selected European countries (Kushcheva, 2011)

Country	Duration of study programs*
France	3 + 1
Switzerland	3 + 1
Great Britain	3 + 1
Finland	3 + 2
Norway	3 + 2
Germany	3 + 2
Russia	4 + 2
Greece	4 + 2
Spain	4 + 2

* Number of study years for Bachelor's (first number) and Master's (second number) programs

2013). If the duration of Bachelor's education in Russia is four years, the foreign students who are studying in double degree programs need to "complete their education" before this date. This is not usually a big problem. Another situation is with the implementation of Master's programs. The recommended duration of Master's programs in the U.S. and Europe is usually four semesters, i.e., two years. However, it is important to note that this is only a recommendation. There are also Master's programs that take one year or 1.5 years. For example, in the field of tourism and hospitality, there is a wide range of different study durations in Europe (Table 1).

Three-year Bachelor's degrees, which are very popular in Europe for the tourism and hospitality industry, are not accepted in Russia. This fact makes nostrification of the European diploma almost impossible, and therefore creates difficulties for applicants to access Master's level education in Russia.

Of course, such a difference in the duration of study programs in partner countries seriously complicates the preparation of double degree programs. The third generation of State Federal Educational Standards provides extensive opportunities for the creation of double degree Master's programs. An educational curriculum consists of two educational cycles (scientific parts 20–30 ECTS and professional parts 30–40 ECTS), training of 52–62 ECTS and a thesis process worth 3 ECTS. Each educational cycle has basic and optional parts. In accordance with those standards, up to 70% of ECTS are related to optional courses ("variantivnaya chast"), which provides university with an opportunity to accept courses completed at other universities (including abroad) (FGOS VPO, 2009).

3.2 Scope of study programs

It is also necessary to pay attention to the differences in the scope of study programs of Russian and European higher educational institutions in Master's programs. The number of modules in Russian Master's programs is typically 1.5–2 times more than the number of modules in foreign programs. It is connected with the idea of a "fundamental" education, which is still present in Russian education. In different

European countries, Master's programs require 60–120 ECTS. In Russia, according to FGOS VPO, a Master's program must be 120 ECTS (FGOS VPO, 2009). Therefore, double degree Master's programs could be introduced only in partner countries with the same scope of study programs.

3.3 Students' workload

In estimating students' workload, institutions consider the total time needed by students in order to achieve the desired learning outcomes. By completing a course, seminar, or module a student is awarded ECTS credits. Every ECTS credit therefore represents a certain amount of work. Depending on the country, one ECTS credit equals between 25 and 30 working hours (Table 2).

There are many factors that partner universities could take into consideration to estimate students' workload in various activities. For example, they could assess the entry level of students for whom the program (or its components) is designed, the approach to teaching and learning and the learning environment (e.g., seminars with small groups of students, or lectures with very large numbers of students), and the type of facilities available (e.g., language laboratory, multimedia room).

Table 2. Workload per ECTS in selected European countries (compiled by the author)

Country	Workload per 1 ECTS, working hours
Netherlands	28
Austria	25
Hungary	30
Finland	27
Belgium	30
Germany	30
Russia	36
Spain	25

There are substantial differences in the practical part of study programs. The number of contact hours in many European universities is determined by the teacher and can be 1–12 hours of classes. All other hours are devoted to independent work, individually or in groups. This work is the main assessment factor for the subject. In Russia, the ratio is usually the opposite – only a quarter of the time allocation accounts for workshops and individual student research.

3.4 Credit transfer

The European Credit Transfer System operates by sharing a guest list of subjects studied between local and foreign educational institutions and vice versa. According to Russian educational standards, universities must follow the same names of disciplines that are mentioned in the basic educational cycle. This means that disciplines

from other universities with names that do not correspond to Russian ones cannot be accepted. However, previously studied disciplines could be accepted after examination (FGOS VPO, 2009).

Each course that students complete in a partner university can be recorded on the list of disciplines studied, not only in the ECTS system but also on the scale of the local institution of higher education, and possibly in a scale compatible with the ECTS scale of assessment, with the same quantitative and qualitative characteristics. The combination of points and credits in the ECTS system could help students to transfer credits to their home institutions.

The guest list of disciplines represented by foreign higher education institutions after the return of students following a period of study abroad is a key document for the full recognition of student learning and credit transfer in the ECTS system and confirms training abroad for future employers.

3.5 Language

Integrating an international dimension in curricula highlights the importance of languages. On the one hand, proficiency in English is a de facto part of any internationalization strategy for learners, teachers, and institutions with courses in English (especially at Master's level) as part of their strategy to attract talent that would otherwise not come to Europe. On the other hand, multilingualism is a significant European asset: it is highly valued by international students and should be encouraged in teaching and research throughout the higher education curriculum.

In the final report of the European Union's ENPI Program for Russia, *Analysis of Double Degree programs between EU and Russian HEIs*, published in 2010, double degree programs were shown to have many benefits. It was mentioned that, "Any work carried out in partnership with someone, is originally organized as a highly efficient system for professional development of teachers and university staff" (ENPI, 2010). Teachers involved in the double degree process noted that, during the years of joint work, they had managed to build up powerful teaching and research potential. Teachers participating in a double degree create a very different educational environment, where there is a constant exchange of information and analysis of literature, adaptation of training materials, and a constant informal process of mutual learning. Therefore, teachers consider double degree programs to be laboratories for teachers.

This process is rather complex and not everything can be done quickly. Nevertheless, representatives of all successful partnerships emphasize the fact that teachers and researchers were trained intensively and regarded this as one of the major achievements of joint projects (ENPI, 2010).

In order to fulfil their potential to successfully integrate in their host country, mobile students, researchers, and teaching staff need specific support for language learning, including the opportunity to learn the local language(s), whether or not this is the language of the study course or research group.

4 DISCUSSION AND CONCLUSIONS

Popular today, the term “knowledge economy” makes sense where education is a serious research foundation. Internationalization of higher education today is not a choice but a necessary condition for the development of universities.

Russian and European Master’s programs are multidisciplinary, cross-cultural programs, which usually focused on questions of Russian and European politics, society, culture, and language. Graduates can further specialize in EU-Russian relations with a special reference to Europe or aspects of Russian society, or Russian language and culture.

One of the main results of double degree programs is the stable implementation of educational programs in accordance with the European understanding of the level and scope of academic quality. New skills and knowledge are passed on to Russian students and the audience – one of the most important results of double degree programs. Introduction of new educational technologies and creation conditions for practical application of students’ knowledge and skills is an effective means of professional and personal adaptation that ultimately gives students the freedom of resources worldwide.

The Russian education system is taking large and complex steps in the development of education, globalization, and internationalization. In order to make this transition, however, it is necessary to understand the problems that we face. Over 70% of universities with double degree programs indicate that the main driving factor for them was increasing the competitiveness of students. Universities participating in double degree programs not only solve problems in the international space, but also provide graduates with new career opportunities in the international labor market.

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3

EVIDENCE-BASED PRACTICE AND CLINICAL DECISION-MAKING USING SIMULATION PEDAGOGY

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Abstract

Working life is changing and nurses require new skills, such as using research evidence on decisions that concern nursing practices. In Finland, the nursing curriculum has been competence-based for a number of years, but in 2013 it was necessary to re-evaluate nursing competences. This work has been organized nationally. Simulations nowadays play a major role in nursing education. New patient simulators have also been developed. Simulations can have different goals and decision-making is one of the most important nursing skills in practice, so simulations often have goals that develop these skills. This article describes how evidence-based decision-making should be taught using simulation pedagogy at Mikkeli University of Applied Sciences. The article also describes the background of the pedagogy, the different learning theories, and the theoretical basis of the metacognitive skills that are needed in decision-making.

Introduction

Changes in working life and in the health of the population, as well as a division of duties and expanded job descriptions, require nurses to possess new job skills that must be acquired during nursing education and training. Nursing education has used a competence-based curriculum for some years (Korhonen 2013), and Arene has also defined the generic competencies for Bachelor's level. (Arene 2010, 7-8). One of the most important competencies that nursing students have to acquire during their education is an ability to use research evidence and independent decision-making skills (Ministry of Education 2006), such as how to determine customer and patient needs, set goals for nursing and care, choose treatments, and evaluate the outcomes of the treatments. The best possible information will guide this decision-making. (Ministry of Social Affairs and Health 2012). The Health Care Act (1326 /2010) that entered into force in May 2011 requires health care to be based on evidence, good management, and good operating practices. (<http://www.finlex.fi/>).

In 2013, there was a national reform to redescribe these competences. The Finnish Nurses Association and the Helsinki Metropolia University of Applied Sciences launched a project entitled *the Future of Nursing Education* in 2011, the purpose of which was to re-evaluate nurses' knowledge requirements in Finland and standardize the curriculum content by establishing national minimum standards of general nursing knowledge. In 2013, all universities of applied sciences participated in formulating areas of competence level descriptors (EQF 6), which can then be used in curriculum development. (Eriksson et al 2013). One of the minimum standards is evidence-based decision-making skills that must be achieved during nursing education.

In Finland, healthcare and educational institutions became much more aware of evidence-based decision-making in nursing when the Finnish Centre for Evidence-Based Health Care became an Affiliated Centre of the Joanna Briggs Institute in 2010. Mikkeli University of Applied Sciences is a co-partner of this centre in Finland. The other co-partners are the University of Eastern Finland, the Department of Health and Social Management, the National Institute of Health and Welfare, and Kuopio University Hospital. The centre also has six affiliated partners. These organizations

are important for implementing evidence-based knowledge in the form of systematic reviews and clinical practice guidelines in health care practice. (<http://www.hotus.fi/>).

The Ministry of Social Affairs and Health (2012) has made proposals on how to develop evidence-based decision-making skills during nursing education. These are understanding evidence-based nursing and what it means in clinical practice, research evidence, treatment recommendations, the identification of best practices, and the utilization of best practices in nursing decision-making. According to the Ministry, the universities of applied sciences should ensure that nursing students gain the skills of implementing evidence-based practice. This means that students must know reliable databases, understand research, and know how to search for reliable research using the databases. Nursing students also need to understand nurses' role in evidence-based practices and how to combine and use different types of knowledge in decision-making. One way to practice evidence-based decision-making skills is using simulations. Multiprofessional groups are needed to practice team-working with different health care students, and in Savonlinna, such simulations have been used since 2012.

Simulations have been used as a teaching method for several decades. Armies have used them in their training since the Second World War. In health care education, simulation-based learning was first adopted in medical education as an effective method for learning in life-threatening situations. In nursing education, simulations have been used for a hundred years. The first patient simulator was The Resusci Anne, which is still used for practicing resuscitation. At the turn of the 21st century, simulation-based learning was introduced in nursing education. (Poikela 2012, 30-32.)

A Finnish patient safety strategy known as “Promoting Patient Safety Together for 2009–2013” pointed out that patient safety must be taken into account in health care research and education. This meant that new teaching strategies and pedagogical solutions were also required in nursing education. One of the predominant technology-based tools is a high-fidelity human patient simulator. This simulator can speak, breathe, and even perspire. Using this simulator, students can learn pathophysiological principles, responses to medications, changes in health status, and responses to interventions (Parker & Myrick 2009).

Scenario-based sessions are an effective tool designed to incorporate realistic clinical situations in a safe environment. The simulation environment can also be used without simulators. Student nurses can simulate different nursing situations with different learning outcomes. In health care, vocational skills have changed. Settings have become more technical and the need for quick decision-making based on evidence has increased (Poikela & Poikela 2012, 10).

It is important to discuss the background of this pedagogy. The educational philosophies of social-constructivism and experiential learning are the biggest contributors to simulations. This discussion is required to ensure that the potential benefits of human patient simulation in nursing education have been maximized. (Parker & Myrick 2009.)

Evidence-based decision-making in nursing

Evidence-based practice (EBP) is defined as “the conscientious use of current best evidence in making decisions about patient care”. EBP is defined also as “a lifelong problem-solving approach to clinical practice” (e.g., Melnyk & Fineout-Overholt 2011). Dr. David Sackett was the first person to define EBP in medicine, but very soon it expanded into other fields of health care, including into nursing. The difference between evidence-based medicine (EBM) and evidence-based nursing (EBN) is said to be that nurses are committed to providing holistic care, and treatment is only one part of the clinical decision-making process. However, the main goal of EBP (EBN) is “to promote effective nursing interventions, efficient care, and improved outcomes for patients, and to provide the best available evidence for clinical decision making”. (e.g., Newhouse et al. 2007).

Clinical decision-making consists of three different resources that are the best research evidence, clinical experience, and patients’ or clients’ needs, preferences, and values. (Burns & Grove 2011, Craig & Smyth, 2012, Melnyk & Fineout-Overholt 2011). The clinical experience consists of the nurse’s clinical skills and experience to identify and treat individual patients. Patients’ values and preferences consist of their personal concerns, expectations, cultural background, and personal characteristics. Research evidence consists of methodologically high quality clinical trials. (Figure 1)

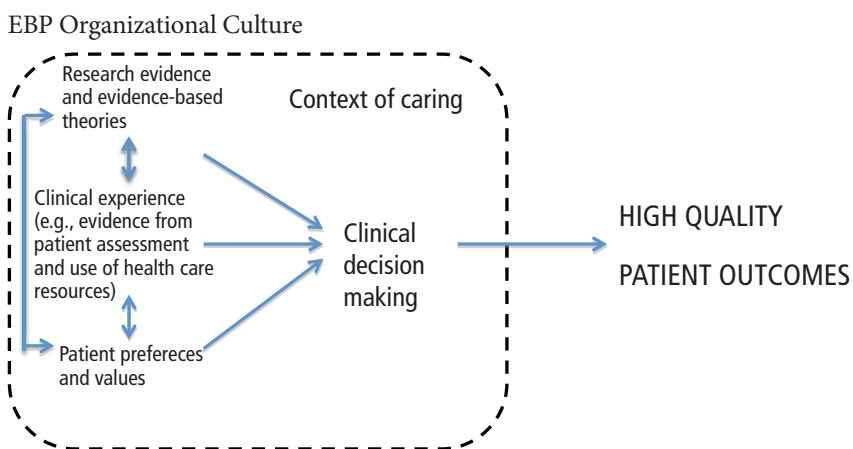


Figure 1 Clinical decision-making (Melnyk & Fineout-Overholt 2011)

Searching for and applying evidence into clinical practice includes at least four different stages (e.g., Ilic 2009). Melnyk and Fineout-Overholt (2011, also Melnyk et al 2010) describe a seven-step model, which is shown in Figure 2



Figure 2. Seven-step model of searching for and applying evidence (Melnyk et al 2010, Melnyk & Fineout-Overholt 2011)

Step 0 requires that nursing practice is examined in a new way. It must be evaluated whether care derives from high-quality, up-to-date information and evidence, such as wound care and catheterization, or whether nurses treat patients using general practices and routines. In step 0, nurses are encouraged to ask which of their practices are currently evidence-based and which of them are not supported by evidence. (Melnyk et al 2009)

In step 1, clinical questions are formulated using the PICOT model (P = patient or population of interest, I = intervention or area of interest, C = comparison group or interest, O = outcome, T = time). All of the areas can be used, or a subsection of them depending on the information desired. For example, it may be necessary to evaluate the effect of the treatment or the patient's experience of treatment. In step 2, information must be searched for using reliable databases and in step 3 the information must be critically appraised. (Melnyk et al 2010) When appraising research evidence, it is necessary to pay attention to whether the research is of sufficient quality and whether the results apply to the specific patient or client. (ICN 2012)

As scientific knowledge alone is not sufficient evidence for proof, it is associated in step 4 with the patient or client's values, needs, and preferences, as well as the nurse's clinical experience of how this knowledge can be applied to treat the patient. (Melnyk et al 2010) For example, if the research evidence shows that hormone therapy can reduce the symptoms of menopause but there is a risk of getting breast cancer, the patient may prefer to make lifestyle changes, for which the research evidence is not as strong. By demonstrating decision-making based on the underlying data, the nurse will be able to justify the proposed treatment, but the final decision is formed together with the patient or client. (Craig & Smyth, 2011) The effect of treatment

can be assessed in step 5. If the treatment proves to be in the best of evidence, it is also important to share these best practices with others (step 6) (Melnik & Fineout-Overholt 2011)

In order for evidence-based practice to become a permanent practice, it is important that nursing students can practice these various steps in their training period (or in simulation). When searching for information on how EBP is taught at different universities of applied sciences in Finland (based on the websites of different universities), it seems that EBP teaching is mostly integrated into theoretical studies (e.g., nursing, information retrieval, research methods). EBP teaching content has been described in curricula and courses in the following terms: the student "knows how to apply evidence-based information", "knows the evidence-based nursing process", "is able to justify her/his decisions on research", "is able to make evidence-based decisions", "is able to assess changes in the patient's condition", "based on research data", "is able to critically evaluate research data and its applicability". EBP learning is most commonly integrated into studies on seeking information, which take place immediately at the beginning of the studies.

In other countries, EBP teaching is designed differently. For example, Emanuel et al (2011) argue that EBP learning should not be merely theoretical, but that it should be a factor in practical actions. Thus, the curriculum must be connected with practice. According to Emanuel and others, this requires guidance and practical co-operation between the practical training fields. Universities should encourage students to use evidence-based practice principles during practical training.

The article by Ross et al (2009) describes how learning EBP is divided into different academic years under eight different themes. In the first year, students study the basic concepts of EBP, practice formulating clinical questions (PICO), seek research evidence, and appraise the evidence. The students study in teams so that they also learn teamwork skills. In the second year, EBP learning is integrated into the different courses, such as the Acute Care module. Students practice clinical decision-making through examples (case studies), and they also evaluate current practices in relation to recommendations, such as changing wound dressings. In the third year, EBP learning activities are integrated into advanced clinical studies, where students practice solving clinical issues. Each task includes a written and/or oral presentation in which other students can participate, along with nurses.

In the articles of Kim et al (2009), Oh et al (2009) and Kruszewski et al (2009), EBP teaching was integrated into clinical training. Kim et al (2009) tested an interactive method of teaching: students practiced searching for research focusing on the clinical question. Oh and others (2009) also studied EBP learning activities integrated into clinical training, where students were searching for evidence for a certain clinical question. The results show that students are encouraged to search for and apply evidence-based knowledge in practice. In the study conducted by Kruszewski et al (2009), students sought research evidence for a clinical question together with nurses who were working on wards. The results show that both students and nurses were happy to learn EBP in this the way.

In summary, it is necessary to divide the evidence-based decision-making (EBP) curriculum into different academic years, using at least the four-step model (e.g., Melnik

et al 2010, Melnyk & Fineout-Overholt 2011). Theoretical learning should include steps 1 to 3, and clinical learning should include step 4. Studying EBP in different semesters brings continuity, especially if it is integrated into the different courses and clinical training. It would be good, however, if the EBP was one study course, to which the other courses are integrated. The final thesis could be the last and most extensive literary search of EBP, where students demonstrate their readiness to search for and appraise evidence-based information for a clinical question from nursing practice (step 1). Steps 4, 5, and 6 would remain either in-depth clinical training within the department where students work when they graduate.

Learning theories and simulation pedagogy

Cognitive learning theory means teaching methods that help students to create knowledge structures and reorganize existing knowledge. Information-processing processes form a whole and, in learners' minds, mental wholes can be constructed. Simulations can create the opportunity to do this. (Poikela, 2012, 35.) Case studies help students to construct mental models, which can be transferred into new situations.

Constructivism emphasises the premise that by reflecting our experiences we construct our own understanding. Each of us generates our own "rules" and "mental models", which we use to make sense of our experiences. Social constructivism (Gergen 1997) argues that the learner must be encouraged to perceive knowledge formation as connected to culture and earlier knowledge. Simulations are always carried out in groups. This means that the information schema in students' minds will be constructed socially. (Poikela 2012, 35.) Parker & Myrick (2009) pointed out in their article that the Tyler model of behaviorism still has a role to play in psychomotor clinical skill acquisition and learning in the sciences. Behaviorist-based guidelines include repetition, classroom supplementation, and modular learning. Immediate feedback and reinforcement to change behavior are also needed. Constructivist-based simulations differ from behaviorism-based simulations in such a way that knowledge is created by learners or groups by processing experiences and interactions with their environment. Constructivist-based simulation is more valuable in developing clinical judgment skills, problem-solving, collaboration, and group process.

Kolb (1984), with his "Experiential learning cycle", argues that the learning process consists of multiple steps. This theory is action-based. "Concrete Experience" is the "doing" component, which derives from the content. It is the starting point and also the result of learning. The "Reflective Observation" element may include feedback, peer observation, and discussions with mentors or participants. "Abstract Conceptualization" (learning from the experience) and "Reflection" bring together theories and the analysis of past action. These steps can easily be found in simulations. Reflection is related to every stage and produces learning for the simulation. Reflection begins when students prepare for the simulation. During the simulation, learners reflect on their action and they can also correct actions. After the simulation, they have a debriefing session together with the rest of the students. (Poikela & Poikela 2012, 14–25.)

Knowledge can be divided into theoretical and practical knowledge. This dualistic conception of knowledge originates in Cartesian philosophy. This philosophy separates theory from practice, the mind from the body, thinking from doing, and abstract from concrete. Education has traditionally been organized according to this traditional epistemological view. However, as Poikela argues, it is not necessary to distinguish knowledge and practice in this traditional way. The three-dimensional conception of knowledge (theory, practice, and experience) can produce experiential knowledge. (Poikela 2012, 19–20.) Simulation pedagogy demonstrates how this three-dimensional idea of knowledge is available.

One important background for simulations is to understand the concept of metacognition. Novak & Gowin (1996) has defined it as “cognition about cognition”. Brown (1978) and Flavell (1971) describe metacognition as “knowing to know”. Flavell (1985) has used also the concept of metacognitive experience and pointed to it when becoming an expert and a skillful practitioner.

Flavell (1971,1985), Brown (1978), and Hacker (1998) pointed to the consciousness of our own cognitive processes, which consist of predicting, planning, controlling, monitoring, and evaluating. Students also need coping systems for their own cognitive processes. These are self-regulation, feedback, and monitoring skills for their own experience of learning. Metacognitive experiences help students to monitor their learning processes and develop metacognitive skills. Metacognitive knowledge consists of different knowledge. Knowledge of oneself combines self-management, effects, motivation, and personal resources. Knowledge of tasks is also needed, such as task requirements, resources, and problems. Knowledge of suitable learning strategies helps students to understand and transfer knowledge to new situations. Knowledge of learning outcomes and of the schedule is also needed. (Flavell 1985.) In simulations, all of these elements are important to ensure learning.

Flavell (1971, 1978) has used the concept of metacognitive activities, which is necessary for successful problem-solving. Metacognitive activities can be described by six categories: orientation, planning, executing, monitoring, evaluating, and reflecting (Meijer, Veenman & van Hout-Wolters 2006). In simulations and in problem-solving, all of these elements are needed.

Decision-making and simulation pedagogy in practice

The background of multiprofessional education comes from some concepts described by Nicolescu. Transdisciplinarity means working between, across, and beyond disciplines to discover unifying frameworks. The purpose is to understand the case by combining knowledge from different fields. Interdisciplinarity means transferring methods from one discipline to another. Multidisciplinarity means working together. Collaborative working is not as extensive as interdisciplinary working. Usually, these concepts are used to talk about research. However, Nicolescu (1994, 1998) pointed out that these orientations are needed to generate new ideas and develop creativity, also when solving complex problems. Simulations requiring knowledge from different fields can help in preparing a collaborative practice and health workforce that is better prepared to respond to health needs. The WHO has also pointed out that collaborative practice improves health. (WHO 2010, 7.) Ponzer and Castren (2013)

also agree on these ideas in their new book. They have highlighted communication between different health care students. This is important for patient safety. Situations can arise in working life in which a patient will be transferred to another unit or receive treatment from other professionals.

When using simulation pedagogy, the first step is to define learning outcomes and make a case. If students are using the simulation environment for the first time, they must familiarize themselves with the technology and tools used. This is especially important when working with a high-fidelity human patient simulator. This type of simulator needs its own room so teachers can guide the simulator and speak as a patient. In a separate room, there is a simulation environment and there is a third room for the rest of the group and for the debriefing session.

When students receive a case study (or scenario), they assign roles and plan how to solve the case. The rest of the students are in the other room and they can follow the simulation. They can also receive some instruction for perceptions that help them to evaluate the simulation, such as how students make decisions or how they work together.

After the simulation, all of the students are together for a debriefing session. Students who were involved in the simulation describe their opinions on what went well and what must be corrected. Students analyze the situation together. The teacher can ask questions to help the discussion progress. The discussion is critical and reflective. It is important that students receive feedback from the experience to make sure that their learning goals were reached. A climate of trust and an encouraging atmosphere among participants are crucially important in achieving a successful simulation outcome.

In summary, working life is changing and nurses' job descriptions are expanding. This requires nurses to have new skills, such as independent decision-making skills. Evidence-based practice also requires the best possible information to guide decision-making concerning patient care. To learn the skills of decision-making in practice requires new pedagogy and applications of simulation pedagogy into learning situations. Simulations are case studies from real nursing practice and the outcomes can be transferred easily to nursing students' practical periods. The complex problems of nursing practice need multiprofessional simulations.

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PART 2

PEDAGOGICAL RESEARCH AT MIKKELI AND KYMENLAAKSO UNIVERSITIES OF APPLIED SCIENCES

4

KYMENLAAKSO UNIVERSITY OF APPLIED SCIENCES (Kyamk) AS AN INNOVATIVE LEARNING COMMUNITY

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Abstract

As part of the Finnish innovation system, universities of applied sciences provide high-quality education leading to bachelor's and master's degrees, holders of which are and will be essential to the future competitiveness of Finland. Pedagogical innovations can be regarded as a means to improve the quality of teaching and learning in higher education, and thus may foster greater competence-building among students. A recent study (Wass 2012) examined Kymenlaakso University of Applied Sciences (Kyamk) as an innovative learning community. Seven innovative learning community characteristics composed by Hokkanen (2001) were used as a framework for this study, together with the concepts of knowledge management, innovative organizations and organization renewal capability. The objective of the study was to examine to which extent the teachers of Kyamk perceived the innovative learning community characteristics as being realized in their organization and how each of the characteristics could be promoted in the organization. The data were gathered by interviewing ten teachers at Kyamk, at the Faculty of Technology and Transport. According to the results, innovation in pedagogical development was allowed by the management, but it was not proactively and strategically led or structured. Teachers experienced pedagogical autonomy while they also expressed a need for more collective and co-operative methods and policies to support them in order for the organization to fully utilize the innovation potential of its multi-professional member groups. As an integral part of the development proposal of promoting a greater innovative learning communality, it was suggested that both the organization's internal and external co-operational networks should be built and maintained with a more long-term perspective.

1 Introduction

Never during their relatively short existence have the Finnish universities of applied sciences had to survive in such a turbulent and uncertain environment. Pressure is building from all existing dimensions and stakeholder groups, ranging from the UAS legislation that is about to be renewed, to the Generation Y students with their 21st century educational expectations. There will be drastic changes in the funding model for the universities of applied sciences. This will coincide with the Government's decision to cut back the number of starting places by a total of 2030, which is a partial cause for the reduction in the number of universities of applied sciences through a series of mergers. Degree programmes have been discontinued and teachers made redundant. Age groups in Finland are growing smaller by the year. At the same time there is widely expressed concern over the long study times among young Finns when the working careers of all Finns should be prolonged considerably. Student groups are becoming more and more heterogeneous as attention is now being paid to educational equality among people of all ages and ethnic groups, regardless of their place of residence, bringing about the need to offer and organize multimodal education, including a variety of online courses.

The above-mentioned challenges have forced all Finnish universities of applied sciences to take action and some have had to rely on drastic measures to ensure their existence. Kyamk will proceed with its plans to merge with Mikkeli University of Applied Sciences by 2017, which both parties committed to as part of the application procedure for new operating licenses in late 2013. As a reaction to the Government's new fund-

ing model, a series of steps were taken at Kyamk in 2013 in order to ensure economically sustainable education in the near future, while attempting not to jeopardize the annual number of students who are to graduate according to plan. The organization of Kyamk was restructured in early 2013: the department-based organization was remoulded into a team organization, now comprising a total of 17 teams divided into four fields of education. This organizational restructuring was immediately followed by the drafting of the new competence-based curricula, which will be implemented from 2014 onwards. In summary, in a very short period of time, Kyamk as an educational organization has undergone major changes.

It could be stated that the only thing to remain relatively unchanged in Finnish universities of applied sciences is the interaction between learners and teachers. In this interaction, there might still be possibilities for innovative thinking and constant pedagogical renewal, no matter how turbulent and uncertain the operational environment may become. Therefore the concept of an innovative learning community was chosen to form the core of a recent study which aimed at examining *the innovative learning community characteristics* held by Kyamk as an organization, and which of these characteristics should be developed further in order for Kyamk to exist and strive for excellence under the constantly building pressure to change.

Hokkanen's innovative learning community framework was created as a summary of a series of extensive Delphi rounds conducted at Jyväskylä University of Applied Sciences' Faculty of Technology and Transport. Hence the same faculty was chosen as the sample for the study at Kyamk. Hokkanen (2001) developed the concept of an innovative learning community as comprising the following seven characteristics:

1. Management
2. Strategic planning
3. Customer orientation
4. Competences and skills of the staff
5. Processes and codes of conduct
6. Partnerships and co-operation in networks
7. Achievements and success

For the purposes of the study, the widely used terms *innovation* and *innovativeness* had to be defined to suit the higher education context. In this definition, innovations include teaching methods and materials, learning environments or equivalent, which are new to the organization and aim to add value to teaching and learning. Innovativeness is defined as the development and implementation of innovations, including those acquired from outside the organization.

In spring 2012, ten teachers from various departments at the Faculty of Technology and Transport participated in semi-structured interviews. The questions for these interviews were loosely formed and stemmed from the seven aforementioned innovative learning community characteristics. The teachers were either senior lecturers or principal lecturers, had completed their pedagogical studies and had worked at Kyamk for between two and 32 years. The interviews were transcribed and analyzed with data-driven content analysis. The summarized findings are shown in Table 1 below and will be discussed in more detail in the following chapters.

Table 1. Summary of findings (Wass 2012.)

Innovative learning community characteristic (Hokkanen 2001)	Present state (Kyamk 2012)	Development proposal (Kyamk 2012)
1) Management	Allowing innovativeness Offering pedagogical autonomy	Support toward co-operation
2) Strategic planning	Lack of big picture Trust as expressed by freedom	Implementing a bottom-up approach in strategic planning
3) Customer-orientation	Multiple customers Established student feedback procedures	Dialogue in developing teaching
4) Competences and skills of the staff	Weak pedagogical leadership Support toward taking initiative in personal development	Utilizing multi-professional competencies
5) Processes and codes of conduct	Bureaucracy Lack of transparency in processes	Agreeing on common procedures
6) Partnerships and co-operation in networks	Informality in networking Necessity of working life contacts	Long-term perspective to developing partnership and co-operation networks
7) Achievements and success	Performance metrics as a means to compare and contrast Teachers isolated from measuring activities	Reacting to measured results

It is to be noted that the data were gathered in 2012, exactly one year before the organizational restructuring of Kyamk was set into motion. Therefore, some of the concerns that have arisen may already have been addressed as teams have been formed and teamwork as the present modus operandi has been implemented widely throughout the organization. For instance, the newly appointed team leaders have been trained and encouraged to reform their teams' educational and co-operational practices in a more creative and innovative direction.

2 Management

According to Hokkanen (2001, 65), in an innovative learning community the role of management is to enable innovativeness by supporting democracy, internal entrepreneurship and collaboration in the organization. In Kyamk, the managerial patterns and attitudes toward pedagogical innovations were described as enabling and reactive, but not proactive or risk-taking. There was a commonly shared perception of a pedagogical autonomy, which allowed the individual teachers to be as innovative with their pedagogy as they chose to. This was also true of teachers showing initiative toward co-operating with other teachers, which was neither explicitly encouraged nor inhibited by the management, but left for the individual teachers. Managerial support in promoting intra-organizational, interdisciplinary collaborative practices arose as the focal development proposal.

A study by Mäki and Saranpää (2009, 79-81) concluded that in the context of the university of applied sciences, the transformation of the conceptions of educational leadership should also aim to make a transition from innovative and development-oriented discourse to its practical implications. According to Vidgren (2009, 167), pedagogical innovativeness requires the entire learning community to dedicate and commit to its renewal. However, teaching may still be seen as an innately solitary profession and thus cooperation between teachers, even across departmental and subject boundaries, should be encouraged and practiced as a separate skill with a value of its own. Suhonen (2008, 186) discovered that in a university of applied sciences, teachers' attitudes and lack of time were the main obstacles to increasing their co-operational activities. Vidgren (2009, 161) found that in order for teachers to engage in greater cooperation, knowledge sharing and team work with one another, deliberate support was needed from the middle management of the university of applied sciences. In addition, Vidgren's findings indicated that while teachers were skilled in and used to distributing co-operational activities among their students, this competence was not transferred to their own working methods with their colleagues.

3 Strategic planning

Strategic planning as a characteristic of an innovative learning community is a deliberate and expressed focus on core competencies and ensuring the innovation process flow, from idea to implementation (Hokkanen 2001). Innovativeness *per se* should be one of the strategic objectives resulting in time and resources dedicated to it. Furthermore, strategic planning should be carried out co-operatively, with every member of the organization contributing to it. The Kyamk teachers who were interviewed perceived themselves as being trusted by the management. This trust manifested itself as a freedom to decide upon their course contents and course implementation plans. The organizational strategy was seen as a separate and remotely familiar document, which the teachers had not participated in writing, hence the need for a bottom-up approach in strategic planning at Kyamk. The interviewees stated that there was not a shared sense of understanding of the "big picture", resource planning and common objectives at Kyamk. This was in accordance with the findings of Toikka (2002, 207), who concluded that Kyamk as an organization was lacking a shared mindset and could be described as a polarized and fragmented organization. This was to some extent explained by the inadequate co-operation between the top management and the operative management.

4 Customer orientation

By customer orientation in an innovative learning community, Hokkanen (2001) means using the customers' – in this case, students' – requirements and expectations as a starting point for the continuous development of staff competencies. This would ideally be carried out in close co-operation with the students, involving them in developmental activities and in pedagogical innovation. Kuusinen (2003, 34) has listed the student-centered features that should be the objectives of all educational reforms: individuality, flexibility, self-direction and wide-ranging implementations. In an innovative learning community, students should be seen as active members

of a learning community that is characterized by equality, respect and appreciation (Hokkanen 2001). These qualities were also listed in Kalima's (2011, 251) study, which examined why some students choose to drop out of universities of applied sciences. Kalima concluded that if the teachers have a positive attitude toward students and regard students as equal partners, it may be reflected in students being better motivated and more committed to their studies.

Kyamk teachers' interpretations of the term 'customer' varied: in addition to students, the surrounding society and businesses were also seen as the customers of Kyamk. Moreover, students were seen as more than customers, as they were also referred to as parts of the learning process or as partners. At Kyamk, the flow of feedback from students to teachers was a well-established routine and an integral part of the courses the teachers taught. However, there were also critical attitudes towards the students' ability to give constructive feedback that would actually benefit the teachers in further developing their pedagogical activities. There was an expressed need to a more profound dialogue, which was characterized as the teacher's sensitivity to informal and possibly weak signals that might launch interaction and discussion between a student or group of students and a teacher, to enable the teacher to gain unforeseen and valuable information for developing the learning process.

5 Competences and skills of staff

Hokkanen (2001) defined the competences and skills of staff in an innovative learning community with a strong focus on pedagogical competence as comprising knowledge, skills and experiential knowledge. All of these are manifested in individual teachers' ability to work together while supporting and implementing co-operative methods and maintaining a wide array of networks.

The pedagogical strategy of Kyamk (2009) defines pedagogy at Kyamk as "... the actions of students, teaching staff and supporting staff that are in accordance with their competence objectives." In an educational context, competence and pedagogy are self-evidently closely intertwined, if not synonymous. The teachers who were interviewed perceived pedagogical leadership to be weak at Kyamk. Firstly, there was not enough guidance toward the desired pedagogical development outcomes. Secondly, there was not much pedagogical discourse in the organization. Finally, the pedagogical strategy had not been implemented properly. Individuals were encouraged to engage in personal and professional competence development. However, decisions on how and what to develop were not strategically directed, but were left for each teacher to make. It was proposed that multi-professional competencies should be put to better use, if intra-organizational competence – the knowledge and skills of all of the organization's members – were to be systematically examined, verbalized and disclosed. For instance, it was suggested that not all training courses needed to be bought from consultants outside the organization, when there could be a competent person to teach that training course working on the other Kyamk campus.

There has been much debate around the constantly increasing competence requirements of UAS teachers. As tasks and duties are added to each teacher's responsibilities, they are bound to distract the teacher from their core competence and function, which, even in an innovative learning community, should be teaching (Hokkanen

2001). This is supported by the observations of Auvinen (2004, 353) and Mäki (2000, 274), that imply that the fragmented or constantly expanding working role of a teacher is a severe distraction and impediment to student-teacher interaction and thus inevitably has a negative impact on the quality of education and learning outcomes.

6 Processes and codes of conduct

In an innovative learning community, the processes as defined by Hokkanen (2001), are run effortlessly, flexibly and openly, and can be developed in an agile manner. Process development is valued and resourced by allocating adequate time and funding to it. In Kyamk many of the processes were seen as non-transparent and there was a great deal of perceived bureaucracy. One of the widely mentioned examples of this was the process of annually planning a personal work schedule.

At Kyamk, there was a need to agree on certain common procedures as many of the traditions of several organizational sub-cultures still existed, making individual teachers act differently in the same process, depending on their department or degree program. These sub-cultures derive partly from the fact that Kyamk was established in the 1990s when a number of formerly independent educational establishments were merged into one university of applied sciences.

7 Partnerships and co-operation in networks

In an innovative learning community, the importance of partnerships and networks, including intra-organizational ones, is acknowledged and they are built and maintained with dedication and a long-term perspective (Hokkanen 2001).

The Kyamk teachers who were interviewed stated that partnerships and networks were more often than not created informally and rather haphazardly. In other words, they arose in random face-to-face encounters in places such as the staff room or the cafeteria. In working life, typical networking environments are events such as company visits, trade fairs and exhibitions. Online environments and social media were not used for building or maintaining networks. Networking with external organizations was seen as an essential element of education. The need for more emphasis on long-term development of partnerships and networks should be extended not only to intra-organizational levels, but also to national and international levels.

8 Achievements and success

According to Hokkanen (2001, 66), in an innovative learning community, performance is measured and there are incentives for achieving good results, since success in this case means better learning outcomes. The Kyamk teachers who were interviewed felt isolated from the measurement activities. According to them, metrics were used merely as a means to compare and contrast universities of applied sciences and the results were often cited in a rather intimidating manner without expressing what to do about them. The development proposal suggests that reacting to measured results

in the organization – changing or maintaining the course of action – could be more explicit and better monitored. This was in accordance with Toikka (2002, 201), who also stated that the results of metrics, indicators and primary feedback should be used in practice to change the method of operating.

9 Discussion and conclusions

The preceding discussion of a study based at the Faculty of Technology and Transport is by no means an attempt to generalize the situation in Kyamk as an organization. Rather, it could serve as a starting point for more explicit and structured considerations on how the members of a newly formed team organization could be supported so that they become united to a greater extent, in order to meet and overcome the challenges and uncertainties they are inevitably facing at present and in the near future.

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5

THE USE OF SIMULATION IN PARAMEDICAL EDUCATION ABSTRACT

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Abstract

The purpose of this study was to investigate the use of simulation in paramedical training. The study was conducted using interviews. The aim of the study was to find out which topics were particularly suited to the simulation method in paramedical education and which issues should be considered regarding patient safety when using simulations. The material was collected during two group meetings in the spring of 2012. There were 13 people involved in the two groups. The participants were considered to be familiar with the simulation method. The study material was analysed by content. In this article, “simulation” is taken to mean the entire learning process in simulation (full-scale simulation).

The use of new and innovative methods should always be considered in education. Simulation as a teaching method should be included in the curriculum for the education of health-care professionals, enabling enough time to be resourced in advance for the teaching method. It is important to set targets in the learning process. Experts in the simulation method also emphasize that attention should be paid to patient safety, both when establishing the objectives of the exercise and when evaluating the situation. The results of this study could be used when planning the education and setting targets for the individual exercise.

Key words: simulation, paramedic emergency care, patient safety

1 Introduction

In the future, we expect more quality from employees. They need to manage increasingly complex issues. Better education is required. Therefore, it is important to focus on the training and knowledge of personnel. (Ryynänen et al 2008, Ensihoitoasetus 39/2011, Seppänen 2012.) Simulation pedagogy is a possible solution to today's increasing demands for training and maintaining skills. In the health sector, the use of simulation has grown rapidly. However, simulation is not new a method in health care education. (Bland et al 2010.) The method should be included in the curricula of health care education (Salonen 2013). Health care simulation training has traditionally focused on individual skills, as well as on the knowledge of an individual or group.

Only in the last few years have patient safety, human factors and management of non-technical skills become key targets. (Shapiro et al 2004, Sandford 2010). Patient safety and service quality are considered important factors, particularly when planning health care education and establishing minimum requirements. (OPM 2006, Kinunen & Peltomaa 2010.) Health care is inspired by safety-critical industries, which have used the simulation training method for years. There are a number of practices used in these safety-critical industries that also apply to health care and health care education. (Helovuoto et al 2011.) The use of the simulation training method should be studied and developed further. The simulation method can be used to teach new safe management practices. Using the method promotes patient safety. (Dieckmann 2009, Helovuoto 2010).

Students think that patient safety is an important subject to learn, which should be regarded when planning health care education (Leung et al 2010). The simula-

tion method is a motivating and useful learning method (Baker et al 2008, Sanford 2010, Lewis et al 2012). Students' confidence in their own skills grows when using the method (Bremner et al 2006, Sanford 2010, Lewis et al 2012). In particular, clinical nursing skills develop most (Shapiro et al 2004, Cioffi et al 2005, Rhodes & Curran 2005, Bremner et al 2006, Kivinen 2008, Lampton 2008, Ackerman 2009, Harder 2009, Sanford 2010, Ricketts 2011, Baker et al 2012, Endacott et al 2012, Bogossion et al 2012, Lewis et al 2012). Clinical decision-making and critical thinking improves (Sanford 2010). Students feel that the simulation method is an inspiring teaching method of high quality (Salakari 2007, Mitchell et al 2012). They also think that it is easier to provide peer evaluations (Sanford 2010).

2 Simulation as a teaching method

Simulation is the imitation of reality. It means simulating an individual or a larger content in an environment that is as close to real life as possible. (Endacott et al 2012, Parekh & Thorpe 2012.) The tasks to be simulated are always pre-determined. Simulation is a process where the objective is to produce comprehensive, experience-based learning (Räsänen 2004, Alinier 2010, Harder 2009, Sanford 2010). Simulation can also include role-play, clinical station practices or computer software modeling (Cioffi et al 2005, Salakari 2010, Sanford 2010). The term "simulator" typically refers to a specific simulation room, a device or an instrument. In health care, it often means a patient simulator. Patient simulators include technology that can simulate real patients with functions close to real life. (Alinier 2007.)

Patient simulators are typically divided into three categories (Harder 2009). "Low-reality" or "low-fidelity" simulators help learners to focus on an individual skill. These simulators enable safe, independent practice. "Medium-fidelity" simulators are also practical for practicing individual situations, but mainly they are used to practice a smaller element in a larger context. In such exercises, the instructor can direct or change the course of the simulation without interfering vocally in the task. "High-fidelity" patient simulators can be steered in the learning situation without the participant noticing. They have almost all the vital functions of a real patient. (Seropian ym. 2004, Yaeger 2004, Harder 2009.)

Simulation-based learning can be thought of as "a circle of learning." Kolb (1984) has introduced this model in such a way that the conceptualisation of experiential activities can be learned. This involves an essential element of reflection achieved through the application, and possibly a change or strengthening of the activity. (Kolb 1984). Salakari (2010) simplifies the circle of learning as follows: "experience, observation/reflection, generalization, experimentation". Dieckmann (2009) divides the circle of learning into four separate sections connecting to the learning circle, where all the parts are strongly intertwined. According to him, learning is a never-ending circle as well as a simulation-learning process. Individual simulation exercises always begin with the participant's own experience. It combines the participant's theoretical knowledge and practical experience. (Dieckmann 2009.) Figure 1 shows a Dieckmann (2009) simulation learning circle. It was modified by Salonen (2013).

Figure 1 indicates that simulation learning starts with theory and experience. Theory and experience provide the basis for a realistic simulation exercise. It is also affected

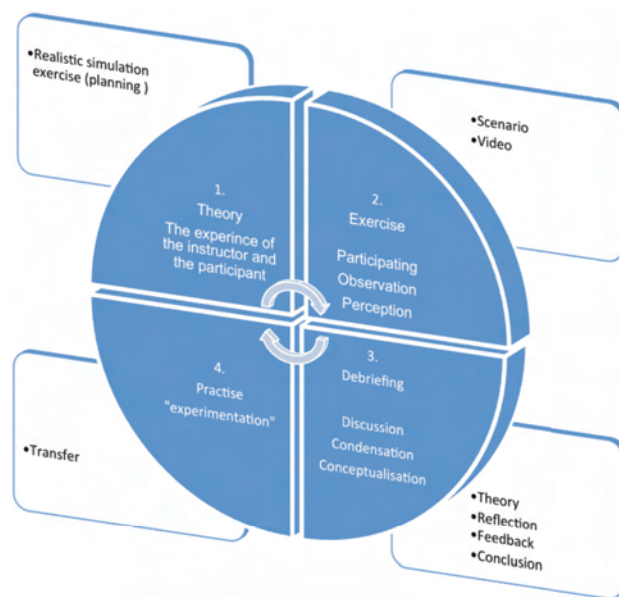


Figure 1. Modified simulation learning circle (Salonen 2013)

by prior knowledge and experience of the studied phenomenon (1). This is followed by a simulation exercise in which participating and observing provide a new experience of the studied phenomenon (2). The learned phenomenon is then conceptualized (3). The ultimate goal is transferring what is learned into practice. (4). (Dieckmann 2009.)

Constructivism is a key concept in simulation learning (Salakari 2007). The learning concept is also very close to socio-constructivism, by which knowledge is socially constructed. In other words "truths" are also social contracts. Commonly shared meanings can be created through discussion. (Tynjälä 1999). The emergency services college considers simulation to be similar to constructivism, realism and experimental learning. It is important that the instructor is responsible for the realism. (Emergency services college 2012.) It is important to set a target for the simulation (Seropian 2003, Yaeger 2004, Salonen 2013). Simulation is a new and innovative practice (Berragan 2011, Bland et al 2010). Gaba (2004) points out that simulation is a technique, not a technology. The intention of simulation training is that the learner can apply what he/she has learned. The aim is to transfer information so that it may be applied in different situations or contexts. (Salakari 2007, Dieckmann 2009.) The simulation instructor must be aware of the students' competence level. Only then is possible to succeed in setting goals. The aim is that students are at the center of the activity. (Salakari 2010.) The exercise and a debriefing should be carried out according to objectives. The instructors must monitor targets and at the same time act as "guardians of realism". (Dieckmann, 2009.) On the other hand, Shapiro et al (2004) find it particularly challenging to create a clinical learning situation in which a real-life environment is recreated as well as possible with regard to materials, equipment and the atmosphere.

2.1 Implementation of the learning situation

Simulation is a comprehensive learning process. The process is commonly known as a full-scale simulation. The duration of the exercise varies greatly. Typically, a full-scale simulation takes about 1.5 hours. Full-scale simulation includes all components. (Hallikainen & Väisänen 2007.) Figure 2 shows the steps of the simulation process (Salakari 2010, Dieckmann 2009). The figure was modified by Salonen (2013).

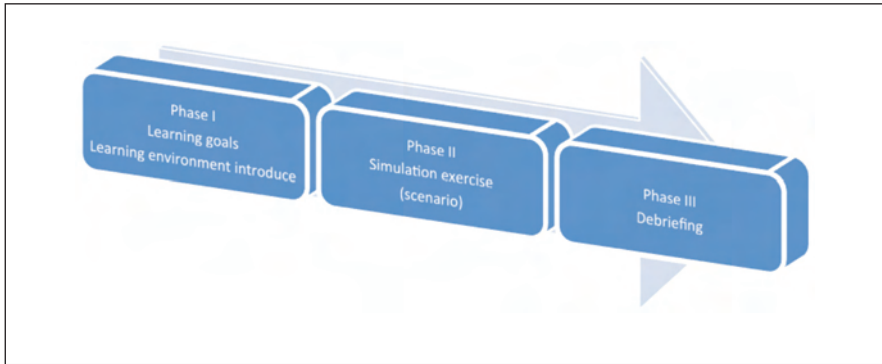


Figure 2. Modified steps of the simulation process (Salonen 2013)

Phase I: introduction to the topic. During this phase, an orientation lecture may be given. (Salakari 2010.) At this point, learning goals are set. (Dieckmann 2009). Phase II: this phase comprises the simulation exercise. Learning occurs by participating in and by observing the simulation exercise. Students assume various roles and gain experience of the simulation. (Parekh & Thorpe, 2012.) The exercise is implemented according to the plan (Dieckmann 2009). Phase III: the learning situation is concluded by debriefing (Dieckmann 2009, Salakari 2010). Debriefing is a challenge for all participants. Participants should be able to evaluate their own actions and the actions of other participants. Participants should also be informed about their thoughts. Equally important is that the instructor knows how to lead the debriefing. Each participant should have the confidence to express his/her thoughts. The teacher should ensure a non-judgmental atmosphere. At the same time, however, realism has to be included. (Rudolph et al 2006.)

A well-executed debriefing helps students to reach their learning goals (Rudolph et al 2006, Dieckmann 2009, Salakari 2010). Debriefing is the most important component (Sanford, 2010). Debriefing helps students to see how things could be done differently (Schultz et al 2012). Debriefing should take about half the time of the simulation exercise (Parekh & Thorpe). The success of simulation learning will always depend on the above-mentioned phases and components. The instructors must enable a transfer effect. (Salakari 2007, Salakari 2010, Dieckmann 2009.)

2.2 Simulation and patient safety

A safe environment and patient safety are essential to nursing. (STM 2009, Kinunen & Peltomaa 2010). The perspective of patient safety should be integrated into

all health care operations, including education. Simulated real-life learning situations ensure the adoption of new operating models. (Kinnunen & Peltomaa 2010, Helovuoto et al 2011). Patient safety experts believe that teaching by simulation improves patient safety. (Baker et al 2008, Dieckmann 2009, Helovuoto 2010, Schultz et al 2012.) Simulation training develops safe action-oriented skills (Shapiro et al 2004). Models have been developed for safe practices. Crisis Resource Management (CRM) is one such model. It was developed to improve the functioning of staff, particularly in crisis management. The basic idea is to try to coordinate, implement and take advantage of all available resources. Resources include all of the people involved and all of their knowledge, skills and attitudes. CRM enables various factors to be taken into account even before a crisis occurs. CRM has been shown to improve patient safety. (Rall & Dieckmann, 2005). The University of Aberdeen (2003) has developed a patient safety framework known as Anesthetists' Non-Technical Skills (ANTS). The ANTS framework can also be combined with the CRM framework. (Fletcher et al 2003, Dieckmann 2009.) Figure 3 shows the four main components of the ANTS framework.

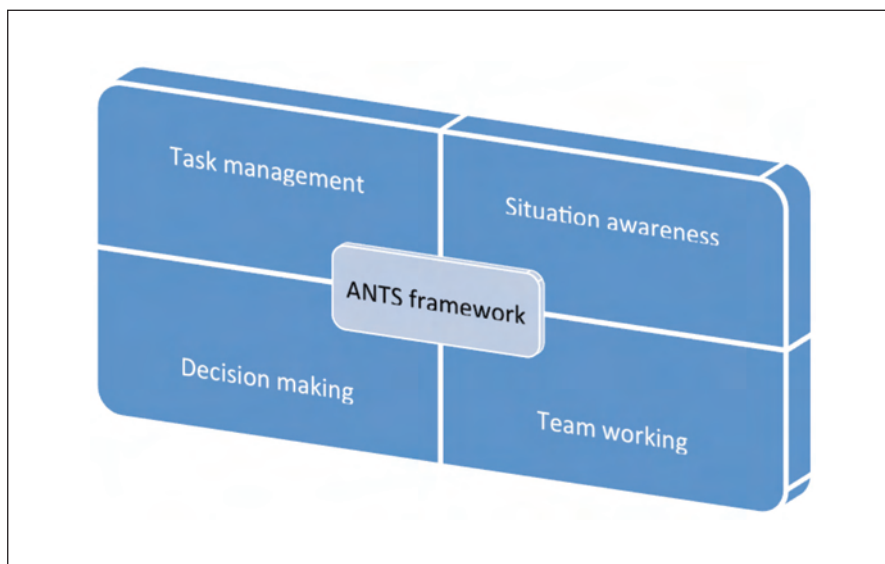


Figure 3. The University of Aberdeen's Anesthetists' Non-Technical Skills (ANTS) framework

Non-technical skills include all of the skills needed to ensure patient safety. For example, understanding human factors, such as communication, teamwork, decision-making and situation awareness, is important. Simulation is useful in these framework exercises. (Sanford 2010, , Dieckmann 2009, Salakari 2010).

3 Research aims, tasks and objectives

The purpose of this study was to investigate which topics are particularly suited to the simulation method in paramedical education in Finland. The study also aimed to further develop the simulation method and to investigate the issues regarding patient

safety that need to be taken into consideration when using the simulation method.

Research tasks:

1. Which topics are particularly suited to the simulation method in paramedical education?
2. Which issues should be considered regarding patient safety when using the simulation method?

3.1 Research material and methods

3.1.1 Data collection

This study was conducted using interviews. There were two interview groups. The group size was kept rather small, making the subject easier to manage and analyse, and improving accuracy. All of the interviewees had experience in paramedic teaching. The average age of participants was 46 years and they had more than ten years' experience in the health care sector. All participants had experience of paramedical simulation. The themes were determined in advance, but they were considered to be open. This enabled as much information about the subject matter to be collected as possible. Interviews were recorded and notes were also made, enabling the data to be analysed.

3.1.2 Data analysis

The study was analysed by qualitative inductive content analysis. The data was analysed in several phases: data reduction, clustering, interpretation and conceptualization. Original statements were extracted and separated from the data. They were coded into letter and number combinations. (Kylmä & Juvakka 2007.) The resulting reductions were classified afterwards. Categories and sub-categories were formulated in accordance with the research tasks and used to refine the final research tasks. (Tuomi & Sarajärvi 2009.)

3.1.3 Results

The key results are summarized in Figure 4. It shows the type of activities simulation experts emphasize in paramedical education.

It is imperative to define learning objectives before the simulation begins. The curriculum guides the systematic implementation of the simulation. *“According to experts, the most important factor is a goal-oriented simulation exercise, planning, execution, and analysis.”* Simulation methods should be defined in the curricula, to enable teaching resources to be allocated and ensure that the simulation suits the demands of the teaching method. Simulation exercises should take place at the beginning of studies. Students need to know *“how to simulate”* and they need to understand how this teaching method helps their learning process. The objective should be to learn in *“flow mode”*. Debriefing should be allocated sufficient time. The supervisor should also consider different ways of conducting the debriefing so that learning objectives

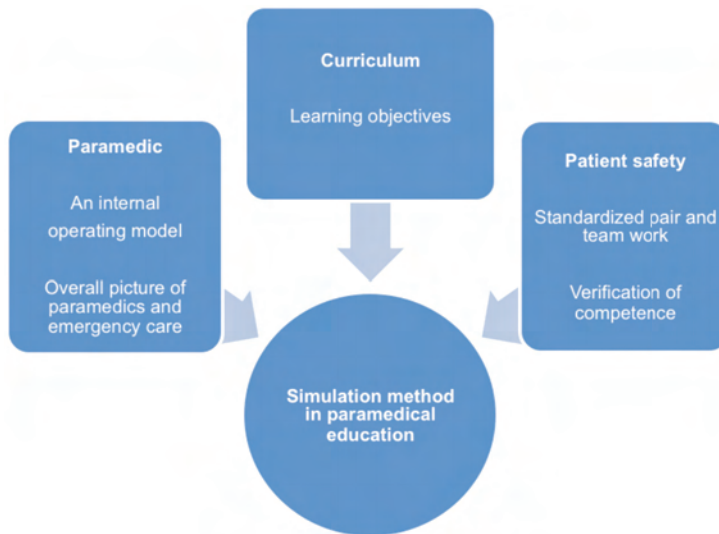


Figure 4. The factors that simulation experts emphasize in simulation learning within paramedical education (Salonen 2013)

can be better achieved. At the same time, a transfer effect becomes possible. It is important that students are motivated before the exercise.

Which topics are particularly suited to the simulation method paramedical education?

Simulation training should emphasize the internal operating model. Management of the treatment process is essential, regardless of the patient case. *“The scenarios should take into account the entity.”* According to experts, the exercises should be realistic emergency situations. The management of instructors’ own subjects is important. It is important to simulate the most common basic tasks that are repeated often pre-hospital. There should also be a wide range of exercises to provide students with a variety of different experiences. According to experts, simulation is also a good method for teaching infrequently occurring situations. Simulation can also combine theory and practical function.

Which issues should be considered regarding patient safety when using simulation method?

Standardized patient-safe operation can be illustrated by simulation. Simulation is also a good way of ensuring competence. Competence evaluations represent valuable feedback from the instructor. The evaluation criteria should also include non-technical skills. Teamwork and the use of various security frameworks are important. *“Teamworks and co-operation between teams are important”.* Patient safety involves the adoption of standardized operating models. In particular, the ANTS and CRM frameworks and models should be used. It is good to practise decision-making by simulation.

4 Discussion and conclusions

Simulation exercises in paramedics should be planned and goal-oriented. Simulation learning should be in the curriculum to enable planning, resource allocation and targets to be clearly visible. Target-setting is essential to guide practice. Simulation exercises should include scenarios where the goal is to learn the internal operating model. Simulation helps students to understand the emergency care entity. A variety of different scenarios should be simulated. Training should take into account patient safety. Objectives should also be recorded for patient safety issues. Standardized operating models need to be practiced in the simulation. Also, a variety of safety-enhancing frameworks should be used. Training in pair- and group-work skills is crucial. Patient safety is promoted by implementing competence assessments in simulated emergency situations. Skills assessments should take into account individual participants as well as pair or group activities, with a focus on the objectives. There must be evaluation criteria for safe and standardized operations.

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6

ARGUMENTATIVE PROBLEM SOLVING THROUGH ONLINE AND FACE-TO-FACE ROLE-PLAY DISCUSSION IN A SOCIAL WORK DEGREE PROGRAM

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Abstract

This article describes a teaching experiment in which students practiced argumentative problem solving through role-play discussions in the Social Work degree program at Mikkeli University of Applied Sciences. Related to the teaching experiments, two quasi-experimental studies investigated whether role-play discussions conducted either online or face-to-face enriched students' problem solving on social issues. The teaching experiments were applied on a course concerning preventative work against alcohol and drug abuse. This article concerns the second quasi-experimental study.

The students wrote essays after having watched cases on elderly people's use of alcohol as pre- and post-tests. Between the tests the students attended lectures (30 x 45 min) on preventative work against alcohol and drug abuse, and engaged in online or face-to-face role-play discussions on young people's use of alcohol. Nine control participants did not participate in the role-play discussion. Finally, the students completed feedback questionnaires.

The results showed that students in the face-to-face group paid more attention to the viewpoints of clients' close friends and relatives in their post-test essays than they did in their pre-test essays. As regards the online group, students were more likely to justify their behavioral solutions (what to do) using ethical principles in the post-test essay than they did in the pre-test essays. The students in both groups reported that the role-play discussion supported their teamwork and communication skills.

1 Introduction

Everyday work in the social field involves solving unpredictable problems. This often requires immediate decision making with clear justification. Social workers should attempt to understand the client's viewpoint, and clients' self-understanding about their own needs and works should encourage clients to participate in the problem-solving process (Parton, 2000).

The problems faced in social work are ill-structured in nature. In contrast to well-structured problems, ill-structured problems are complex, ill-defined, and open-ended, with many solutions; the information, action, concepts, rules, and principles needed to solve problems are indistinct (Chi & Glaser, 1985; Ge & Land, 2004; Jonassen, 1997; Voss & Post, 1988). In this study, the students' task was to solve ill-structured problems.

Argumentation is needed to solve ill-structured problems (see van Bruggen & Kirschner, 2003; Cho & Jonassen, 2002; Jonassen, 2000). The advantages and disadvantages of solutions must be discussed and decisions justified (Ge & Land, 2004; Jonassen, 1997; Voss & Post, 1988). This helps problem-solvers to create their own viewpoint on the problem by clarifying others' viewpoints (Jonassen, 1997; Kuhn, 1991). The solutions in social work should be based on ethical principles of social work (see Talentia, 2005). These principles include a client's right to a life worth living, decision-making autonomy, and participation in society. The ethical principles were one criterion in the assessment of students' justification in this study.

The importance of merging theoretical studies in higher education with the requirements of professional practices has been noted by many authors (e.g. Galea, 2001; McLaughlan & Kirkpatrick, 2004; Moss, 2000; Parton, 2000; Tynjälä, 2001). Because argumentative problem solving is needed in the work on social field, it should be practiced during professional education. McLaughlan and Kirkpatrick (2004) recommend that educational institutions increase the use of active, engaging learning methods (e.g., collaborative learning, problem-based learning, case methods, enquiry-based learning, role-plays, and discussions) in their curricula to enable students to develop generalizable and transferable professional skills, such as argumentative problem solving (see also Jonassen, 2000).

This paper will describe role-play discussions that were used to practice students' argumentative problem solving on a course on preventive drug abuse work as part of a social work degree program at Mikkeli University of Applied Sciences. The study design and results will also be presented.

The research questions were: 1) Did the quality of students' argumentative problem-solving improve when practiced online or face-to-face? 2) Did the students feel that they benefitted from the argumentative practicing methods?

2 Argumentative problem-solving through role-play discussion

The role-play discussions that were used in this study include dimensions from role-play and role-play simulations. Role-plays are artificial situations in which participants assume a viewpoint or the identity of a character that would be not normally assumed (Barkley, Cross, & Major, 2005; Alexander & Boud, 2001). Participants engage in the core concepts of the learning theme in unfamiliar situations, and the roles should be created to include interests, values, and knowledge related to the problem case (Barkley et al., 2005).

Based on many studies, Kettula (2012) stresses that the term "simulation" includes several different activities, such as educational simulations, role-plays, and games. She emphasizes that some researchers define role-play simulations openly as a learning environment that simulates reality, but some make a clear distinction between different actions.

Online role-play simulations have been delivered because of the many advantages of the internet: access to information; independency of place or time; and the opportunity to use software to track students' activities during the action (McLaughlan & Kirkpatrick, 2004). Online role-play simulations are described as beneficial for attaining different stakeholders' viewpoints, beliefs, actions, and values about a problem without a "correct" outcome (Jones, 2007; Linser, 2004; Maier, 2007; McLaughlan & Kirkpatrick, 2004), and for supporting communication and collaboration skills (Naidu, Ip & Linser, 2000). They have been found to support students' active learning (Naidu, Ip & Linser, 2000; Hull, 2008; Poustie 2001).

Face-to-face role-play simulations have been conducted in many disciplines (McLaughlan & Kirkpatrick, 2004). The benefits that have been noted are applying material achieved from lectures to real life situations (DeNeve & Heppner, 1997); understanding stakeholders' roles and perspectives; improving negotiation skills and skills to contribute to the debate (Fletcher, 2001); multidimensional understanding (Davidson, Preez, Gibb & Nell, 2009; Plous, 2000; Prince, 2006); critical thinking (Sloman & Thompson, 2009); integrating theory and practice (Moss, 2000). Additionally, Kettula (2012) found role-play to be a good method for developing students' professional expertise as a supplementary learning method alongside work-based learning.

It has also been noted that online role-play simulations are challenging for teachers to conduct and for students to participate in (Poustie, 2001; Naidu, Ip & Linser, 2000). The research results by Krain and Lantis (2006) and Poling and Hupp (2009) showed that role-play simulations did not provide any particular development in students' knowledge achievement. They seemed to have a more significant role in supporting students' multifaceted understanding (Krain & Lantis, 2006; Poling & Hupp, 2009; Vapalahti, Marttunen, & Laurinen, 2010).

Multifaceted understanding is an important professional competence in social work. Uggerhøj (2007) studied role-play among social workers and social work clients and noted that role-plays made clients feel like important informants concerning social problems. Social workers, for their part, got an opportunity to engage in discussion and problem solving with their clients.

3 Teaching experiment and data collection

The teaching experiment consisted of six phases, including research activities (e.g., pre- and post-tests), regular teaching activities on the course (lectures on preventive work against substance abuse), and role-play discussions. The quasi-experimental design is presented in Table 1:

All of the students wrote pre-test essays (Phase 1, Table 1) after having watched a DVD recording on alcohol use by elderly people. The dramatizations described ill-structured problems simulated from real-life situations without any solutions. The students had to try to find alternative solutions with justifications to the problems with the help of question prompts.

After writing pre-test essays, all of the students participated in 30 lectures on preventative alcohol and drug abuse work (Phase 2). After the lectures, 14 students participated in role-play discussions conducted face-to-face and 15 online (Phase 4). The nine controls wrote post-test essays without participating in a role-play discussion. For the role-play discussions, the students were assigned to groups according to a test on argumentative problem solving in which they were asked to solve a given social problem, justifying their decisions (Phase 3). Thus, it was ensured that the argumentative problem-solving skills of the students in each group were as similar as possible.

Table 1. Study design

Phase	Content of the activity	Group		
		Online (n=15)	Face-to-face (n=14)	Control (n=9)
1. Pre-test (45 min)	Watching problem case A (10 min)	X		
	Watching problem case B (10 min)		X	X
	Writing essays on problem case A (35 min)	X		
	Writing essays on problem case B (35 min)		X	X
2. Lectures and information (34 x 45 min)	Lectures on preventive substance abuse work (30 x 45 min) A lecture on argumentation in social work (3 x 45 min)	X	X	X
	Information concerning the research arrangements (45 min)	X	X	X
3. Test for small group formation	An assignment on argumentative problem solving	X	X	X
4. Practicing argumentative problem solving	Instructions for the online role-play discussion (10 min)	X		X
	Instructions for the face-to-face role-play discussion (10 min)		X	
	Online role-play discussion (4 days, 5 people/group)	X		X ⁱ
	Face-to-face role-play discussion (45 min, 4–5 people/group)		X	
	Peer assessment of solutions generated by the other groups conducted online	X		X ⁱ
	Presenting role-plays to the entire group, peer assessment of solutions conducted face-to-face and class-wide discussions (45 min)		X	
5. Post-test (45 min)	Watching problem case A (10 min)		X	X
	Watching problem case B (10 min)	X		
	Writing essays on problem case A (35 min)		X	X
	Writing essays on problem case B (35 min)	X		
6. Feedback discussion and questionnaire (45 min)	Sharing opinions about the benefits of the role-play discussions and the experiment	X	X	X

Note: X=participation in the activity; i) the control group participated in delayed online role-play discussion after the post-test.

During the role-play discussions, the experimental groups, which were divided into groups of either four or five members, engaged in a debate on a fictional young girl's use of alcohol (three groups online, and three groups face-to-face). The students were given brief descriptions of their roles in the debates. They discussed the problematic use of alcohol by adolescents through the roles of a young girl and the people (parents, classmates, and teachers) surrounding her. Half of the members of each group were in favour of the young girl's use of alcohol and half were against it. Both the online and face-to-face role-play discussions were planned to increase students' multidimensional understanding of alcohol use by adolescents (see Vapalahti, Martunen, & Laurinen, 2010).

After having participated in role-play discussions, the students did a post-test task (Phase 5) that included an essay similar to the pre-test task. In the pre-test task, the students in the online group watched problem case A, whereas the students in both the face-to-face and control groups watched case B. However, in the post-test, the order of the cases was reversed in order to avoid any test-wise effect (see Gall, Borg, & Gall, 1996, p. 519; Campbell & Stanley, 1966, pp. 50–52).

In Phase 6, all of the students anonymously completed a questionnaire on their opinions about the benefits of the methods used during the teaching experiment. The questionnaire included Likert-scale questions on role-play discussions, as well as both closed- and open-ended questions on student's readiness to participate in similar role-play discussions.

4 Data analysis

The data consist of 75 student essays and 31 questionnaires. The students in the online group wrote 30 essays, the face-to-face students wrote 27 and the control group wrote 18. The quality of the students' problem solving was analyzed in their essays according to the analysis framework created by applying the definition of the problem-solving process used by Ge and Land (2004), which was supplemented with ethical principles included in problem solving in social work (see Heinonen & Spearman, 2001, pp. 149–168). The problem solving process consists of three phases: 1) problem representation, 2) solution development, and 3) solution evaluation. Argumentative ability is needed in all these phases. The ethical principles of client work were key factors in the argumentative analysis of the students' essays in this study.

The variables used in the analyses were formed on the basis of the analysis framework. In the students' essays, the variables were identified and the values were given according to Table 2. The program Atlas.ti was utilized for the qualitative analysis.

The pre- and post-tests within the two experimental and one control groups were compared with a non-parametric Mann-Whitney test. Parametric tests could not be used because the data was too small and the values of the dependent variables were not normally distributed (see Bland, 1988, pp. 216–224, p. 238; Gall, Borg, & Gall, 1996, pp. 399–403).

The questionnaires were analyzed both quantitatively (Likert scales) and qualitatively (content analysis of the open answers). A non-parametric Mann-Whitney test

Table 2. Variables used in the analysis of the students' essays

Problem-solving phase	Variable	Value
Problem representation	1. Problem definition	0 = poor (no problem representation) 1 = moderate (problem presented explicitly in the video case) 2 = good (problem conducted from the situation of the video case)
	2. Justification of problem definition	0 = poor (no justification or poor justification) 1 = moderate (arguments for the selected definition) 2 = good (justified with ethical principles)
	3. Seeing the client's perspective	0 = poor (not observed) 1 = moderate (somehow observed) 2 = good (well observed)
	4. Seeing the perspectives of the client's close friends and family	0 = poor (not observed) 1 = moderate (somehow observed) 2 = good (well observed)
Solution development	5. Number of behavioural solutions	0–10
	6. Level of justification of the selected behavioural solution	0 = poor (no justification or poor justification) 1 = moderate (arguments for the selected solution) 2 = good (justified with ethical principles)
	7. Number of verbal solutions	0–13
	8. Level of justification of verbal solutions	0 = poor (no justification or poor justification) 1 = moderate (arguments for the selected solution) 2 = good (justified with ethical principles)
	9. Level of construction of alternative solutions	0 = poor (same as the selected solution) 1 = moderate (new solution) 2 = good (new solution integrated into the selected solution)
Solution evaluation	10. Level of evaluation of the selected solution to the problem	0 = poor (no evaluation) 1 = moderate (advantages of the selected solutions presented) 2 = good (both advantages and disadvantages of the selected solution presented)
	11. Level of evaluation of alternative solutions to the problem	0 = poor (no evaluation) 1 = moderate (advantages of alternative solutions presented) 2 = good (both advantages and disadvantages of alternative solutions presented)
	12. Level of comparison between different solutions	0 = poor (no advantages or disadvantages mentioned) 1 = moderate (advantages and/or disadvantages of the selected and/or alternative solutions named) 2 = good (the superiority of the selected solution compared to the alternative solutions has been justified)

Table 3. Comparisons (Mann-Whitney test) of the pre- and post-test results (Means) relating to the problem representation, solution development, and solution evaluation phases between the different groups

Phase of the problem solving process	Variable (range 0–2)	GROUP											
		Online				Face-to-face				Control			
		Pr (M)	Po (M)	U	p	Pr (M)	Po (M)	U	p	Pr (M)	Po (M)	U	p
Problem representation	Level of problem definition	1.8	1.6	90.0	ns.	1.5	1.7	73.5	ns.	1.6	1.1	22.5	*
	Level of justification of problem	0.7	0.8	98.5	ns.	0.9	1.0	87.0	ns.	0.7	0.3	30.0	ns.
	Level of seeing client's perspective	1.5	1.4	103.0	ns.	1.5	1.6	87.0	ns.	1.4	1.4	38.5	ns.
	Level of seeing the perspectives of the clients' close friends and family	1.9	1.7	97.5	ns.	1.4	1.9	39.5	***	1.8	2.0	31.5	ns.
Solution development	Level of justification of the selected behavioural solution	1.2	1.6	72.0	*	1.4	1.8	58.5	ns.	1.6	1.1	24.5	ns.
	Level of justification of the selected verbal solution	1.0	1.3	85.0	ns.	0.8	0.9	83.0	ns.	1.4	1.0	26.5	ns.
	Level of construction of alternative solutions	0.7	0.7	110.0	ns.	0.7	0.9	73.5	ns.	1.0	0.9	36.5	ns.
Solution evaluation	Level of evaluation of the selected solution to the problem	1.4	1.0	76.5	ns.	0.7	0.6	84.5	ns.	0.9	1.0	36.0	ns.
	Level of evaluation of alternative solutions to the problem	1.2	0.8	84.0	ns.	0.9	0.8	82.0	ns.	0.9	1.2	31.0	ns.
	Level of comparison of different solutions	0.9	0.7	98.5	ns.	0.6	0.9	64.0	ns.	0.9	1.0	36.5	ns.

Note: Pr = Pretest; Po = Posttest; ns. = non-significant; * = $p < .06$; ** = $p < .05$; *** = $p < .01$

was used to compare the means between the online and face-to-face groups.

An inter-rater reliability test was conducted for 15% (11 essays) of the data for the variables except for Variables 5 and 7, which differ from the other variables in their nature. The agreement percentage was 68.

5 RESULTS

In the Table 3 the main results have been presented.

In the problem representation phase, the students in the face-to-face group were better aware of the perspectives of clients' close friends and relatives in their post-tests than in their pre-tests (Means 1.4 vs. 1.9, Table 3). There were no significant differences between the pre- and post-tests in the students' ability to define problems in the online and face-to-face groups. In the control group, the students' ability to define the problems decreased ($M = 1.6$ vs. 1.1) significantly.

In the solution development phase, the students in the online group justified their behavioral solutions (what they would do in the situation) better in their post-tests than they did in their pre-tests (Means 1.2 vs. 1.6). In their post-tests, the students used more ethical principles to justify their solutions than in their pre-tests. The students evaluated their own and alternative solutions quite similarly in the pre- and post- tests in all groups, and no statistically significant differences were found between the pre- and post-test results.

The students in both groups assessed the utility of the role-play discussions in terms of their learning as quite good, with the mean values from 2.5 to 3.8 (range from 1 to 5). Furthermore, the students in both groups assessed the role-plays as most beneficial for developing their teamwork and communication skills ($M = 3.4$ and 3.8 , range from 1 to 5). All the students felt the role-play discussion to be least beneficial for the development of their knowledge acquisition and evaluation skills, and the students' opinions did not differ significantly between the face-to-face and online groups.

When the students assessed their work during the role-play discussions, the results showed that the students in the face-to-face group thought that the role-play discussion enabled them to apply theoretical knowledge to practical situations more often than the students in the online group ($M_{\text{face-to-face}} = 3.6$ vs. $M_{\text{online}} = 2.9$, $U = 51.5$, $p < 0.05$). The students in both groups felt most strongly that they were able to utilize their previous knowledge about adolescents' use of intoxicants (Means 3.6 and 3.7).

Most of the students (25 out of 31) said that they would still be ready to participate in role-play discussions as a part of their studies. However, some students found the given roles to be too strictly determined, or role-plays required a level of creativity that they didn't feel comfortable with.

The students were asked how they felt about the problem-solving writing tasks after having watched the problematic cases (pre- and post-tests). They mentioned that, although the task was interesting, it was also challenging and that the time limit was too strict. Some students thought that it would have been more beneficial to try to solve the problems by discussing them in small groups than by writing individually.

6 Discussion and conclusions

The purpose of this study was to develop teaching methods for improving argumentative problem solving skills by students on a social work degree program. The results of the study showed that the students improved their argumentative problem solving skills in some areas. When defining the problem in the face-to-face group, the students were better able to consider the perspectives of the client's close friends and relatives in their post-tests than in their pre-tests. Additionally, in the online group, the students offered more sophisticated justifications for their behavioral solutions in their post-tests than in their pre-tests.

Teaching argumentative problem solving is a challenging task. The students improved on only two out of the 12 variables used to measure their progress. Thus, teaching methods for improving students' ill-structured problem solving should be developed further. For example, argumentative skills should be practiced more throughout professional studies, particularly when practicing to solve social problems. When solving social problems, the focus is on the ethical principles of social work, which are sometimes complicated to reflect and apply in practical situations. Hence, practicing the use of argumentation based on the ethical principles of social work is important.

Argumentative problem solving in social work is a complicated professional skill. In this study, the students practiced problem solving in a teaching experiment, including the use of simulated real-life cases in which they had to use their knowledge of both the ethical principles of social work and alcohol-related issues. The experiment was carried out over a fairly short period, so in order to achieve more noticeable learning results students clearly need more time than they were provided in this study to engage in problem-solving exercises and to reflect on their experiences.

It appears to be relatively difficult for students to evaluate the solutions to problems. The students compared alternative solutions with each other quite rarely. In 26 out of 75 essays, the students did not mention any advantages or disadvantages at all. In 37 essays, the advantages or the disadvantages of solutions were named without justifying them, and in only 12 essays did the students justify the priority of their own solution over the other. Kuhn (1991) emphasizes that a critical evaluation of alternative viewpoints is an essential issue in developing critical thinking and in understanding the reasons behind social problems. The teaching experiment did not seem to promote students' evaluation skills. Possible reasons for this could be that the problem-solving task was quite challenging for the students, and the time limitation in this study was strict.

The students' evaluations of both their learning and working in the role-play discussions showed that they found the role-play discussions to have benefitted their teamwork- and communication skills. Similar results were also found by Naidu, Ip and Linser (2000). Argumentation is needed in teamwork and cooperation in both multi-professional work and in the work with clients in the social field. Consequently, it seems to be useful to use methods for enriching argumentation skills in social work education to provide students with practical environments for learning the

skills needed in their future work. Role-play discussions are one alternative for that.

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7

DEVELOPMENT ORIENTATION AND METHODOLOGICAL CHOICES IN SELECTED MASTER'S PROGRAMMES: IN SEARCH OF INTERDISCIPLINARITY IN THESIS PRACTICE

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Abstract

This article focuses on master's theses at Kymenlaakso University of Applied Sciences completed in 2011 and 2012. The purpose of the article is to inform the discussion about the state of master's theses at universities of applied sciences and how these could be developed in the future from the point of view of interdisciplinarity. Theses have been written for master's programmes in social and health care, technology, maritime, and business. We are interested in the topics, settings of development tasks, and choices of methods for the theses. Similar data from the social and health care master's programme at Mikkeli University of Applied Sciences is used as a point of comparison. The theses are analyzed on the basis of abstracts found in the thesis database www.theseus.fi, and using dialogical conversation and reflection together with focus group discussions. Firstly, the article describes the task and purpose of master's theses at universities of applied sciences, both in general and within the Kymenlaakso region. Secondly, it provides some background on interdisciplinarity and its role in the master's programmes under scrutiny. Thirdly, the data and methods of this study are laid out before the thesis topics, settings of development tasks, and the choices of methods are analyzed in further depth. The article concludes by reviewing the overall picture of the theses, evaluating the direction of the development of theses, and future development tasks.

1 Introduction

This article deals with master's theses at Kymenlaakso University of Applied Sciences (Kyamk) completed in 2011 and 2012. The theses were written for master's programmes in social and health care, technology, maritime, and business. We are interested in the topics, settings of development tasks, and choices of methods for the theses. Similar data from the social and health care master's programme at Mikkeli University of Applied Sciences (Mamk) is used as a point of comparison. The theses are analyzed on the basis of abstracts found in the thesis database www.theseus.fi in autumn 2013. The purpose of the article is to inform the discussion about the state of master's theses at universities of applied sciences and how these could be developed in the future.

The topic is relevant because the tasks and roles of universities of applied sciences are under reconsideration due to legislative changes governing universities of applied sciences. The new Universities of Applied Sciences Act determines the responsibilities of each university of applied sciences to offer bachelor's degrees in certain fields. In addition, the same institutions have the opportunity to offer master's degrees in the fields in which they have been given responsibility to offer bachelor's degrees. This opens the door for a higher education policy choice: universities of applied sciences may either develop and extend their offering of master's degrees or they can start closing down their master's degree programmes.

It is thus a good time to re-evaluate the role and meaning of master's degrees in universities of applied sciences. We are going to delve into this matter in the context of the south-east of Finland. We ask how our master's degrees contribute to the region, and we look at it from the point of view of development work.

We are also going to address the question of how teaching methodology should be developed in order for it to appropriately reflect the development orientation of master's degrees at universities of applied sciences. This is particularly relevant now when teaching at universities of applied sciences is under radical change due to cost cutting and the evolving roles of teachers. New paradigms of competence-creation and learning, as well as individualized needs, must be taken into account when designing course offerings. What will all this mean from the perspective of teaching and supervising thesis work?

This article belongs to the development process leading to the new Master's School, which includes all master degrees of both Kyamk and Mamk. The article continues the discussion that we began in the book *Kehittyvä YAMK – Työelämä uudistava osaamista* published by *HAMK Publications* (Lindeman, Niiranen-Linkama & Veistilä 2012).

Firstly, we will describe the task and purpose of master's theses at universities of applied sciences, both in general and within the Kymenlaakso region. Secondly, we will provide some background on interdisciplinarity and its role in Kyamk' master's programmes. Then we will move on to the data and methods of this study, and look at the thesis topics, setting of development tasks, and the choices of methods by programmes. We conclude by reviewing the overall picture of the theses, evaluating the direction of the development of theses and future development tasks.

2 Master's theses at universities of applied sciences and Kyamk: the starting point and current challenges

The purpose of master's degrees at universities of applied sciences is to produce level 7 competences according to the National Qualification Framework (NQF). Among other things, this means competences of understanding and critical evaluation of questions relating to the interfaces between various fields, solving problems and developing methods where knowledge of various fields is applied and combined, and working independently in demanding expert duties. (Ministry of Education 2009)

Universities of applied sciences have themselves evaluated that their master's degrees produce working competences as well as abilities to improve workplaces and professional practices. In employers' opinions, particular strengths of master's degrees include encouraging independent thinking and a sense responsibility for improving practices and processes, as well as interaction skills. Master's students emphasize the fact that the degree keeps their knowledge up to date while improving reflective and dialogical skills. (Rauhala 2012, 19-23) These perspectives describe the meaning of master's degrees for three key actors in the context of universities of applied sciences: master's programmes combine the professional development needs of students, practical development needs of working life, and regional development mission of universities of applied sciences. (Rantanen 2009, 227)

According to the Kymenlaakso wellbeing barometer 2012, the region's public officials, political decision makers and professionals consider the ability of the

region's education system to provide its inhabitants with opportunities for lifelong learning to have diminished. People's competences have also been utilized less and less. However, the impact of the regional education system on people's control of their own lives has increased. Appreciation of education is on the rise. (Pekkola, Lehtonen & Haavisto 2013, 8-15.)

Kyminlaakso University of Applied Sciences responds to the educational needs by offering a wide range of bachelor's degrees and also providing master's degrees in six fields: social services, health promotion, technology management, maritime administration, design, and international business management. The latter two are conducted only in English. Health promotion is conducted both in Finnish and English, and the rest of the programmes are in Finnish. At least 50 master's degrees are completed annually. Each student does thesis work worth 30 ECTS, meaning that, every year, experienced master's students contribute to the region's development with a minimum of 1500 ECTS. Further calculations show that with the official measure of 27 hours of student work per 1 ECTS, master's students at Kyamk provide 40,500 hours of work – or 25.3 man years – for the region every year. In this article we are interested in how this work is done.

3 Interdisciplinarity expertise as a goal in Kyamk theses and in curricular practices

Interest in interdisciplinarity has been growing steadily within higher education in the wake of more wicked problems to be solved in the world, demands of industry for ground-breaking research-based innovation that typically happens through disciplinary boundary-crossing, and as a consequence of funding agencies' emphasis on interdisciplinary collaboration (Raisio 2010, Huutoniemi 2012, Lyall, Fletcher 2013). Moreover, philosophers of science have taken up the challenge of systematic work on interdisciplinarity as advocated recently by Uskali Mäki in his "Philosophy of Interdisciplinarity: A Manifesto" in the Pre-symposium of the European Philosophy of Science Association's conference in Helsinki in August 2013 (author's lecture notes).

Interdisciplinarity is related to the discussion on multidisciplinary and transdisciplinarity. Multidisciplinary refers to two or more disciplines working together on a common problem but drawing only on disciplinary knowledge, that is, maintaining their basic assumptions, concepts, methods and other manifestations of disciplinary boundaries. Transdisciplinarity really calls into question disciplinary thinking, as Thomson Klein argues (2004, 524). It refers to close collaboration and exchange of assumptions, concepts and methods that approaches the formation of a new discipline. Interdisciplinarity lies somewhere between multidisciplinary and transdisciplinarity. Concepts converse and migrate across disciplines, methods are compared and contrasted between disciplines, and, after critical analysis and evaluation, better formulations of methods may be achieved through cross-disciplinary discourse, which looks at a discipline from another discipline's perspective and which may lead to greater integration, that is, to real interdisciplinary engagement. There is typically also some reflection of each individual discipline's basic assumptions against the assumptions of another discipline but each discipline

maintains its (current) fundamental commitments, which does not happen in the case of genuine transdisciplinary enterprise. (Stember 1991, Thomson Klein 2004, Rubin 2004)

In the context of a university of applied sciences, discussion of multi-, inter-, and transdisciplinarity plays a role among teaching staff as they have typically all been trained in an academic discipline. Multidisciplinary collaboration in research and development projects is becoming more common as industry demands it, but reflective interdisciplinary engagements are harder to find. Transdisciplinarity hardly exists since forming new disciplines is a realm for traditional universities rather than universities of applied sciences, whose mission is to educate and to apply research and development work.

The master's students of a university of applied sciences can be seen to come from different professions rather than disciplines, because they enter their respective master's programmes with at least three years of work experience after the bachelor's degree. They typically possess even more work experience, often 5–15 years. From the perspective of master's students, universities of applied sciences could be said to be inherently multiprofessional. Now the challenge for developers of master's programmes and their research and development orientation is what to do with the multidisciplinary teaching staff and the multiprofessional student body if there are drivers towards greater interdisciplinarity and analogous interprofessional collaboration, as was claimed at the beginning of this subchapter, and has also been suggested by Hautamäki and Stähle (2012), among others.

We remarked in an earlier article (Lindeman et al. 2012) that multidisciplinary, multiprofessional, interdisciplinary, interprofessional and their variants appeared in only one title of the articles included in the previous book on the development of master's degrees at universities of applied sciences (Varjonen, Maijala 2009). In the most recent similar volume (Töytäri 2012), there are two articles with such terms in the title: our own and another one on an interprofessional teacher group. Otherwise, the book focuses on the relationship between working life and different aspects of educational practices on master's programmes, without explicit attention to interdisciplinarity or interprofessionalism. However, the need for interdisciplinary and interprofessional collaboration has been recognized widely, in Honkanen and Veijola (2012), for instance.

The evolving aim at Kyamk has been to move from multidisciplinary towards interdisciplinary work among faculty members of different master's programmes. A further aim has been to expose master's students to interprofessional encounters, particularly in general management and leadership studies, and, more recently, also in project management studies and multicultural studies.

A challenge that has yet to be taken up seriously concerns the development of research and development studies, as well as the thesis supervision process, in a way that would increase interdisciplinary collaboration and interprofessional problem-solving, as we pointed out in our previous article (Lindeman et al. 2012). This challenge is particularly wicked with respect to thesis work and supervision. In order to fully understand the task and challenge ahead, we need a closer look at the research-assisted development work that master's students have done in their theses.

4 Data and methods

The data we used consists of 114 abstracts of master's theses published on www.theseus.fi by master's students of Kyamk and Mamk. (Appendix 1) 88 abstracts are from Kyamk programmes and 26 from one Mamk programme. The theses were published in 2011 and 2012. The abstracts represent all¹ of the theses completed during the two-year period across five master's programmes at Kyamk and one at Mamk. The following Kyamk programmes were included: Social Services, Health Promotion, Technology Management, Maritime Administration, and International Business Management. Two Kyamk programmes taught in English – Health Promotion and Design – were left out of the study because these programmes have been launched so recently. The theses from Mamk included Development and Management of Social and Health Care Services, which is taught in Finnish. This programme was included as a point of comparison, as it has a profile which combines two fields – social work and health care – and also for the sake of continuity, as this programme was included in our previous article on the subject. It would have been interesting to include the theses of all Mamk master's programmes in this study but, due to the limited time available, they were left out this time.

The data was retrieved from the Theseus database by the authors and a librarian. We classified the topics on the basis of the titles of the theses. In some cases, we adjusted the classifications on the basis of the elaboration of the title in the abstract. We thematized settings of the development tasks on the basis of the entire abstract. In some cases in which the setting of the thesis was difficult to decipher from the abstract alone, we consulted the entire thesis to determine the correct thematization of the setting of the development task. We also looked into the research and development methods used for the theses. The method or methods used were determined solely on the basis of the abstracts. We did not check if the method stated in the abstract had indeed been used in the thesis, nor did we check how the author had understood and used the method that he/she claimed to have used.

After gathering data from the abstracts, we produced tables of thesis topics, settings of development tasks and methods (Appendix 1). We analysed the tables in two ways. Firstly, we used dialogical conversation and reflection to discover similarities and differences between theses within a programme and between programmes. Also, dialogical conversation and reflection between the authors helped to uncover what was absent from the overall picture: which topics were not covered, which perspectives were lacking or played a minor role in the settings of the development tasks, and how the choice of methods was biased within a particular programme. After this analysis, we presented the table to a focus group including three principal lecturers from three Kyamk master's programmes. We were also present at the focus group discussion. The focus group was asked the following questions:

- i. How do you see the topics, settings of the development tasks and choice of methods in the theses on your programme and how do they look in relation to the theses of other programmes?

¹ Students are not obligated to publish their theses on Theseus. Some thesis abstracts published in 2011–2012 may thus have been missed.

- ii. What comes across as interesting in the tables? What did you expect to see in the tables that was not present?
- iii. How could thesis supervision and quality of the theses be improved through interdisciplinary work between methodology teachers and thesis supervisors of different programmes?

After the focus group discussion, these questions were emailed to the participants. All members of the focus group complemented their answers in writing.

5 The development orientation and choice of methods in master's theses

5.1 Setting and nature of the development task

In his guide for master's theses at universities of applied sciences, (Salonen 2013, 7) Kari Salonen defines *development work* as the main concept for an activity that results in a new thing. He defines *research work* (ibid. 9–10) as a process conducted according to the common rules and conventions of the scientific community that leads to new knowledge.

Theses at universities of applied sciences are development tasks, which are informed by research orientation. This basic view now seems to be shared quite unanimously. (Rantanen 2009, 218) Development orientation usually builds upon the needs of a student's own work and workplace. The current challenges in a professional field are filtered to students in the form of development needs through discussions within professions. It follows that the development perspectives of the theses are closely connected to a particular professional field.

On the basis of our data, the development orientation in the theses at Kymenlaakso University of Applied Sciences seems to differ according to the programme and field. Development orientation within social services emphasizes the development of methods for client work. Development work is also directed towards improving service quality and workplaces. In health care, the main emphasis is surveying the health condition or social situation of a sub-group of the population. In addition, development work has focused on describing workplace practices, as well as on developing and evaluating different operating models.

The development orientation of the Development and Management of Social and Health Care master's programme at Mamk is strongly based on evaluating and developing services using productization and on describing service processes. In Mikkeli, some development resources have also been directed to human resource management issues.

Multi- or interdisciplinary perspectives are not evident in the development orientations of social and health care theses in Kymenlaakso. As a rule, these theses have been focused on developing professional fields from the point of view of that particular field. Managerial orientation is emphasized alongside the social and health care orientation in the name of the respective master's programme in

Mikkeli. For this reason, one might expect to find more orientation towards business management. However, the data does not support this expectation.

The setting of the development task in theses on the International Business Management programme is tightly connected with the organization that the student works in or is doing the thesis for. The mix of International Business Management theses covers a good variety of aspects of business management and organizational life but wider perspectives are few. For instance, a focus on industry comes through only in 1–3 theses. Accordingly, future orientation or a historical time horizon in the theses is fairly limited; the theses typically deal with short- to medium-term issues, which reflects the fact that the development setting was often based on present situations in current workplaces. Moreover, a clear international management perspective was surprisingly rare, as noticed by the focus group. On the basis of the abstracts, there is no sign of interdisciplinary engagement with the development task.

The development tasks set in theses of the Technology Management programme are typically operational and very workplace-orientated. Thesis questions included how to make international virtual teams work better, how to write operations manuals for standardizing IT processes, how to deploy wikis in a corporation, how to calculate the profitability of transportation at the company level, how to measure employee wellbeing, how to develop recruitment process, and data security. Three of the 21 theses start more obviously from a setting that looks at the bigger picture: development of an industry (boating), strategic development of competences, and implications of generational changes in education.

Two of the four theses on the Maritime Administration programme set a development task for the operations of a ship. The other two take a more strategic view of the future of maritime education and investigate perceptions of public and maritime professionals more broadly, thus trying to capture societal influences on the maritime industry.

5.2 Choice of topic

The choice of topic plays a secondary role from the perspective of competences: the purpose is to gain well-grounded expertise in a specific topic but students can decide on topic themselves. The competence perspective challenges students to attain solid methodological competence: problem-solving skills, and development and research competence.

The master's students originate mainly from within the region. Most come from within 130 km, so they can be considered participant developers of the region. The topics are, however, initially discussed at students' workplaces. Only later, well into the programme, will the topic be brought up with thesis supervisors, when the focus and limitations of the theses come under discussion. The choices of topics in the studied theses strongly reflect the workplace and professional practice. In some cases, students' aspirations to further understand the dynamics of an industry are clearly visible. In the case of health care, the research and development agenda of regional and national experts in the field are on display.

There has been lively discussion on whether theses should be more closely connected to universities' own (regionally, nationally or internationally financed) development projects. This seems, however, to be the case only in few universities of applied sciences. In our data, only the health promotion programme had a more deliberate policy of linking theses to and supervising them from the point of view of one development project.

In the Social Services programme, 13 out of 19 theses are focused on developing methods for client work. The emphasis is on a proactive orientation to work, early support, and preventive work, all of which are in line with development trends in the field. In addition, the objects of development include services for clients living in particularly challenging life situations. The changing needs of clients and problems with employee wellbeing are also among the topics. Almost all of the theses are linked to services for children and youth according to the stated focus of the programme. Of 21 theses in the health care field at Kyamk, three focus on the health condition of a specific group and six theses survey the social situation of a specific group. The emphasis is on describing situations of youth groups, which is explained by the fact that most of these theses are connected to a project entitled *Voi hyvin nuori* (wellbeing for youth), a research and development project managed by Kyamk. Five theses describe the working methods of a health care unit and seven theses focus on the development of social and health care services or the evaluation of the success of development work. Attention is paid to preventive services, both in describing the services and in developing them.

Mamk' Development and Management of Social and Health Care Services programme produced a total of 26 theses in 2011–2012, of which 20 focus on the field's service processes, their description, and evaluation of the quality of those services. New tools and models have been developed from the point of view of client needs and client-centred development of services. This type of work has been done in service housing and service counselling. Moreover, the titles of theses on human resources management describe the promotion of employee wellbeing, development appraisal practices, and how personnel deal with difficult situations and client cases. The topics of the 23 theses on the International Business Management programme fall into six categories. Most of the theses (9) belong to marketing, customer management and service development. The second biggest group (6) is theses dealing with different forms of strategy work, leadership and management development. The third most popular topic (5) was human resource management and change management. The other three categories include only one or two theses each. There are two theses on entrepreneurship, one on project work, and one on supply chain management. Despite the title of the programme, typical international management topics were rare due to the fact that many theses were anchored so tightly to the needs of students' current workplaces or businesses, which were not internationally oriented.

The topics of the 21 theses on the Technology Management programme fall into a much broader range of subject areas. The most popular topic (four theses) is competence development in vocational education from various perspectives. The second most typical topic, closely related to the previous topic, is human resource management with three theses, and third come two theses looking at the profitability and competitiveness of transportation businesses. The remainder of

the theses (12) all have different topics. These include project management, data administration, wikis, sales management, ICT development methods, electricity distribution networks, access control, distillation of wood, software development, public services development, and competence management, of which the last could also be classified as the most popular category mentioned above. Interest in competence management in general may be explained by the original Finnish title of the programme (*Teknologiaosaamisen johtaminen*), which places a practical emphasis on '*osaamisen johtaminen*' (competence management) instead of '*teknologiajohtaminen*' (technology management). Technology Management shows the greatest variety of topics compared to other programmes in this study.

The four theses written for the Maritime Administration programme have different topics. One deals with on-board medical care, the others with maritime education, bridge management and maritime industry image.

5.3 Choice of methods

There is not much research on the methodological competences produced by universities of applied sciences. It is safe to assume that students should possess some epistemological understanding or verbal explication of how they understand knowledge and production of knowledge. There is very little ontological reflection in master's theses at universities of applied sciences.

It is important to explain the method of a thesis in order for the reader to understand how the results have been achieved. This is also a question of justification. The reader and potential user of the practice-based knowledge needs to be able to evaluate the methods and the argumentation leading to the results.

In the social and health care field at Kyamk, a great variety of methods can be observed from the data. Overall, we can say that health care has focused more on survey and interview methods and content analysis. In the social services field, on the other hand, many qualitative research and development methods have been used, even though most of these involve varieties of group interview. In Mikkeli, the focus has been on methods of evaluation and process description. Several theses use also action research and its variants.

A great majority (12) of the theses on the International Business Management programme used the case study method, which has been a typical qualitatively motivated choice of method in business studies in recent decades. Most of the theses used single case studies, although they are not usually identified as such in the abstracts. There are one or two multiple case studies, too. Some theses using case study as the principal method indicate having used additional methods to complement the case study design. Two of the theses used a survey method of some form along with interviews and benchmarking. Action research gets only one explicit indication, one thesis used autoethnography, and one thesis used narration and narrative interpretation of personal journal entries.

The choice of methods in the theses for Technology Management does not include case studies at all. The most common method (7) is interview. Two theses used

the survey method in some form. Test trials, gathering user experiences, analysis of measurements and various types of documentation were also used. One thesis used trend analysis and two theses relied on the method of comparison of results or alternatives. An interesting and unexpected observation is that four out of 21 theses do not mention the use of any method. Indeed, the Technology Management programme seems to focus heavily on problem-solving related to working life rather than contributing to developing methods and/or understanding of them *per se*.

Theses for the Maritime Administration programme favoured the survey method, as three out of four theses rely on it along with a complementary method. The fourth one, which dealt with foresight studies, used the Delphi method.

6 Discussion and Conclusions

6.1 From disguised development to engaged development

The choice of topics shows that master's students at universities of applied sciences are very interested in describing current situations at their workplaces and organisations. While studying, students have the opportunity – even an obligation – to observe and reflect on their own work from further afield, to combine work practices with theoretical understanding. In some cases this reflection has led students towards determined development of their own work and reporting of that development work. It is probably safe to assume that some development has occurred, even in cases in which development work and method have not been reported in the thesis. The development orientation of theses manifests itself in different forms and can be described as follows: desktop research – development in sight – development process – evaluation of development process. If master's theses are supposed to be more development-oriented then more attention should be paid to the description of this process. A critical question is how students can attain experiential knowledge of development actions and even strategic development processes within relatively intensive work-study periods during these part-time programmes.

6.2 Methodological variety

Master's students' epistemological commitments were not evident in the abstracts. However, something can be inferred from the choice of methods. It seems that in the social and health care fields in particular, knowledge is thought of as being produced by people and accessed by asking them in one way or another. In business, knowledge seems to be considered as individualized and unique, pertaining to certain contexts and situations. In the technology field, knowledge seems to reside in people, documents and things from which it can be gathered via tools or measurements, and that knowledge – rather than people – solves the problem. In general, epistemological commitments should be explicated when reporting research and development work, and they should guide methodological choices.

Methods are usually chosen on the basis of what is familiar and convenient for the teacher and what is also possible for the student to grasp due to prior knowledge or preferences. Methods are often chosen appropriately on the basis of the requirements

of problem-solving. It seems obvious and understandable that the methodological choices of theses reflect the teacher and the approach to teaching and thesis supervision in any particular master's programme. Since students and their work are subject to this influence, it should be clear, however, that teachers' epistemological commitments are to be disclosed openly to students, and that students have a chance to evaluate them.

There is much discussion at universities of applied sciences about increasing the teaching of quantitative methods and about the persistence of the sharp distinction between quantitative and qualitative methods. Looking at the theses studied here, we may say that most problems they aim to solve lend themselves to a variant of qualitative methodology. It is seldom necessary to produce quantitative data and, in some cases, quantitative data could be obtained from existing sources. Looking at the issue of quantitative vs. qualitative from the point of view of practice-based research-oriented development or problem-solving, the preoccupation with the distinction seems quite unnecessary. At worst, the focus on this distinction prevents students from understanding the true epistemological commitments, which methods serve development and how methods are best applied.

6.3 What should be integrated between programmes and how should this be done?

We should direct UAS theses from individual topics towards strategic interdisciplinary RDI themes. At the same time, we should guarantee students and workplaces the opportunity to develop their own work – multidisciplinary should not be obligatory but its benefits should be noted. One way of solving this dilemma could be a multidisciplinary thematic study group model, which could also enable the local and areal needs to be more easily met.

Interdisciplinary methodological reflection is a tool for master's-level competencies. Critical understanding of interdisciplinary questions is essential for master's students. Concrete steps towards this type of understanding are taken at Kyamk as part of the Master School's common studies, including the Methodological Summer School. It is important to have this understanding as a shared vision among all master's level students and staff. Interdisciplinarity may easily be seen as a threat to professional identity among students and staff. We hope that with a shared vision this can be turned around so that interdisciplinary engagement becomes a natural ingredient in a new professional identity. The study model envisioned above would be the first step towards addressing interdisciplinary questions in real terms, thus helping professionals to adapt their respective fields and identities to the changing world.

As noted in 6.2 above, methodological choices reflect teachers' biases. Since nobody is nor needs to be a master of all methods, this perhaps represents the most fruitful place for interdisciplinary exchanges between teachers across programmes and in open discussion with students. Students' methodological awareness can be raised regardless of discipline, and this may in fact require exposure to a greater variety of epistemologies than found within any one relatively small master's programme. This would increase methodological pluralism, which is well suited to problem-solving

that is driven by practical aims but requires creative and informed use of multiple methods (Hautamäki 2007).

The practice of relying mainly on the information provided in abstracts in this article can be seen as a limitation but it also produced some very interesting results. Among these was the observation that some thesis writers did not claim to have used any method at all. It would be wise to include all Kyamk and Mamk theses from a certain period in forthcoming updates of this study – perhaps conducted together with master's students as part of their methodological training – as this would help in the development of thesis supervision practices in the new Master's School.

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Appendix 1: Summary tables of thesis abstracts from 2011–12.

Theses, Sosiaaliala (Social Services, taught in Finnish) Kyamk 2011–12

Topics and number of theses (in parenthesis)	Setting of the development task	Choice of method
Development of methods of client work (13)	<p>Goal-oriented work</p> <p>Working methods in a special unit</p> <p>Early support</p> <p>Art-based promotion of participation</p> <p>Peer support in the third sector</p> <p>Promotion of peaceful school atmosphere</p> <p>Challenging clients and development of client work</p> <p>Searching and identification of foresight data to develop client work</p> <p>Production of knowledge</p> <p>Multiprofessional work in a changing environment</p> <p>Piloting process in client work</p>	<p>Theme interview</p> <p>Focus group discussion</p> <p>Thematisation</p> <p>Forums</p> <p>Survey</p> <p>Expert group</p> <p>Content analysis</p> <p>Survey</p> <p>Lyric competition</p> <p>Content analysis</p> <p>Action research</p> <p>SWOT analysis</p> <p>Interview</p> <p>Content analysis</p> <p>Focus group discussion</p> <p>Student health surveys and FSSF framework</p> <p>Production of handbook</p> <p>Interview</p> <p>Narrative analysis</p> <p>Role-playing</p> <p>Case study, survey and journals</p>
Service quality and development (3)	<p>Client needs</p> <p>Experiences of support and its availability</p> <p>Problem finding in system level knowledge production of services</p>	<p>Survey</p> <p>Action research</p> <p>Observation</p> <p>Discussions</p> <p>Writings</p> <p>Thematisation</p> <p>Reflective analysis</p> <p>Theme interview and survey</p>
Workplace development (1)	Wellbeing at work	<p>Development appraisal forms</p> <p>Development day</p>
Clarification and development of work orientation (1)	Conflicts of work roles and their clarification in a profession	Narratives and their analysis using grounded theory
Understanding of phenomenon (1)	Excess game playing among youth	<p>Survey</p> <p>Frequency distributions</p> <p>Cross-tabulation</p>

Theses, Sosiaali- ja terveysalan kehittäminen ja johtaminen (Development and Management of Social and Health Care Services, taught in Finnish) Mamk 2011–12

Topics and number of theses (in parenthesis)	Setting of the development task	Choice of method
Counselling of personnel and personnel management (5)	Workplace well-being plan Identification of empathy exhaustion Development of group development appraisal practice Modelling the use of substitute personnel Mentoring model Evil in client work Development appraisals Rota planning	Work conference method Action research Narrative interview Content analysis Action research Process modelling Theory-based development Narratives Theme interviews of focus groups Activity theory and developmental work research
Evaluation and development of services, processes and productization (20)	Client-centred evaluation of services Development of immigrant services Development of evaluation measure Development of planning tool Project evaluation and conceptualisation of phenomenon Development of quality management system Development of a new service Understanding experiences of participation Evaluation of a self-evaluation measure Development of an operation model Project evaluation Mapping client needs Description of core processes Description of an operation model Description of selection process for a housing client Description of quality and impact of service housing Development of services counselling process Development plan for student support services Process description of strategy Productization of service model Implementation of evaluation method Use of services	BIKVA model BIKVA Survey BIKVA Process development model Action research ITE process PDSA cycle Interview Theory-based content analysis ITE2 Survey Documentation Observation Reflection Realistic evaluation Action research Process development Process description Activity theory and developmental work research Kitson's quality assurance cycle Double team method Survey, BSC Theme interview Questionnaire Time tracking Work log Structured interview Survey, frequency distributions
Johtamismallien kehittäminen (1)	Change management	Action research, theme interviews in focus groups

Theses, Terveyden edistäminen, (Health Promotion, taught in Finnish) Kyamk, 2011–12

Topics and number of theses (in parenthesis)	Setting of the development task	Choice of method
Understanding of health condition and social situation (9)	Dental health of children under seven years Impact of micro loans on the household economy of young adults Risk behaviour of young men Time management, stress and intimate relationships of students Communality among men in national service Health condition of unemployed youth Adaptation of immigrants Social networks of an adolescent in foster care Patients' need for care	Survey questionnaire Interview E-mail survey Content analysis Survey questionnaire Frequencies and cross-tabulation Survey questionnaire Frequencies and cross-tabulation Survey questionnaire Frequencies and cross-tabulation Study visits Physical condition tests Group interview Theme interview Content analysis Case study Content analysis Quality of life measurement
Description of workplace activities (5)	Capabilities of health promotion Emergency care communication Capabilities of health care personnel Customer service quality Opinions about the operation model	Survey Observation Classification Survey Sum of variables Observation and interviews Survey, asymptotic distributions
Creating an operation model or service development (5)	Promotion model for non-smoking Career development and critical study of working life Substance abuse and mental health services Curriculum Photography	E-mail surveys to Delfi panel Content analysis Observation Group interview Theme interview Content analysis Focus group and theme interviews Content analysis Interview, journals and survey
Evaluation of the impact of an operation model (2)	Impact of rehabilitative work activity on youth Client and employee descriptions of service impact	Theme interview Content analysis Interview and survey Content analysis and Excel

Theses, International Business Management, Kyamk 2011–2012

Topics and number of theses (in parenthesis)	Setting of the development task	Choice of method
Project work (1)	Knowledge-intensive project services	Multiple case study
Human resource management (2)	Initiating process Socialisation Safety culture Sharing of knowledge Competencies and capabilities in purchasing	Case study
		Case study
Change management (3)	Aligning perspectives of management and personnel Communication in a merger	Case study
	Middle management	Case study
	Classification and measurement of change management efforts	Case study with surveys and interviews
Management development (1)	Balanced scorecard Strategy implementation	Action research
Leadership development (3)	Emotional intelligence Gender	Self-evaluation Discussion
	Organisational capabilities for strategic leadership	Mini-survey
	Leadership culture Leadership style	Autoethnography
Strategy development, future studies (2)	Competitive advantage Link between forecasting and strategy	Interviews Case study
	Competitiveness Strategic management	Delphi method Scenarios
Marketing management (5)	Marketing higher education	Benchmarking
	Marketing fee-based higher education	Internal and external interviews
	Marketing sports services in social media	Case study with web-based questionnaire
	Multi-brands Distribution channels, recruitment of distributors	Multiple case study Case study SWOT analysis
	Life styles of middle class tourists Perception of service Satisfaction with service	Expert interviews Case study Desktop research
Supply chain management (1)	Information flows	Description
Customer management (2)	Customer orientation Customer information management Customer relationship management	Single case study
	Sales process Order handling Customer relationship management	-
Service development (2)	Interorganisational coordination of public services	Interviews
	Customer service system process	Explorative case study Focus group
Entrepreneurship (2)	Founding of a company Becoming an entrepreneur	Experimentation Narration, narrative interpretation Journal entries
	Business plan	Interviews Observation

Theses, Teknologiaosaamisen johtaminen (Technology Management, taught in Finnish) Kyamk 2011–2012

Topics and number of theses (in parenthesis)	Setting of the development task	Choice of method
Project management (1)	Virtual environment International projects Leadership styles	Theme interview
Data administration IT (1)	Operations manuals Standardization	Analysis of e-mail archives and IT department documentation and personnel discussions
Wikis (1)	Deployment in corporate setting User experience	-
Transportation business (2)	Profitability Cost accounting Competitive bidding Adaptation of a company	Cost tracking tool -
Vocational education (4)	Working-life based competence development Generation Y Teaching and learning methods Social media Learning environment and workplace safety Safety training Safety education Continuous improvement Integrated management system Quality management Performance measurement	- Literature review Interviews Brainstorming Comparison of alternatives
Sales management (1)	Leadership Balanced scorecard	Interviews
Future of the boat industry (1)	Boat concepts Boating concepts Trends	Trend analysis Conceptualization Materials testing
Agile methods in public ICT development (1)	Benefits from the vendor's perspective Applicability of agile methods from public organisation's perspective Benefits of agile methods in public ICT projects Vendor contribution	-
Reliability of electricity distribution networks (1)	Life-cycle costs Development of distribution networks	-
Electronic access control (1)	Prevention techniques Grey economy	Researcher's own past & user experience
Slow dry distillation of wood (1)	Wood structure Chemical composition	Test trials Analysis of measurements
Membership register (1)	Project management Data security	(Action research) Product development
Public services (1)	Business support services Experience of service recipients	Personal interviews
Human resource management (3)	Wellbeing at work Personnel wellbeing Wellbeing at work Motivation Productivity HRM in small ICT service firm HRM strategy Recruitment process	Survey Comparison between t1 and t2 Literature review A phone interview Literature review Personal interviews Discussion
Competence management (1)	Knowledge management Strategic competence thinking Competence management methods	Survey (ZEF survey tool) Theme interview

**Theses, Merenkulun hallinto (Maritime Administration, taught in Finnish),
Kyamk 2011–2012**

Topics and number of theses (in parenthesis)	Setting of the development task	Choice of method
On-board medical care (1)	Ship nurse Security environment	Survey Interviews Content analysis
Maritime education (1)	Foresight study	Delphi method
Bridge management (1)	Safety Decision-making	Simulation Semi-structured interviews
Industry image (1)	General public Maritime industry professionals	Questionnaire SWOT analysis

PART 3

PEDAGOGICAL EXPERIMENTS AT MIKKELI AND KYMENLAAKSO UNIVERSITIES OF APPLIED SCIENCES



PEDAGOGICAL ASPECTS OF THE SOLAR CHALLENGE RACING TEAM

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Abstract

In November 2011, Mikkeli University of Applied Sciences and Kymenlaakso University of Applied Sciences joined forces to establish a racing boat team. The team was to compete in the DONG Energy Solar Challenge World Cup in 2012 in Holland, with an electric boat powered entirely by the sun. This was a starting point and target for a project that initiated from the need to encourage students in their studies. This diverse, real-life design and building project was suitable for students in boat, material and electrical engineering and for designers. The organization of the DONG Energy Solar Challenge and concept of the race offered practical guidance from start to finish and served as an ideal platform for creating a student-based project. The schedule and steps were guided by the organization and, when working internationally, social aspects became highly important. During the project, the students and teachers collaborated with team members separated by a distance of 200 km, planning, organizing and managing design tasks and keeping up the actual building process. The platform offered a motivating learning environment including third-party feedback and guidance. A project-based learning philosophy as an instructional model and the “learning by doing” teaching method were the driving pedagogical forces on this project. Compared to classroom teaching, the motivation and problem-solving capability of students is higher when they confront problems that need to be solved to achieve a common goal, in this case participation in the race.

1 Introduction

The role of teaching or of a teacher is increasingly moving away from traditional classroom lecturing or information delivery toward facilitating learning, and teachers are expected to support learners along the learning path (Bender 2012). New technology offers endless resources of information and knowledge that can be accessed in a matter of seconds while manageable knowledge of a single person or institution is limited. Universities and colleges are no longer the ultimate sources and repositories of information and their socio-economic status in Finland has changed in past decade. There is thus a need to reconstruct content and the role of educational institutions while preserving the fundamental function of education. While projects and project-based learning have been popular practices for some time now, advances in communication technology and information sharing are opening new perspectives (Bender 2012). Alternative teaching methods enabled by social media are increasing out-of-classroom thinking and more social pedagogical methods are also expected at a higher level of education.

Universities of applied sciences in Finland are working in close co-operation with local organizations via education, various development projects and innovation activities. This gives rise to a close relationship between schools and the surrounding society. These relationships are directly available for teaching, and the function of universities of applied sciences is often said to be more practical or closer to working life than the academic universities, which focus more on scientifically oriented work. Since academic institutions are generally well equipped and funded for basic activities, the disposable resources generated by the institutions and active local or-

ganizations together provide a unique opportunity to develop pedagogical methods and create new learning experiences for students. It is also a great interest of educational institutes to combine business and research at a time when research funding is highly competitive. An example can be found in the recently announced collaboration between VTT and the Finnish company Protoshop, where the mutual interest is to create new business activity (Eurometalli 2013).

The above-mentioned developments in the means of sharing information, organizing education and economic demands are driving forces to engage students to collaborate in realistic multidisciplinary projects and face problems that are set by the real world. In this teaching philosophy, and the project presented in this paper, learning by doing together with project-based learning are the key methods when motivating students for better learning results. The motivation arising when working with fellow students from different fields of engineering to achieve actual physical results – the boat – and participate in an international race are believed to help students in the path towards find their own working methods and best practices. Students will also learn to handle previously gained information in a wider context. It is one target of the project that students become capable of running projects independently and are more prepared for projects to come. The learning process will cover a variety of subjects, from developing leadership skills to project scheduling and handling sudden practical limitations set by external influences.

2 Team initiation and engaging students to the project

The idea of participating in the DONG Energy Solar Challenge had independently lived in minds at Mikkeli and Kotka for a number of years before November 2011. The decision to participate was made on 3 November 2011 and this set the base time line for the project, not only in a technological sense but also from the pedagogical point of view. The race was to be held in July 2012 so the actual executable time available was eight months. There were no plans setting out what needed to be done or students yet involved and, from this perspective, the project needed a flying start. The meeting started the project and at the same time, the boat design. The first technical concepts and ideas were already on the table the same day and the team named as Midnight Sun Finland.

2.1 Organization of the design process by the race regulations

Participation in the race included nine approval steps. Most of the steps were completed during the boat design and building process, while the last steps included swimming tests for the drivers. Each step required accurate drawings from sub-assembly or partial design details including calculations to be approved by the race technical committee. These pre-defined design steps and deadlines set by the committee offered clearly marked milestones and targets for students to follow. The first steps were guided by strict competition rules that consisted of technical rules and limitations for the boats. There were also administrative duties such as a deadline for announcing participation, including insurance policies to be followed. The overall concept of the race, with all the regulations and fixed deadlines, including the ac-

tual race, is very suitable for educational purposes. It offers a clear target and direct feedback for the work done. Students get feedback from other students, from experts who are not members of their own society, from teachers and from partners in cooperation. All participants can also see how their design and decisions become reality in the form of the physical boat.

Because the design process was carried out in two cities, separated by a distance of more than 150 km, the Moodle learning environment was utilized. Moodle enabled design information to be distributed and the progress of the project to be tracked. It was necessary to arrange live contact and physical meetings between students since not all students were capable of working through the networks, causing a mismatch in the progress of the design teams. Technical challenges were also set up by the design software, which varied between groups. When individuals are used to working with one tool, it is challenging to get everyone working together in an open project like this, especially when students may be capable of handling only one particular application. A seminar was organized in Mikkeli to enable students to exchange their thoughts and plans. The seminar's topics included the cabin prototype and a large collection of material samples. At this point, the students at Kyamk had already made some prototypes from composite materials to be applied at the hull. One of the main questions at the seminar considered the hydrodynamical efficiency of the boat hull (see Figure 1).



Figure 1. Presentation and discussion around the prototype at the design seminar (Photos: Kari Dufva)

The school's laboratories provide excellent facilities for practical projects where learning by doing requires physical activities. The project utilized Mikkeli's electrical and material technology laboratories, as well as the design laboratory with wood processing facilities. Kymenlaakso University of Applied Sciences offered an important working environment at Kotka's boat technology laboratory, where the boat was assembled, and a machining laboratory in Kouvola. The machining center in Kouvola offered the opportunity to work with large-volume molded materials. The production of a high-quality boat hull was made possible by Kotka's experienced composite laboratory personnel using state-of-the-art technology, knowledge and devotion. Throughout the project, it was considered important for students to have the opportunity to take full advantage of the school's laboratory facilities and work by themselves. This helped students to feel more involved.

The DONG Energy Solar Challenge race had three competition classes, where boats differed from each other in terms of the maximum energy applied, their main dimensions and the number of crewmembers. All classes followed the same race regulations and route, and used the sun as their only energy source. The Midnight Sun participated in the B category, as the boat had two drivers and five solar panels. The type and manufacturer of the panels is strictly predefined. All participants were able to borrow panels from the organizer. The number and type of panels varied between the competitive classes. Other classes limited the number of crewmembers to one person. The length of the Midnight Sun is 8 m and its motor had a power of 2 kW, enabling a maximum velocity of 20 km/h.

3 Practical design process and team development

The boat's hull was designed by students at the department of boat technology for maximum performance in terms of velocity and energy consumption. The amount of energy that can be stored during the competition is limited and, therefore, it must be used as efficiently as possible. In addition to hull performance, the emphasis in the boat's design was energy storage and efficient transfer of energy. According to the race rules, the boat was allowed to have a battery, but the battery could not be charged during the race – only at the beginning. During the race, the battery could only be recharged by the solar cells of the boat.

3.1 Concurrent design philosophy in practice

When the boat hull and overall hydrodynamic design were started it soon became clear that the complex interaction between efficiency and performance in design targets required multiple design teams. Three main groups were set up, one for material selections for the hull, one for hydrodynamics and one for electrical solutions. Additionally, smaller teams devoted to designing the cabin and appearance were set up. Students were therefore able to work with the technologies they felt the most familiar with and where they could apply their skills. Battery concepts were provided by European Batteries, a local company that manufactures batteries that are well



Figure 2. Motor testing at the laboratory (Photo: Kari Dufva)

suiting to the technology used in the race. This provided a solid foundation for efficient energy storage. The available battery technology also made success a realistic possibility and, hence, expectations began to grow. As shown in Figure 2, the boat's engine was installed in a test bench in laboratory of the electrical engineering department to test the motor's operation under optimum conditions.

Reinforced plastic was chosen as the material for the boat's hull. This is a typical boat-building material. The reinforcing material was carbon fiber, which, when embedded in epoxy resin, produces a lightweight structure. Material selection requires a mold and this added a new phase to the construction workflow. The team members, including teachers, did not realize exactly the amount of work needed at this point, but this was also a lesson to be learned. The mold was made by milling huge polystyrene blocks and then joining them together. The actual hull material is made by first laying reinforcements and the resin against the mold's surface, and, when the resin has hardened, they connect firmly to produce a material with very high strength relative to its weight. The manufacturing process of the carbon fiber laminate using the vacuum infusion technique is shown in Figure 3. The figure also shows the simulation results of the infusion process. Studying simulation results and infusion-related parameters helps students to understand the fundamental physics behind the method. For manufacturing, it is helpful to know beforehand what is going to happen when the tap of the resin tank is opened, since the procedure cannot be reversed. A cross-sectional view of the trimaran is also shown in Figure 3.

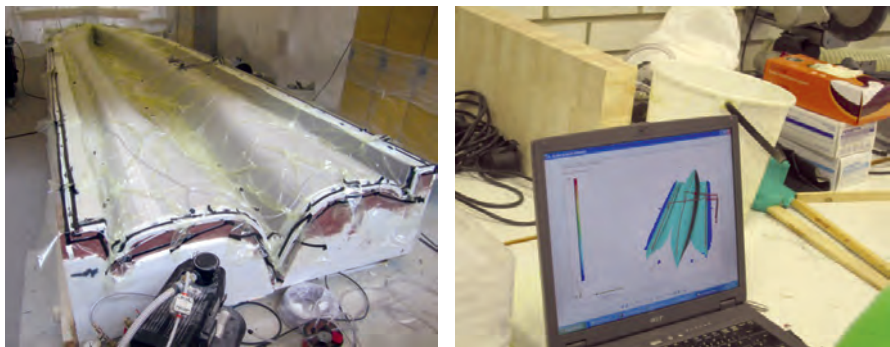


Figure 3. Infusion process starting at the laboratory and simulated flow (Photos: Kari Dufva)

3.2 Strengthening and developing the team through the project

Building a team requires more than a group of people with similar outfits (Atkinson 2001). This saying was quickly discovered to be true of this project. By the rules of the competition, the project's timeline worked out in such a way that different drawings, plans and calculations were due, approximately, every two months. Team decisions to change the layout of the boat in the middle of the process caused conflicts between design groups. While one part of the team was more eager to work with original layout, the other group was willing to go further and was in favor of a more demanding design scheme. From a team-management viewpoint, this was the most

challenging phase, to re-motivate part of the team. The team was forced to use the opportunity to return to the previous design steps. In this case, a major boat layout had to be cancelled and re-designed due to changes in the previous steps to gain approval for them again. The boat was to use an inboard engine instead of external outboard engine. The driveline became more complex to build, as well as the motor mounting and electrical controls.

Due to the long distance between students, team formation was challenging. A get-together meeting was held in Kotka in December 2011 and, at this point, the students of boat engineering had already generated initial ideas. It was clear that this group would take a leading role. On the other hand, the electrical design was driven by the students at Mikkeli. Due to this separation of groups, it was not clear to all team members who should be doing what, and when students were in new environments, work did not progress as quickly as it could have. The project was executed in a very short time with respect to the targets. Students needed more guidance than could be arranged and the lack of a detailed project plan generated much extra work in keeping the team together. When actual building work started and time was running out, the most devoted and motivated students composed the real team and pushed the project forward. It was not until then that the team members were working together for mutual goal.

4 The race and lesson in responsibility

The competition started on 14 July 2012 in Leeuwarden, Holland. The total length of the race was divided into smaller legs, of which two to four were driven during each race day. In total, the route was approximately 220 km, following the famous ice skating route, which actually can be used very rarely. The first days were devoted to inspections and safety issues, such as swimming tests. Technical boat inspections are an important part of the event, not only to ensure that the boats are safe, but also to validate the design process. The boat is required to be built as planned and approved. This is one of the key issues in terms of the lessons to be learned from the students' point of view: you must fulfill the promises you have made. The team travelled to Holland via Sweden, with ferry links between Germany and Denmark, and onwards to Holland. On the morning of 6 July 2012, the team arrived in Leeuwarden and began to set up camp. While other teams made last-minute repairs and finished their electrical work, the Midnight Sun was completely finished and ready for a test drive in the real environment. The Midnight Sun and the camp at the Leeuwarden are shown in Figure 4.

Race regulations strictly prohibit anybody other than team members being involved in any operation related to racing or maintenance. Since teachers were not part of the named eight-person racing team, the students were entirely responsible for racing. The team members decided upon the strategy and maintenance operations together with other competitive teams. Co-operation and social networking with other teams played an important role during the event. Giving control of the activities to the students gave them confidence in themselves and unified the team members when they needed to solve practical problems and find solutions to a variety of challenges. Everyone's task and duties were clearly defined and the team worked well together.



Figure 4. The boat and camp at the Leeuwarden. (Photos: Kari Dufva)

5 Discussion and conclusions

The joint racing team project was carried out mainly by students, but also required strong the commitment of teachers and laboratory members. This made it possible to build a competitive racing team and successfully complete the project. The project and the racing concept on the whole were very demanding for students. This was reflected in the actions of many teams, whose unfinished boats were still under construction during the race. Teams with more success consisted of a combination of newcomers and more experienced race participants. The Midnight Sun did not have this possibility. Some of the boats had to drop out of the race when they proved to be unreliable and unsafe.

The students who participated in this project did not receive any noteworthy study deliverables. Taking the other teams into consideration, it became clear that this activity is more of a hobby than studies. Students in some teams took a year out of their studies to fully concentrate on their racing project. Similar project activities can be found elsewhere, including Formula Student, where students build racing cars. The practical implementation of such a large project to work through the academic year is challenging but it offers a motivating approach to studying.

The framework offered by the race concept is considered to greatly support project-based learning. It is large and demanding when done for the first time, and successful implementation of this type of project will require extensive preliminary planning and guidance throughout, thus requiring a large amount of work from teachers and other personnel to guide students all the way from start to finish.

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9

AIMING AT QUALITY LEARNING ONLINE-PROMOTING TEACHERS' COMPETENCE

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1 Introduction

E-learning or online learning has been on the development agenda of Kymenlaakso University of Applied Sciences (Kyamk) for over a decade. Considerable energy has been put into developing learning technology infrastructure and support services for e-learning. This has been done with the help of various EU-funded projects, as well as through partnerships in various networks. The key idea has been that, in addition to a functional learning technology environment, technological and pedagogical support, as well as capable teaching staff, are needed to make efficient use of new technology and the opportunities it offers for learning. This article describes some of the work that has been done in the field of staff development and opens some perspectives on the results of the actions.

2 What do we mean by online learning?

Online learning, e-learning, web-based learning. Many different terms are used to describe learning that is supported by information and communication technology. In this article, online learning refers to courses that are either partly or entirely conducted in online learning environments. This means that at least part of the teaching-learning process and study support takes place online, with the help of one or more applications. From this point of view, online learning is not just self-paced independent study or a way of delivering study materials. In addition to the interaction between the student and the study materials, student-teacher interaction and student-student interaction are needed. In its purest form, online learning is conducted in the form of distance learning, meaning that students can be physically situated anywhere. In a blended mode of online learning, most of the studies are conducted online at a distance, but a proportion of the studies will take place on a physical campus. Online learning can also be used as a supportive element alongside traditional teaching and learning.

At Kyamk, online learning includes both distance and blended modes of studies. Distance learning, where the whole teaching-learning process is conducted online, is used for optional studies. Optional courses are open for registration to students from different faculties of Kyamk and also to students from other universities of applied sciences through the Finnish Online UAS network. Over 500 students participated in these courses in 2013. Blended learning is used for degree studies for adults. On these courses, students meet their teachers face-to-face once or twice a month, typically at the weekend. The rest of the studies are conducted online using video lectures, synchronous meetings in virtual classrooms (Adobe Connect), group and individual assignments in the Moodle online learning environment, and other technologies. In 2013, over 700 students participated in these studies. For other studies, online learning tools are used in various ways to support the learning process. These tools may be used for group work or bringing in visiting lecturers.

3 What makes quality in online learning?

Quality in online learning is a highly complex issue. What constitutes quality depends on the point of view taken and on the phase of the educational process. In

any case, quality consists of several factors. From an organization's point of view, quality in online learning arises from such things as an up-to-date strategy for the use of information and communication technology in learning, functioning technical infrastructure, capable staff and technical and pedagogical support for staff and students. These provide a solid ground for successful and widespread adoption of online learning. (Nichols 2008, 60; Bates 2013; Ossiannilsson 2011, 62–70) In terms of the educational process, this means taking care of the prerequisites for quality online learning (Ehlers 2004). The educational organization is in the leading role when it comes to this aspect of quality in online learning.

The teachers play a key part in the planning and implementation phase of the teaching-learning process. They are the ones that make choices on which approaches, pedagogical strategies and tools they use or do not use. In the ideal scenario, the prerequisites are in line with the objectives, and the objectives, teaching methods and evaluation practices are compatible with each other. This type of coherence indicates high-level pedagogical thinking (Aaltonen 2012, 19–20). The teaching methods should support and guide the learning process of the student and be suitable for online learning. It has been observed that teachers' personal perceptions of teaching and learning are significant factors when they make decisions about what they do. It has also been noted that what they say and what they actually do are not necessarily in congruence. Changing perceptions about teaching and learning in such a profound way that it also affects actions is neither a short nor a quick process. (See Valtonen, Kukkonen, Puruskainen & Hatakka 2007.)

4 Building capacity for development

As a result of continuous development, 2010 saw the introduction of a learning technology support unit named Kymiedu, an e-learning coordinator and a range of learning technology tools for staff to use. From the few learning management systems available in the early years of 21st Century, the technological infrastructure has been supplemented with multimedia tools that enable live video and audio connections, streaming and the use of 3D environments. Kymiedu has also served the staff of the local school district and offered short courses in using tools such as Moodle, Hot Potatoes, Adobe Connect and SmartBoard. There is great potential for the next step in the development of quality e-learning. At the same time, Kyamk and Mikkeli University of Applied Sciences have begun collaborating more closely. The two schools have formed a strategic alliance, with learning technology and online learning becoming a common issue. In the pedagogical strategy of Kyamk, online learning is seen as a great tool for making studies more flexible and accessible, especially for adult learners. Online teaching has been recognised as an area of expertise and there is a need to provide support for developing such skills.

4.1 Verkko.ope 2.0 training programme

The Verkko.ope (e-teacher) project was developed to support the changes in the teaching profession, the changing role of the teacher and the quality of online learning. In the spirit of the pedagogical strategy of Kyamk, the basis of the project was a

humanistic idea of man and a socio-constructivist concept of learning. In practice, this means that the learner is seen as an active constructor of knowledge and learning is seen in essence as a social process, something that happens as a result of social interaction (see Manninen & al. 2007, 114–116). From this point of view, online learning cannot be seen as a solitary or passive process of receiving information. Quality online learning engages learners in social interaction with each other and with learning materials and aims to produce understanding and refined perceptions of things to be learned (Ossiannilsson 2012, 66). The role of the teacher is to plan and guide learners' study process so that they are engaged in activities that trigger and support learning. It is no longer enough for UAS teachers to be specialists in their subject areas. They need to create a learning environment for the student group, ensure that everyone gets started and check that the group process gets well underway. During the course, the teacher monitors the process and guides the students when needed, allowing the students to be active learners without abandoning them. To be successful in this task in an online learning environment, teachers need pedagogical and technological skills, the right attitude and courage, in addition to subject expertise (Muhonen & Pilli-Sihvola 2011).

The Verkko.ope training programme aimed to give participants a broad perspective of the elements that contribute to quality in online learning. Online learning needs to be in harmony with the overall objectives of the organisation and the study programme. Technological tools and solutions must be based on teachers' conceptions of good learning. Teachers' workloads must be in congruence with the study credits acquired. The study process needs to engage learners. It needs to be well planned and organised and the online learning environment must be constructed according to the needs of the learning process. Learners must be supported throughout and the assessment needs to be in line with the study approach.

Verkko.ope was designed to give participants first-hand experience of collaborative online learning and collaborative tools. The goal was to show them that it is possi-



Figure 1. Intensive discussion and knowledge-sharing among teachers (Photo: Marko Sirén)

ble to create collaborative learning environments and situations online. The design process of an online course should be guided by learning goals, not by the technology. This was the way of thinking we hoped the teachers would adopt and our goal was to show them how to put this thinking into practice.

The Verkko.ope 2.0 training course took place during three semesters and it was worth 15 credits. Training was conducted in the blended learning mode as a combination of distance learning and contact sessions. During contact sessions, the participants worked collaboratively in groups. Lectures were given via Adobe Connect, mainly during distance learning periods. The participants – 16 teachers – were divided into three subgroups and each group had their own tutor. Tutors were e-learning specialists from the two universities of applied sciences (Kyamk and Mamk) and from the University of Oulu's learning and educational technology research unit. A tutor from Oulu University was also one of the lecturers on the course. Since Oulu is situated over 500km from the Kymenlaakso region, the tutor participated in contact sessions through video conferencing. The training programme was designed and lead by an e-learning coordinator and the head of the learning technology unit of Kyamk. All the tutors participated in planning contact sessions and learning tasks. Several different models of collaborative learning (Dillenbourg 1999), such as jigsaw, problem-based learning and reciprocal teaching, were used, both in face-to-face and online group work. In addition to that, the participants carried out work-related development projects, either in pairs or in groups.

The aim of the programme was not to produce a mass of new online courses but to enhance teachers' perceptions of designing and implementing collaborative learning online. The programme followed the ideal design process of an online course, starting from the presumptions lying behind the teaching practises and the wider context and role of online learning within our universities of applied sciences. From the presumptions, we proceeded to planning the content, pedagogical structure and scripting. Participants were offered various tools and models for planning, structur-



Figure 2 Oulu online (Photo: Marko Sirén)

ing and conducting their online teaching. Student workload and assessment were also discussed. In addition to lectures, group work and development projects, practical hands-on workshops were also organized. These provided teachers with an opportunity to try and learn to use different technologies and applications as tools for learning.

The concept of the training was successful, particularly in the combination of collaborative group work, the use of e-learning tools, the personal experience of being an online learner and the hands-on training on different tools. Time management was a challenge for participants and from time to time the workload seemed too heavy. One of the participants commented that “less is more”, meaning that some parts of the subject matter could have been left out and more time spent on the remaining subjects. The training worked well in broadening participants’ perspectives and opening their eyes to new possibilities. For some participants, it managed to change their prejudices about online learning (“collaborative learning CAN happen online!”). This type of change in teachers’ thinking is most likely to result in changes in actual behaviour.

The planning and implementation of the training was a collaborative process in itself and, as such, was an important learning experience for the people in charge. It has reinforced the capacity of both teaching and support personnel.

4.2 Pilot project Kieppi

Verkko.ope 2.0 was followed by Kieppi, a pilot project using mobile learning to teach foreign languages. Five language teachers participated in this small-scale experiment. The teachers were given an iPad, a MacBook and an iPod to use and they were offered technical and pedagogical support to do various experiments in their classes. The approach was very pragmatic. No formal assignments were required and there was no traditional teaching. Instead the teachers gathered regularly for a 2–3 hour workshop session guided by personnel from the learning technology unit and the e-learning coordinator. The teachers themselves came up with ideas on how to use the devices. As a result, the iPads and iPod were used to produce an iBook in French with a group of students, to record and publish student speeches, and to produce subject-specific and free-to-use photo material. One important thing was that teachers’ fear of technology was reduced and they became more daring in using technology in front of the class.

The Kieppi pilot project was not exactly online learning but represented educational use of technology. The idea was to create more engaging study experiences for students. Students in the French group were thrilled about the iBook project and participated full-heartedly in producing dialogues, video clips and other study material. They dared to get involved and speak French even though it was their first French course. The role of the teacher was merely to guide the process and compile the output of the student group in the form of an iBook. Presentation skills students enjoyed the opportunity to watch their speeches online. When peer assessment of the speeches was done using the online environment, class time was freed up for other work requiring face-to-face contact. The Swedish teacher had her own collection of photos to be used, giving her more courage and motivation to use her own

material in teaching. The students excelled when using photos instead of text as a basis for their presentations. They put more effort into expressing themselves, with great results.



Figure 3. A view from the iBook on French

The learning project was fitted around teachers' schedules and closely connected to their work. They found it to be a meaningful and stress-free way of familiarizing themselves with new technology. This supports the findings of other researchers (Fullan & al 2005, 57; Kullaslahti 2011, 178; White 2007, 847) who state that development can be best supported by work-related and on-task learning.

Kieppi was also a learning experience for the educator from the learning technology unit. To be able to support and assist the teachers, she familiarized herself with the Apple ecosystem, iOS and pedagogical uses for mobile technology. It opened up a whole new world to her and she is now enthusiastically looking for new ways to use mobile technology to support teaching and learning in a university of applied sciences.

4.3 Peda days

Although the Verkko.ope training and Kieppi pilot project were educating for the learning technology team, their expertise was also strengthened by a training programme designed especially for them. Since the teachers were taught to use technology, the technologist wanted to learn more about pedagogy, especially collaborative learning. This led to the launch of Peda-päivät (Peda days), an event with the objective of drilling down into the meaning of collaborative learning and discussing what it means in practice. How could it become alive in the work of a learning technology unit? How can the teaching personnel be supported in designing and implementing online learning based on the idea/principles of collaborative learning? Peda days were conducted as a study group, guided by the head of the learning technology unit

and the e-learning coordinator. The participants read articles on collaborative learning and the content and its relevance to the team were discussed during the group meetings. As a result a new, more profound understanding of the basis, objectives and methods of collaborative learning was reached. This led to new ways of organizing courses in the learning technology unit. Beside the traditional short courses, thematic workshops were organized. The main point of the workshops was to bring together teachers who share similar interests, present one or two practical examples of the theme and then allow time and space for mutual knowledge-sharing and joint problem-solving. Teachers found these workshops very useful.

4.4 E-learning award and Verkko.ope seminar

As sharing knowledge and good practices is important for creating a learning culture that supports high-quality learning, more ways of bringing out good practices were searched for. The Verkko.ope 2.0 training programme ended with a Verkko.ope seminar, during which the Verkko.ope teachers presented the results of their development projects. The seminar was open to the teachers and other personnel of Kymenlaakso and Mikkeli Universities of Applied Sciences. During the first seminar, a decision was made to make the Verkko.ope seminar an annual event. The second Verkko.ope seminar was arranged in December 2012 and the third in January 2014. Since the first seminar, the seminar has consisted of a mixture of keynote lectures around a relevant topic (such as mobile learning) and local case studies. In 2012, the e-learning award (Vuoden verkko-opetusteko -palkinto) was launched. The award aims to highlight and share best practices in e-learning and to improve the quality of e-learning. The prize can be awarded to a teacher, a group of teachers, an online course or an innovative way of using e-learning tools. Nominations of people or courses for the award can be made by the students and staff of Kymenlaakso and Mikkeli Universities of Applied Sciences. The winner is chosen by a panel of judges and is announced at the Verkko.ope seminar.



Figure 4. Lively discussion in the second Verkko.ope seminar in Kouvola in December 2012 (Photo: Marko Sirén)

5 Discussion and conclusions

A lot has been done and we are heading in the right direction. There is still a long way to go before online learning is seen as a mode of teaching rather than a separate or isolated phenomenon. As for today, online teaching is often regarded as separate from “normal teaching” and pedagogical development, not as a tool for reaching the educational goals of institutions of higher education (Ossiannilsson 2012, 66.), at least not in practice.

The actions described above have been small steps towards a more collaborative working culture and knowledge sharing. Cultural change is a slow process but it appears that we are heading in the right direction. As Fullan & al (2005, 56) state, there is no place for innovation in a competitive culture. What is needed instead is collaboration, open discussion and learning from others. It is not enough to train teachers and other staff beforehand or on a one-off basis (Fullan & al 2005; Bates 2013). More flexible ways of providing training to teaching staff and support staff are needed so that teachers can adopt new ways of teaching while working. Fullan (2010, 14) calls this job-embedded professional learning that is both in time and on time.

Continuous support, planned development and strong leadership is needed, too. It is no use having skilled and qualified personnel if they do not have a chance to use their skills. The leaders within the educational organization need to be engaged in developing online learning and using it as part of the learning environment. They also need to pull the majority of their staff along with them. A clear vision of what needs to be done and why, as well as the atmosphere and surroundings to enable the implementation of that vision, will support the mission. To take the positive development further, push and pull factors are needed. People need the right combinations of pressure and support to become adept and comfortable with the new way of doing things (Fullan & al 2005, 57).

As Nichols (2008, 607) reminds us, it is up to the organizations how they realize their potential and keep getting better. At Kyamk and Mamk, there is will to improve the learning experience of e-learners. As proof of that, a common eKampus – a virtual campus for the students of both Kyamk and Mamk – is being built. eKampus will be the first common campus of the two organisations. It will offer learning tools, e-learning opportunities and study support services for both existing and future students of Kyamk and Mamk. Part of the project is the development of common ways of operating in the eKampus environment. The learning technology unit, which now is part of the library and learning technology services in Kaakkois-Suomen Ammatikorkeakoulu Ltd, has an important role in the creation of eKampus and in providing pedagogical and technological support for online teachers and online teachers at Kyamk and Mamk.

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10

DEVELOPING ENGINEERING COMPETENCES BY USING WEB-BASED LEARNING METHODS

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Abstract

Bachelor's education at Finnish Universities of Applied Sciences has encountered severe problems. Financing is decreasing, while new teaching and learning methods should be commissioned. The working life of engineers has changed, and is changing all the time. Life-long learning and innovativeness are called for. Technology-based working and operating environments are the urgent driving force for a radical change in junior and adult education. This article discusses the development of engineer competences using web-based teaching and learning methods.

This article first sets out some of the background to the new competence requirements for engineers. It then focuses on current engineering competences and reflects upon the current Energy Technology curriculum at Kymenlaakso University of Applied Sciences (Kyamk). Finally, this article describes some practical experiences of the increasing usage of web-based teaching and learning methods and reflects upon the requirements of real-life engineering activities.

1 Introduction

In an outlook survey for science, technology and society, the Academy of Finland and Tekes stated in 2006 that life-long learning practices will be crucial to the success of society. The focus will be on human technologies that support learning, and on increasingly technology-based working and operating environments. This will be a trend in professional activities, as well as in civic skills, life control and social innovations. The success of those learning processes is related to the development of the communication infrastructure in society. Ubiquitous information and communication will be widely expected. Human interaction, usability and user interfaces will play an important role in that ubiquity. (Finnsight 2015, 2006.)

Several predictions of the Finnsight 2015 survey have already come true. Many people in developed countries utilize web services extensively in their everyday life and work. In addition to laptops, the usage of smartphones and tablets as user interfaces has been increasing significantly in recent years. Many societal services, such as taxation and social security services, have moved onto the web. Banking and web shopping are everyday activities for most of us. Cloud services for navigation assistance and emergencies are available in cars. Some social media services are already disappearing, while new ones are starting up. Companies, school and universities are providing ever more web-based distance learning.

The Finnish Ministry of Education and Culture emphasizes the significance of information and communication technology (ICT) in education, professional life and society in its development plan for education and research for 2011-2016 (OPM 2012, 18). According to a recent international study (PIAAC 2013), web-based communication skills among Finnish adults are rather good on average compared to those of other OECD citizens. However, 19 % of respondents were unable or unwilling to use web technology for basic everyday problem solving. The respondents were aged between 16 and 65.

The globalization of communication can be identified very clearly in the current work programme on Information and Communication Technologies for Horizon 2020 (Horizon 2013). Education and research form the basis for tomorrow's life, representing many challenges in educating the engineers of today and tomorrow. The fundamental issue is how to utilize information and communication technology more efficiently and integrate it into personal and professional development.

Engineers' everyday work has changed considerably. Most of the practical work takes place within scheduled projects. Teams may be globally distributed but virtually connected through communication networks. Everything should be documented electronically. Clear texts, diagrams and figures are expected at high speed. Customer service should be constantly available, and short messages may lead to misunderstandings.

2 Engineers' competences as reflected in the Kyamk curricula

Several institutes, organizations and companies set up and update lists of engineers' competences to aid in accreditation, recruitment, cost classification and compensation classification. In higher education, universities use these competence lists to specify the engineer competences of different education disciplines as a part of their curriculum development. Finally, the engineering competences or qualifications are the learning outcomes of curricula, study modules and courses. Principally, there should also be intended learning outcomes for every session in teaching and learning practices.

Table 1. General learning outcomes in engineering, adopted from UK Standard for Professional Engineering Competence 2013

GENERAL LEARNING OUTCOME IN ENGINEERING	DESCRIPTION
KNOWLEDGE AND UNDERSTANDING	Graduate BSc engineers must be able to demonstrate their knowledge and understanding of essential facts, concepts, theories and principles of their engineering discipline, and its underpinning science and mathematics. They must appreciate social, environmental, ethical, economic and commercial considerations.
INTELLECTUAL ABILITIES	Graduate BSc engineers must be able to apply appropriate quantitative science and engineering tools to the analysis of problems. They must be able to show creativity and innovativeness.
PRACTICAL SKILLS	Graduate BSc engineers must possess practical engineering skills acquired through, for example, work carried out in laboratories, workshops and industries, and in the development and use of computer software in design, analysis and control. Some evidence of group working and participation in major projects is expected.
GENERAL TRANSFERABLE SKILLS	Graduate BSc engineers must have developed transferable skills such as problem solving, communication, working with others and the effective use of information technology facilities. The principles of self-learning and lifelong learning are also included in these required skills.

2.1 General learning outcomes in engineering

The recently updated standard by the British Engineering Council defines the following four general learning outcomes for Bachelor engineers' education (UK Standard for Professional Engineering Competence 2013) (see Table 1).

The British Engineering Council's list of competences conforms closely to the Finnish National Qualification Framework (NQF) at level 6 for Universities of Applied Sciences (OPM 2009, 46) (Arene 2009). Both documents are based on related European recommendations.

Innovativeness at a personal level describes creativity which can be developed further with other experts. An innovative engineer stands centre-stage in innovation activities. According to Kairisto-Mertanen and Mertanen, innovation pedagogy should lead to a new generation of professionals. In this approach, the development of students' innovation skills will start at the very beginning of their studies. The innovative, measurable learning outcomes of curricula should specify both the cognitive and practical skills that are expected from future engineers. (ICEE 2012, 43–48.) The tendency to strengthen innovativeness in education practices is growing. Innovativeness appears on the 2014 curricula of Kyamk in the form of a study module on managerial work and entrepreneurship with a course entitled "From Idea to Innovation", which will be compulsory for Bachelor's students of all disciplines. All curriculum developers are encouraged to pay attention to innovativeness when specifying the learning outcomes of study modules and courses.

Cooperation and collaboration as practical skills should be trained. Cooperation means working together in a team, while collaboration refers to more complicated processes. The collaborative learning process consists of cognitive, social, emotional and motivational processes when team members are committed to shared working and outcomes. Computer-Supported Collaborative Learning (CSCL) is one method to promote collaboration in teams. For engineers' education, it is still rather difficult to create collaborative teaching and learning conditions. In her study, Vuopala (2013) deals with factors that promote or hinder collaborative learning in university distance-learning courses. According to Vuopala (2013, 194), one of the basic requirements for collaborative learning is generating an atmosphere of trust among the team members. This will enable fluent interaction within the team.

Project work is widely used for cooperative and collaborative working in industries. While current times emphasize individuality, technical facilities, such as web services, support collaboration with sharing. Sharing is not yet widely used in learning processes by students, except copy/paste methods. It may be somewhat hard to include collaboration in curricula but collaborative activities could be scripted, at least in course realization plans. Kyamk' healthcare curricula have adopted collaborative learning methods very well.

Table 2. Specific learning outcomes in engineering, adopted from UK Standard for Professional Engineering Competence 2013

SPECIFIC LEARNING OUTCOMES IN ENGINEERING	DESCRIPTION
UNDERPINNING SCIENCE AND MATHEMATICS, AND ASSOCIATED ENGINEERING DISCIPLINES	Graduate BSc engineers must have the necessary knowledge and understanding of scientific principles and methodology, and mathematical principles to underpin their education in their engineering discipline. They must possess the ability to apply and integrate knowledge and understanding of other engineering disciplines.
ENGINEERING ANALYSIS	Graduate BSc engineers must understand engineering principles and be able to analyse key engineering processes. They must be able to identify, classify and describe the performance of systems using analytical methods and modelling techniques, and apply computer software relevant to their engineering disciplines.
DESIGN	Graduate BSc engineers need knowledge, understanding and skills to investigate and identify problems with constraints including environmental and sustainability limitations, health and safety, and risk assessment issues. They need to be able to identify and manage cost drivers. They need creativity to establish innovative solutions, to manage the design process and evaluate outcomes.
ECONOMIC, SOCIAL AND ENVIRONMENTAL CONTEXT	Graduate BSc engineers need knowledge and understanding of the commercial and economic contexts of engineering processes, and understanding of the requirements for engineering activities to promote sustainable development. They have to understand the need for high-level professional and ethical conduct in engineering.
ENGINEERING PRACTICE	Graduate BSc engineers need practical engineering skills to combine theories and experiences in working with particular materials, equipment, processes and products. They need practical workshop and laboratory skills, as well as skills for using technical literature and information sources. They should identify quality issues and understand codes of practices and industry standards.

2.2 Specific learning outcomes in engineering

The British Engineering Council gives the following five specific learning outcomes for Bachelor engineers' education (UK Standard for Professional Engineering Competence 2013) (see Table 2).

The list of specific learning outcomes by the British Engineering Council specifies the necessary engineer competences in greater detail. The list of specific learning outcomes partly overlaps the list of general learning outcomes. Underpinning natural sciences and mathematics is a fundamental factor, while practical engineering skills with the management of key engineering processes and application software are necessary. Sustainable development aspects should be taken into account.

In a German study, with a rather wide coverage, engineer competences are focused from the education aspect. Among postgraduate students, some competences such as communication, project management, internationalization, entrepreneurship and company know-how are less developed than they should be, according to the expectations of employers. Learning outcomes of study programs should be applied more than before to the general competences. Special expertise and research competences are on a desired level. (RWTH 2009.)

When looking at the Energy Technology curriculum at Kyamk, most of the engineer competences mentioned in (UK Standard for Professional Engineering Competence 2013) and (RWTH 2009) have been included in the learning outcomes of the study modules since 2010, but there is no measurable evidence on the success of cooperation, collaboration and innovativeness. According to internal studies there are some signs of increasing learning satisfaction and positive atmosphere. In separate discussions, some employers have been very pleased with their new recruits from Kyamk. The developers of British engineers' education do not mention internationalization in their engineers' learning outcomes but German developers refer strongly to it (VDE 2005). Perhaps British people take project skills and English as a project language for granted due to the country's history. For small national populations such as Finland, the management of engineering English is a rather serious matter requiring a lot of training. The internationalization of education is considered a highly significant factor for the future of Finnish competitiveness (OPM 2012). Siekkinen (2013) has studied the realization and equity of internationalization in Finnish education. There are measurable results from increasing internationalization activities, and this tendency should be strengthened further.

3 Practical approaches to web-based learning methods

At the moment, the education of engineers encounters severe problems. Financing for education is decreasing, and significant changes in teaching and learning methods should be made. The requirements of life-long learning and technology-based working and operating environments represent a driving force in the direction of web-based learning methods.

3.1 Learning and teaching platforms with databases

The Moodle virtual environment, which is equipped with a database, has proved to be a very useful tool for multimodal or web-based teaching and learning. Moodle is widely used in Finnish degree education, and all over the world. Kyamk has been using Moodle since 2006 in the Faculty of Technology. There are similar e-learning platforms such as ILIAS and Blackboard.

Moodle supports cooperative and collaborative teaching and learning very effectively. The layout can be customized for users' needs. Basically, the user interface layout consists of a very clear week-based or issue-based display. Every participative teacher is able to use the database simultaneously and cooperatively. Files can be downloaded and links can be added in a flexible way, enabling students' easy access to preselected and organized learning materials. To begin with, the data-base tool-Moodle acts as a repository for learning materials but utilization gradually improves. Participative teachers start adapting their activities to other teachers' and students' contributions. In this way, they start to share. Finally, collaborative teachers will be developing their professional competences together with students.

Moodle also provides tools for student collaboration. Students may use the Wiki activity collaboratively to create team reports together. With Wikis, every participant may contribute to shared reporting, for example, and adapt her or his work to

other participants' contributions (Figure 1.). Everyone will see the contributions immediately, and anyone can comment. This collaborative working method has been tried several times in the Degree Programme of Energy Technology, and the results are encouraging. The sense of responsibility seems to increase when there is enough confidence in the contributing team. The best contributors are found on a volunteer basis.

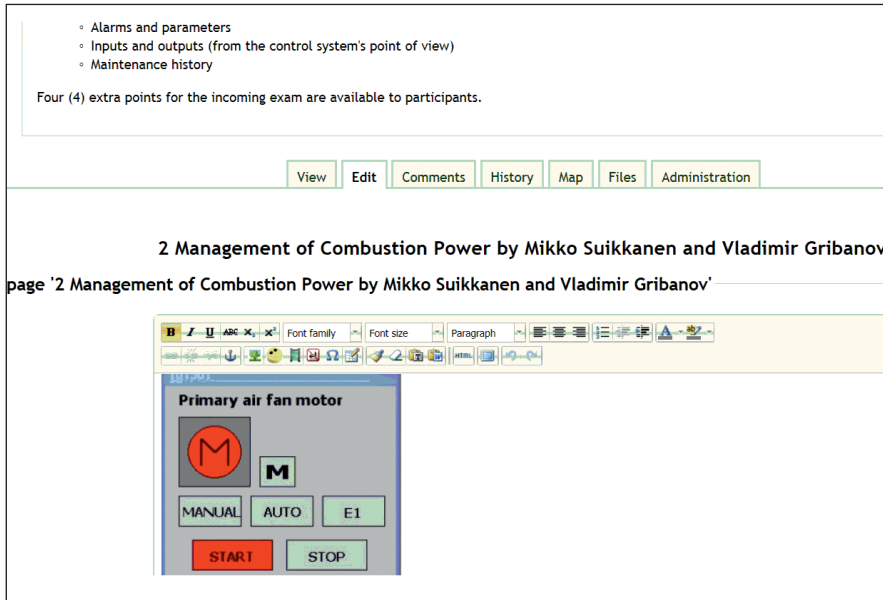


Figure 1. Shared report making in Moodle, in the collaboration of students and teachers

3.2 Communication aids

Business travelling has decreased because companies have found it necessary to compete by reducing costs. Thus there are frequent needs for various communication tools.

Some scientists and experts predict that smartphones will be the most utilized user interfaces during the next years. Today, wireless communication networks are also available in many public facilities. The versatility of smartphones and tablets increases their popularity but middle-aged and elderly people may feel that the user interfaces of smartphones are too small and impractical. Currently, tablets and smartphones are useful tools for web browsing, while laptops and desktop computers with big monitors and keyboards perhaps provide more flexible hardware platforms for long-term data processing. Students are encouraged to utilize a wide variety of user interfaces in their everyday learning. Unfamiliar terms and concepts may be checked immediately when teachers forget to explain them. Project details may be photographed for reports. Some users may get caught up in irrelevant browsing and lose touch with the situation.

Regular use of Adobe Connect, a communication tool, began in 2009 at Kyamk when the multimodal education of an adult group in the Degree Programme of Energy Technology started. The students had ten weekends (Fridays and Saturdays) of contact learning at the university every year and ten weeks of online distance learning. At the moment, Adobe Connect is mostly used for online distance learning among adult groups. Later, the usage of Adobe Connect will be partly extended to groups of younger students.

Working with Adobe Connect resembles Skype calls or video conferences with other tools (Figure 2.). The user interface layout may be customized to lecturing, workshop or discussion activities. In presentation mode, a student is in control and may show something from her or his computer to share with others. The scheme processing on the Adobe Connect Whiteboard can be collaboratively shared, too.

Since 2011, Adobe Connect has been successfully applied to a collaborative, web-based course on Wind and Solar Energy Technology and Business with Lappeenranta University of Technology. There are lecturers both from Lappeenranta and Kymenlaakso. The lecture series runs online every week, and the lecture sessions are recorded for later listening.

Adobe Connect has been successfully used for pilot teaching and learning sessions with FH Flensburg, University of Applied Sciences, and with FH Stralsund, University of Applied Sciences, both located in Germany. Gradually regular collaborative teaching and learning should take place with these universities. International collaboration among professionals will become more common.



Figure 2. Shared teaching and learning with Adobe Connect and Moodle.

4 Discussion and conclusions

It is somehow strange that interest in engineering studies seems to decrease in developed countries although everyday life is becoming more and more technical. However, most jobs are based on the use of digital communication technology.

The identity of professional engineers should develop while studying but this does not always happen. The lack of an expected professional identity may be due to a lack of motivation. The concept of systematic life-long learning should also be extended to younger generations. School institutions – including primary schools, secondary schools and high schools – and families should encourage young people to evaluate and choose a direction for their professional education and career at an early age. In this respect, professionally oriented vocational schools and high schools with specialization classes are preferable to ordinary high schools.

The educational sector in its own activities should effectively promote web-based, collaborative teaching and learning methods, and thus develop technology-based working and operating competences among future engineers. Smartphones, tablets, data-base and video facilities are well-proven communication tools. Teachers are encouraged to realize study modules or courses collaboratively with other teachers and students, even with international partners, because this mode of working resembles real-life team working in engineering. Unfortunately, life in web-based societies and subcultures may leave some people without real-life contacts.

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