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Innovation pedagogy – learning through active multidisciplinary methods

Pedagogía de la Innovación – aprendiendo con métodos activos multidisciplinares

Liisa Kairisto-Mertanen
Meiju Räsänen
Jouko Lehtonen
Harri Lappalainen
Turku University of Applied Sciences
Turku, Finland

Abstract

Traditionally, the role of education has been to give knowledge-based readiness, which later would be applied in practice to various innovation processes in working life. Innovation pedagogy introduces how the development of students' innovation skills from the very beginning of their studies can become possible. The core of innovation pedagogy lies in emphasising interactive dialogue between the educational organization, students, and surrounding working life and society. It aims to develop the student's innovation competencies which are the learning outcomes which refer to knowledge, skills and attitudes needed for the innovation activities to be successful. It is defined as a learning approach that defines in a new way how knowledge is assimilated, produced and used in a manner that can create innovations. The purpose of this study is to first present the concept of innovation pedagogy and later give examples of the methods used in Turku University of Applied Sciences to implement this pedagogical concept into the everyday life of the university. Innovation pedagogy has been developed in Turku University of Applied Sciences where it also forms part of the strategy in the university. The multidisciplinary projects of applied research and development respond to the customer needs and are integrated with education in a flexible way.

Key words: Innovation pedagogy, active learning, learning methods, innovation competencies.

Resumen

Tradicionalmente, el papel de la educación ha sido el de proporcionar una preparación basada en el conocimiento, que más tarde será aplicada en la práctica de diferentes procesos de innovación en la vida laboral. Pedagogía de la Innovación presenta cómo puede llegar a ser posible el desarrollo de habilidades de innovación en los estudiantes desde el comienzo de sus estudios. El núcleo de la

pedagogía de la innovación radica en el énfasis en el diálogo interactivo entre la organización educativa, los estudiantes, y la vida laboral y sociedad circundante. Su objetivo es desarrollar las competencias de innovación de los estudiantes, que son los resultados de aprendizaje que se refieren a conocimientos, habilidades y actitudes necesarias para que las actividades de innovación tengan éxito. Se define como un enfoque de aprendizaje que define de un modo nuevo cómo es asimilado el conocimiento, producido y utilizado de una manera que puede crear innovaciones. El propósito de este estudio es presentar primero el concepto de la pedagogía de la innovación y más tarde dar ejemplos de los métodos utilizados en la Universidad de Ciencias Aplicadas de Turku a la hora de aplicar este concepto pedagógico en la vida cotidiana de la universidad. Pedagogía de la innovación se ha desarrollado en la Universidad de Turku de Ciencias Aplicadas en la que también forma parte de la estrategia de la universidad. Los proyectos multidisciplinares de investigación aplicada y su desarrollo responden a las necesidades del cliente y son integrados con la educación de una manera flexible.

Palabras clave: Pedagogía de la Innovación, aprendizaje activo, métodos de aprendizaje, competencias de innovación.

Introduction

Universities of applied sciences in Finland were established at the beginning of the 1990s to support regional development, unlike the traditional research universities which create new universal knowledge in basic research and serve the whole society and mankind. The pedagogical approaches of traditional research universities were not suitable for the universities of applied sciences. Therefore, Turku University of Applied Sciences (TUAS) developed innovation pedagogy to promote innovations and regional development (Kettunen, 2009, 2011).

The Faculty of Technology, Environment and Business (later TEB) in TUAS is a vastly multidisciplinary educational unit, which comprises more than ten degree programmes of different fields. The combination of various fields naturally creates novel possibilities for the faculty. Taking advantage of those possibilities in a manner that best serves teachers and students as well as the surrounding society, however, is a rather imposing challenge. Therefore, the teaching at the faculty is intensely focused on connecting with the common practices of working life and emphasizing the importance of interdisciplinary activities in addition to the role of cooperation in all working practices. An integral part of building the students' future is the project-like approach to working implemented according to the principles of innovation pedagogy. From the very beginning of the studies, this approach introduces students to the present-day working life. (Lyytinen, 2011.)

The purpose of this study is to first present the concept of innovation pedagogy and later give examples of the methods used in Turku University of Applied Sciences to implement this pedagogical concept into the everyday life of the university. Innovation pedagogy has been developed in Turku University of Applied Sciences where it also forms part of the strategy in the university. The multidisciplinary projects of applied research and development respond to the customer needs and are integrated with education in a flexible way. Innovation pedagogy also supports entrepreneurship and internationalization.

Innovation pedagogy

Traditionally, the role of education has been to give knowledge-based readiness, which later would be applied in practice to various innovation processes in working life. Innovation pedagogy introduces how the development of students' innovation skills from the very beginning of their studies can become possible. (Kairisto-Mertanen, Kanerva-Lehto, Penttilä, 2009.) Innovation pedagogy contributes to the development of new generation of professionals whose conceptions of producing, adopting and utilizing knowledge make innovative thinking and creating added value possible. (Putkonen, Kairisto-Mertanen, Penttilä, 2010; Kairisto-Mertanen, 2011.)

The core of innovation pedagogy lies in emphasising interactive dialogue between the educational organization, students, and surrounding working life and society. In accordance to this its conceptual core can be divided, as Figure 1 describes, into three different spheres in parallel to the three major actor groups benefiting from innovation pedagogy: (Penttilä, Kairisto-Mertanen & Putkonen, 2011.)

- Final learning outcomes, creation of innovations and produced capability to participate in diverse innovation processes – having primarily to do with students, who are expected to create innovations while affiliating with working life
- Learning of innovation competences along side with study programme specific knowledge, skills and attitudes – being mostly connected with working life, which provides students with ideal surroundings to acquire the competences needed in innovation processes and in future working life in general
- Meta-innovations – referring to methods of learning and teaching utilised in the learning processes by the faculty members together with the students enhancing both the creation of innovations and innovation competence.

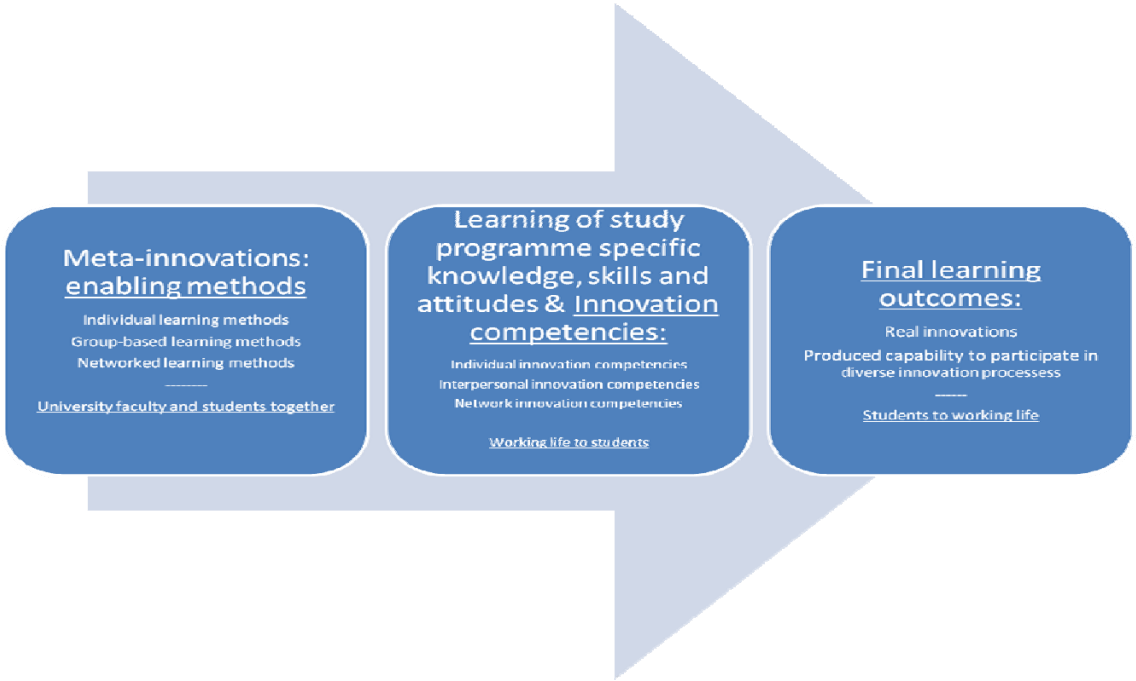

Figure n.1. The final learning outcomes according to innovation pedagogy.

Learning outcomes are statements which are used to describe specifically what is expected from a learner in form of understanding, knowledge and know-how at the end of a certain period of learning. They are broad statements of what is achieved and assessed at the end of the course of study (Harden, 2002; Buss, 2008). They represent an approach to education in which decisions about the curriculum are driven by the outcomes the students should display by the end of the course. In outcome-based education, product defines process. The curriculum is being developed from the outcomes the students are wanted to demonstrate rather than writing objectives for the curriculum which already exists. A learning outcome is a written statement of intended and /or desired outcome to be manifested by student performance. (Spady, 1988; Harden, Crosby, Davis, 1999; Proitz, 2010) Guidelines for defining learning outcomes recommend that they should be clearly observable and measurable (Buss, 2008).

The outcomes cover both cognitive and practical skills (Davies, 2002). The learning outcome is divided into components consisting of the to be achieved cognitive, psychomotor and affective domains of an outcome. They can be called knowledge or understanding, skills and attitudes, feelings and motivation accordingly. As Spitzberg (1983) points out the distinction among knowledge, skills and motivation is important because performance can be enhanced or inhibited by any one or all of these components. Learning outcomes are also guaranteed achievements which can be institutionalized and incorporated into practice. The ownership of the outcomes represents a more student-centered approach. Students take responsibility for their own learning. (Harden, 2002) As it is argued that learning outcome might not be suitable for every discipline of education literature also speaks of emerging learning outcomes and thus leaves room for emergent ones which differ from the predetermined intended ones and make unexpected occasionally occurring learning possible. (Hussey & Smith, 2008; Buss, 2008, Brady, 1996).

Innovation competencies are the learning outcomes which refer to knowledge, skills and attitudes needed for the innovation activities to be successful. The methods applied and the way how teachers and students interact constitute a base for learning and thus enable the forming of innovation competencies. The methods used also facilitate intuitive and unexpected learning during the learning process and make transmitting of tacit knowledge possible when dealing with working life. In innovation pedagogy his kind of learning outcomes can manifest them in the form of intuitive and tacit learning which takes place in the learning cituation. They can be f.ex. experiences about cultural differences, about working at customer surface etc. The core idea in innovation pedagogy is to bridge the gap between the educational context and working life. Learning and teaching processes are developed so that they provide improved competences for the students and enable personal and professional growth. Learning is deeper when the previously gained knowledge is continuously applied in practical contexts. (Penttilä, Kairisto-Mertanen, Putkonen, 2011).

Innovation competencies are learned gradually as new information is added to our knowledge structures. Knowledge acquisition and application are critical components in this process. Thus, creating new services, products and organisational or social innovations – new added value – requires both knowledge and skills, which are applied in an innovation process. (Gibbons et al., 1994; Kairisto-Mertanen, Penttilä,

& Putkonen, 2010; Nonaka & Takeuchi, 1995; Nowotny et al., 2001, 2003) *Innovation pedagogy is defined as a learning approach that defines in a new way how knowledge is assimilated, produced and used in a manner that can create innovations.* (Kairisto-Mertanen, Kanerva-Lehto & Penttilä, 2009; Kairisto-Mertanen, Penttilä & Putkonen, 2010; Nuotio et al., 2010).

Innovation can be defined in many ways. For example, Schumpeter (2003) speaks about innovative entrepreneurship. It is an Idea, practice or object which is considered new by the people (Rogers, 2006) or a solution which brings economical benefits (SITRA, 2006). In Finland's national innovation strategy (2008), innovation is understood as competitive advantage based on knowledge. Innovations are best born in a special culture which includes freedom to think, equality and brotherhood. In the context of innovation pedagogy innovation is understood as the process of constantly improving knowledge, which leads to new ideas, further knowledge or other practices applicable in working life. (Kairisto-Mertanen, Penttilä & Nuotio, 2011).

Innovation pedagogy contributes to the development of new generation of professionals whose conceptions of producing; adopting and utilising knowledge make innovative thinking and creating added value possible. (Kairisto-Mertanen, 2011; Putkonen, Kairisto-Mertanen & Penttilä, 2010) This is an important target mentioned in the Finnish National Innovation Strategy (2008), which integrates applied research and development, entrepreneurship and flexible curricula to meet the multi-field customer needs in regional and international networks (Kettunen, 2011). The core idea in the application of innovation pedagogy is to bridge the gap between the educational context and working life. Learning and teaching processes are developed so that they provide improved competences for the students and enable personal and professional growth. Learning is deeper when the previously gained knowledge is continuously applied in practical contexts. (Penttilä, Kairisto-Mertanen & Putkonen, 2011).

Hatcheries as part of learning in innovation pedagogy

In working life the way of working includes that problems are solved and innovations are created in groups and networks. However in universities the students typically study by memorising lectures and reading. Collaboration in learning is not appreciated and sometimes even forbidden. Educational research has noted the transfer problem where learning cannot often be recalled and applied in working life (Illeris, 2009). The transfer problem is recognized: the learning in one type of setting is not accessible when the learner is moved to another setting. This problem can be, at least in part, avoided by creating identical elements in education and working life. (Kettunen 2009, 2010, 2011).

According to the aims of innovation pedagogy different methods must be developed so that when the cornerstones of innovation pedagogy can be found in the learning environment. Those methods should contribute especially to the development or student's interpersonal and networked competencies. The cornerstones include gross disciplinary environment, research and development activities executed by a big amount of students, flexible curricula, concentration of

acknowledging the importance of entrepreneurship and service production and internationalization in the level of research, development and student engagement.

R&D projects carried out together with external operators and undertakings funded from external sources are part of everyday functions at TEB. An increasing amount of work conducted in the projects is performed by the students of the faculty. Thus the ability for independent and responsible working methods as well as the mastery of the basics of project work is expected of the students throughout their studies. (Lyytinen 2011).

At TEB, one of the new ideas for applying and carrying out education according to the principles of innovation pedagogy is a method called **hatchery work**. This method combines real life adssingments, peer councelling and working in gross disciplinary groups including the international aspect in all work. It is a teaching and learning method which includes different types of hatcheries. The principles of carrying out the work in the hatcheries is approximately the same but the expertise level of student varies in the different hatchery types. A first year student is capable of handling less complicated assignments requiring not so much expertice whereas a third year student has much more content, often individual, knowledge to be used when participating in the hatchery work.

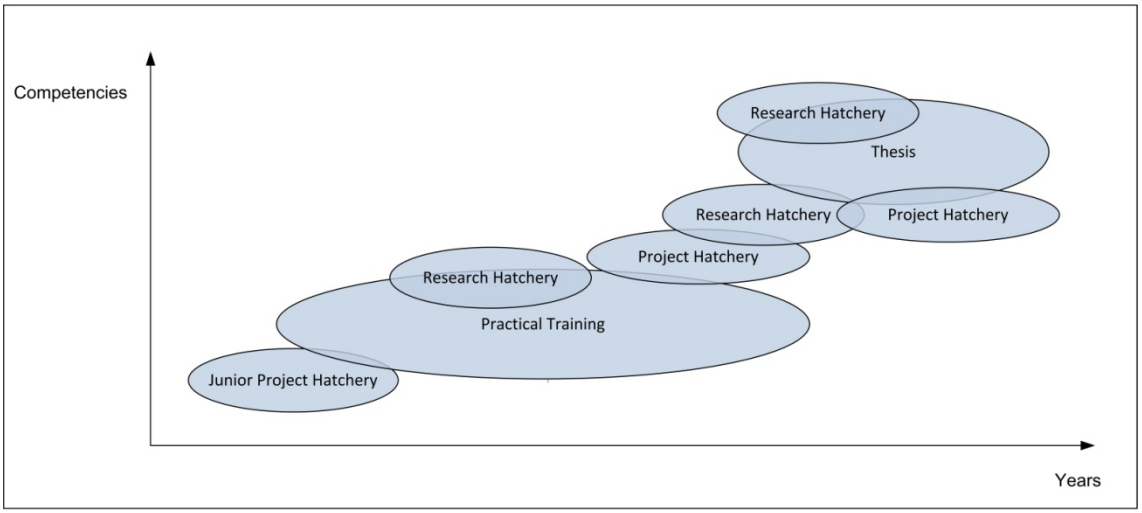

Figure n. 2. The different hatcheries in the students path.

When innovation pedagogy is applied it is essential, as can be seen from Figure 2, to give the students several opportunities to engage themselves in different kinds of hatcheries during their studies. Junior project hathery forms the base and introduces the capabilities needed for this type of studying and working. After that it is up to the student to choose between different available options.

The research hatchery is meant for the students in the beginning of their studies who have completed their basic studies and, as a result, are familiar with the basic methods of the field and have thus reached an appropriate level of general knowledge on the topics of the more advanced hatchery. The students may also have experience of project activities when they get involved with the research hatchery. (Lyytinen, 2011). A Research hatchery can form part of the studies also later on as the knowledge of the student increases and makes it possible to concentrate on desired subject

specific matters. The more advanced students can also act as tutors for younger students in the research hatchery groups.

Both the research hatchery and the advanced project hathery are essentially content-orientated. In other words, the target learning outcome of them relate to the subject matter itself. The difference between the research hatchery/advanced project hatchery and the junior project hatchery is at its greatest in this context, in junior project hatcheries the orientation is towards methods rather than contents when compared to junior project hatcheries. Working within the conceptual sphere of the project hatchery and gaining methodological skills precedes the production of content which happens in the research hatchery.

Practical training is a compulsory part of the education in an university of applied sciences and it always takes place out at the workplace where contacts to real working life are natural. Thesis work is another compulsory part of a university degree, it is preferably accomplished in close co-operation with working life. Research hatcheries bring the research done at the university to the proximity of every student. A student can participate in a research hatchery several times during the studies and move from less complicated tasks to more complicated ones as the studies progress. Advanced project hatcheries bring the working life problems to the university to be solved by the students. They offer a great and easy access point to the surrounding environment and make it possible for the students to start building networks with working life partners already during their studies.

Junior Project Hatchery – the first step in the learning path

Introduction

The Junior Project Hatchery study unit has two objectives. The first is to generate novel thoughts, methods and innovations by bringing together students specialising later in different fields. The second is to teach the students how to turn problems and differences in interests to a creative resource base (Lyytinen, 2011). The teaching goals of the concept are defined as follows:

> *The aim is to increase the feeling of belonging to the working community and to create a situation where students of different fields get to know each other, trust each other and respect each other as future professionals who are different and study different subjects. At the same time, we want to introduce the students to project-like learning and independent work as well as to help them to tolerate uncertainty right from the beginning of their studies. In addition, enhancing presentation and teamwork skills is also vital. Learning the actual content is considered less important, but it is expected from students that each group will increase their knowledge during interesting projects. Be that as it may, the most essential goals belong to the realm of soft skills. Indeed, they are the skills that have become a crucial part of any profession learned in a university of applied sciences.*

In the curriculum, the aims of the concept are described as follows. During the Junior Project Hatchery study unit, the student (Lyytinen 2011)

1. Is trained in a research-minded approach to working and learning.
2. Learns to search and utilise information independently.
3. Learns to work in a multidisciplinary team.
4. Becomes familiar with different degree programmes of the faculty.
5. Begins to create the networks s/he will need in working life.
6. Improves his/her skills relating to working in projects.
7. Enhances his/her presentation and interactivity skills.
8. Begins to enhance his/her innovation capabilities.

Implementation of the Junior Project Hatchery

Over 400 new students begin their studies at TEB each autumn and the Junior Project Hatchery study unit is compulsory for all of them. The extent of the study unit is 3 ECTS credits comprising weekly contact lessons and independent study. In the junior project hatchery, the students are placed in groups with one student tutor each. There is also a teacher tutor who is responsible for the student tutor guided junior hatcherier. The student tutors are more advanced students who are retaking the study unit in the role of a tutor as a part of their personal or optional studies. The average size of a junior project hatchery group is around twenty students. In each group there are students from every degree programme of the faculty (Lyytinen, 2011).

In the beginning of the study unit, the students are given a short orientation to the implementation and aims of the study unit, after which they are put into groups and given the topic that each group will work on during the autumn. The student tutor is always present when the hatchery group is working and the teacher tutor is present as well but mainly to guide and advise the student tutors.

Generally in the beginning of the junior project hatchery, very few of the students know each other or the university of applied sciences as a working and studying environment. Thus the central initial challenge is to create a sense of belonging to the group between students who come from different fields of study. Little by little, the primary aim becomes directing the time and resources of the study unit to the actual work as the students become more familiar with each other as the course progresses (Lyytinen, 2011).

The study unit contains of both independent work and weekly contact lessons. In the timetable of the first year students, there is a continuous period of four hours each Friday morning reserved for the junior project hatchery lessons. Each group selects a project manager who takes the lead when the topic assigned to the group is taken into examination. The groups are allowed to choose their working methods freely, but the attendance on Friday mornings is compulsory. The actual brainstorming of the project and other separate tasks take place mostly outside the contact lessons in the manner the group desires (Lyytinen, 2011).

There are predetermined compulsory tasks allocated to each group involved. These tasks are defined separately for every junior hatchery and can include f.ex. (Lyytinen, 2011):

1) Drawing up a project plan for the support of their work in the hatchery.

2) Drafting a poster relating to their results and future plans.

3) Preparing a presentation discussing their work and results.

4) Writing a final report on their activities and results.

The aim then, despite of dissimilar topics, is to provide all groups with a common template. The template introduces the basic features typical to project work and aids in achieving the central goals of the study unit (Lyytinen, 2011).

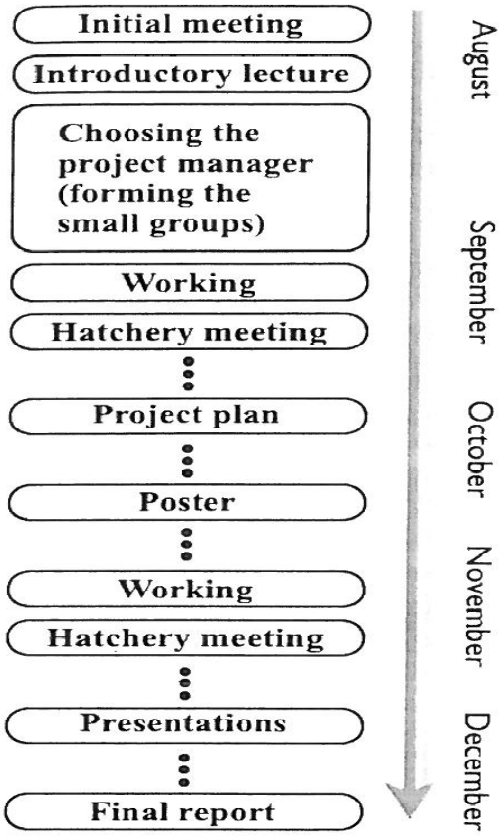

Figure n. 3. The timeline of the Junior Project Hatchery study unit (Lyytinen, 2011).

Learning outcomes in Junior Project Hatchery

A comprehensive body of feedback about the junior project hatchery has been collected from both the students and teachers in each year. The questionnaire handled students´ opinions and thoughts about implementation of the study unit, topics of the groups, expectations of the study unit, students´ activity and involment and also what they thought they have learned from the junior project hatchery. The questionnaire

included structured statements (e.g. multiple choice type questions) and open questions in the questionnaires, which were answered anonymously.[1]

The junior project hatchery´s teaching goals can be summarized into three areas[2]. It´s no longer enough that students have theoretical knowledge but he/she also needs to master social skills and must possess a strong and courageous attitude in order to be able to compete in multisectoral, uncertain and changing working life.

Based on the data (439 respondents), the Project Hatchery seemed to have a biggest effect on students´ social skills (average 3,42)[3]. This judgment is also supported by the students´ open answers. The strenghtening of project working skills and subject spesific learning (average 2,98)[4] and self-confidence (average 2,91)[5] were reacted more neutrally. There were no statistical differences in gender, educational background or implementation year.

Three different groups were found regarding the effectiveness of the study unit (Figure 4 and 5)[6]. More than one third (32,8 per cent) of the students belonged to group A. In this group students thought they learned a lot especially about project working skills and knowledge of the hatchery´s subject. They also thought that they learned social skills and that their self-confidence had increased. More than half of the respondents (52,7 per cent) belonged to group B. In this group students´ attitudes were neutral. They didn´t totally agree or totally disagree with the statements. Instead the third and the smallest (14,5 per cent) group, group C, consisted of students whose attitudes were negative. Students of this group thought that they didn´t learn from the junior project hatchery neither project working skills nor knowledge of the hatchery´s subject, social skills or didn´t get more self-confidence.

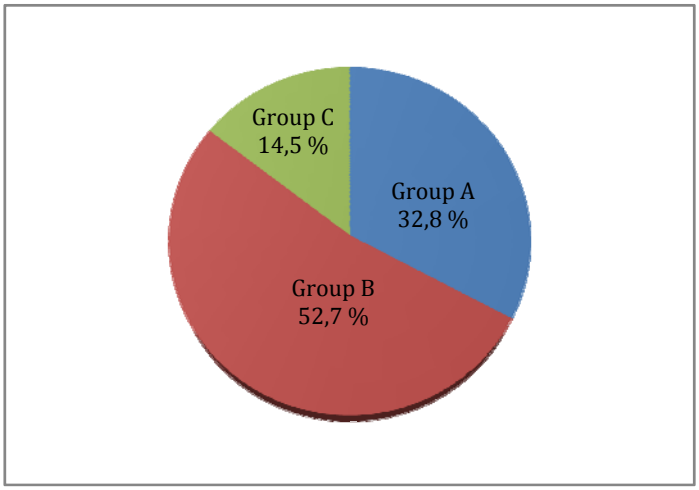

Figure n. 4. Three student groups.

[1] The collected data were saved and edited with the statistical processing.

[2] Three sum of variables were formed from the multiple choice type questions. The multiple choice type questions were numbered by from one to five. The alternatives were following 1) meant I totally disagree, 3) meant I do not agree or disagree and 5) meant I totally agree. So the higher the average of sector is the more students learned that skill.

[3] Social skills (α 0,78): In the Project Hatchery I learned to understand diversity of human. In the Project Hatchery I learned to work in group. In the Project Hatchery I learned interaction skills.

[4] Project work and subject specific learning (α 0,76): In the Project Hatchery I learned to organize things. In the Project Hatchery I learned to supervision of work. The Project Hatchery gave me good abilities to work in project based environment. The Project Hatchery increased my knowledge from the hatcher´s subject.

[5] Self-confidence (α 0,77): In the Project Hatchery I learned self-confidence. In the Project Hatchery I learned to tolerate insecurity. In the Project Hatchery I learned presentation skills.

[6] Project work skills and subject specific learning F(2, 485) = 531,120; p = 0.000. Social skills F(2, 485) = 429,294; p = 0.000. Self-confidence F(2,485) = 425,885; p = 0.000.

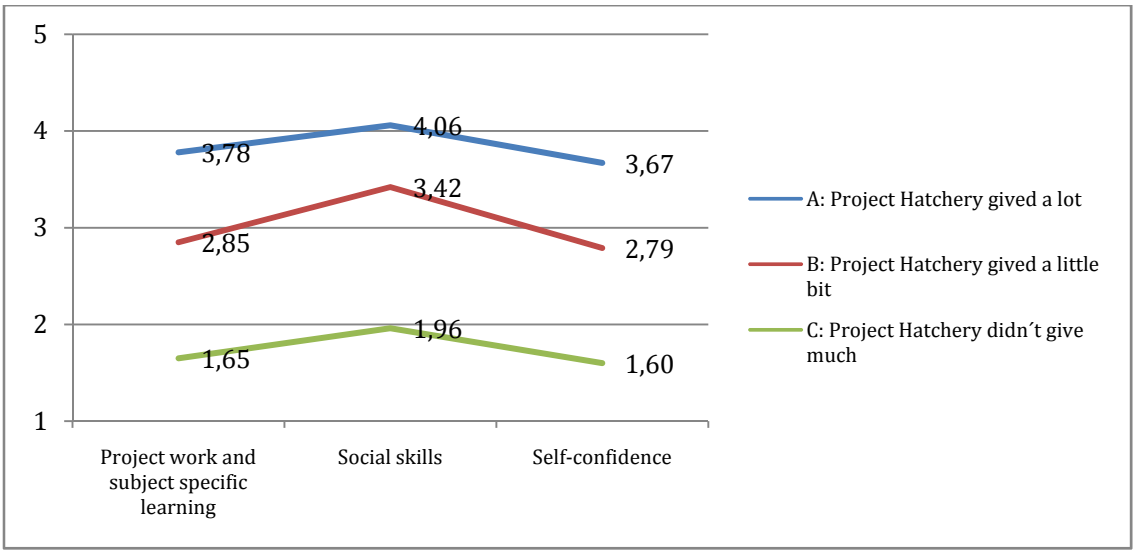

Figure n. 5. Learning outcomes in junior project hatchery according to three student groups.

The attitudes of these three student groups were also similar in the other areas of the questionnaire. Although differences were clear in the learning outcomes and attitudes, the groups didn´t differ from each other by background variables (e.g. gender, educational background or implementation year) but the students were very similar in each group.

The junior project hatchery offers good basic abilities and first steps in the innovation pedagogy learning path. The study unit develops especially students´ social skills which are very important when starting to learn other skills and competencies. These results show that in spite of a very supportive learning environment all students don't develop their innovation competencies equally. So the attitude is playing a key role. Student group C´s attitudes could tell something about general reluctance towards the new learning styles and learning environments. Thus student group A´s attitudes could reflect openness and enthusiasm towards new ways of learning. An important issue is how to get all the students to adopt a new way of thinking and an innovation attitude.

New skills cannot be adopted if we are not ready to let go of the conventional, established or outdated practices and attitudes. In other words, it is also important to know how to grow out from the traditional learning processes. To accomplish this a new learning culture which reaches throughout the whole duration of the studies is needed.

Research Hatchery - A Concept for Combining Learning, Developing and Research

Introduction

Research Hatchery (REHA) is an environment for learning and research, where students can carry out their studies under counselling and where new information is produced for research and development work. In research hatcheries, the students

work on their own subprojects. During regular meetings, students report back on their work and receive guidance to manage their work as a whole. (Kanerva-Lehto, H.; Lehtonen, J.; Jolkkonen, A. & Riihiranta, J., 2011).

Closely connected to the emergence of innovation pedagogy, the research hatchery concept has been developed since 2004. The operational idea of the concept is to offer a functional learning environment, where students, under counselling, can create new information with reliable methods by carrying out assignments originating from companies and other organisations. In other words, the goal is to combine teaching and learning with research and development activities as well as serving the purposes of working life.

Developing the concept

The REHA concept came into existence out of the practical needs for a research project that concerned underpinning of buildings. After the project started, it was quickly discovered that the project workload was going to grow remarkably, perhaps even multiply. The project budget was clearly insufficient for such an increase. As a means for balancing the budget, a decision was made to try out students as research assistants for the project. Their task was to participate in the collection of data from different sources as well as to the assorting and interpretation of the material.

The preliminary outlines for the first research hatcheries were as follows:

- The voluntary students were to be divided into small teams of three.
- Each working group member – former or present research assistant – was to be given the duty of counselling one of the teams.
- Each individual research hatchery was to be opened with one or several meetings, during which both the substance and the methods of the research were to be carefully discussed.

Other working methods were not planned in detail beforehand. The students carried out the research work partly at the project facilities and partly at home. It was soon discovered that group counselling was needed on a regular basis. Meetings in intervals of a couple of weeks were started for the whole REHA staff. The meetings included each student's oral report on their progress, and any questions or problems arising from the reports or the following discussions were considered at length. A part of the meetings was always used for counselling.

The schedule principle of a research hatchery is presented in Table 1.

Task	*Week 1*	*Week 2*	*Week 3*	*Week 4*	*Week 5*	*Week 6*	*Week 7*	*Week 8*	*Week 9*
Starting lectures	x								
Counselling meeting, all groups		x	x	x	x	x	x	x	x
Counselling meeting, group 1		x	x	x	x	x	x	x	x
Research hatchery work, student 1	→	→	→	→	→	→	→	→	
Research hatchery work, student 2			→	→	→	→	→	→	
Research hatchery work, student 3	→	→	→	→	→	→	→		
Counselling meeting, group 2		x	x	x	x	x	x	x	x
Research hatchery work, student 4			→	→	→	→	→		
Research hatchery work, student 5	→	→	→	→	→	→	→	→	
Research hatchery work, student 6		→	→	→	→	→	→	→	→

Table n. 1. Example of a research hatchery schedule during one term.

The actors of a research hatchery consist of students, student assistants and a project leader or teacher. The student assistants, older students with experience on project work, who counsel the student groups play an essential role in the system (see Figures 6 and 7). This method makes it possible for both the assistants and the students to get natural support from their fellows

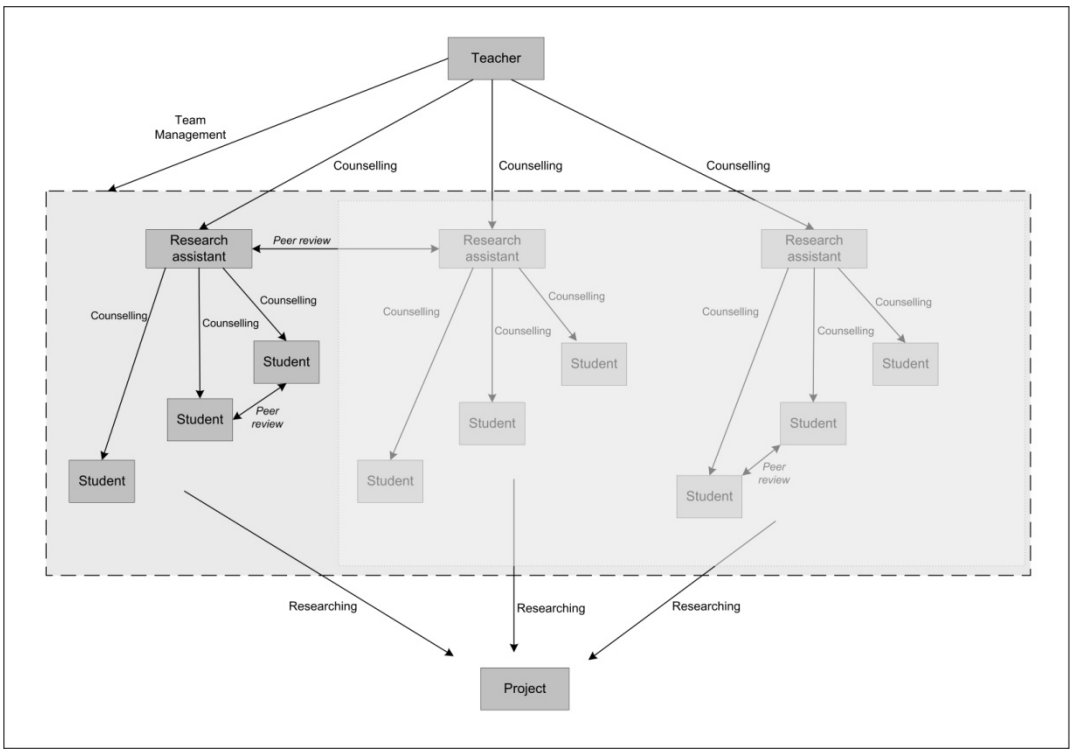

Figure n. 6. Counselling and knowledge transfer in research hatcheries.

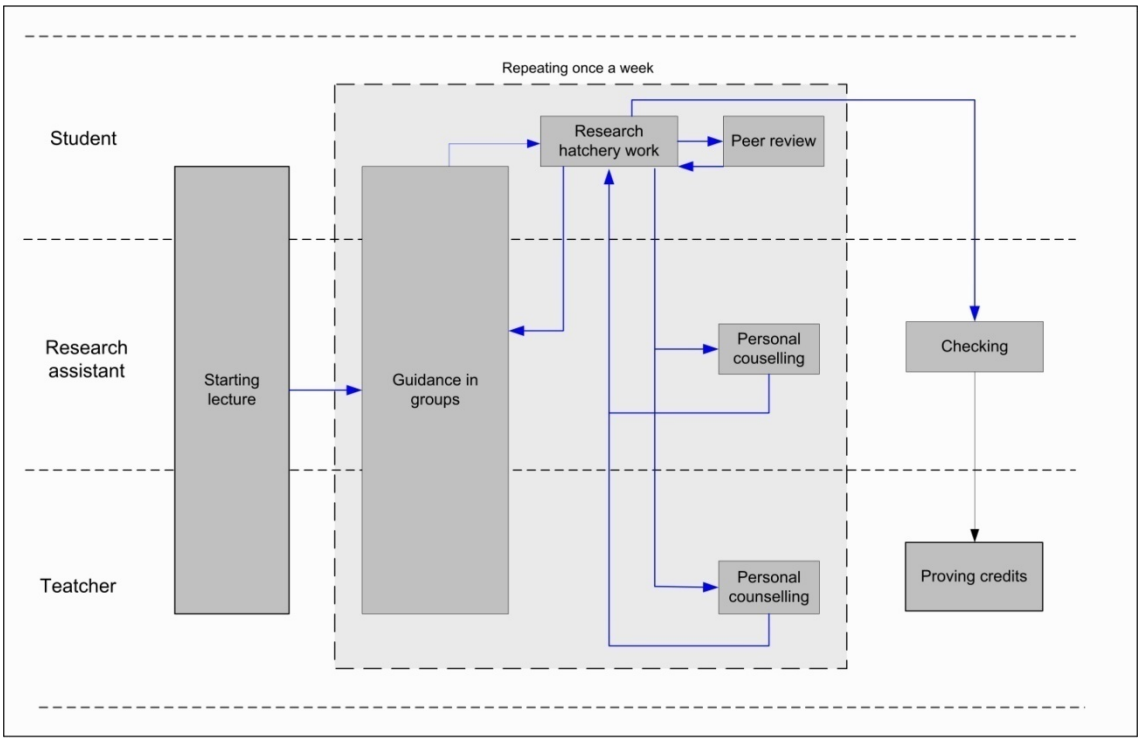

Figure n. 7. A process chart for the counselling taking place in research hatcheries.

The research hatchery differs from a usual classroom learning environment as it has more to do with teamwork than traditional school teaching. The REHA method can be applied so that the basic idea does not have to change to suit particular subject matter. However, the planning of research hatcheries should include careful consideration regarding sufficient resources in the form of financing, personnel and scheduling.

To sum up, the focal features of the research hatchery concept are:

- Research subjects arise from real-world needs for new information.
- Students take on different responsibilities of the research and get credits for their work.
- More experienced students act as tutors for their group.
- Meetings organised in regular intervals aid in keeping different subprojects together and the work flow steady.
- Peer support is always available for all participants.
- Learning occurs in different ways: through self-study, counselling and guidance as well as with the help of fellow students and more experienced researchers. (Lehtonen & Kanerva-Lehto & Koivisto, 2006).

The most important objective of the REHA concept is for the students to get acquainted with the conventions of working life. The working methods have been created to reflect that goal and to offer the students a fruitful environment to practice the skills in question. During their studies, it is possible for them to try out different working routines and make mistakes. As the learning process takes place under close counselling, the students can be given support on a personal basis.

In addition to working life skills, another important aspect for the students to learn is the project managing skills. When the students familiarise themselves with project managing already in their first study year and continue to do so throughout their studies, they have time to digest plenty of details concerning project work and its pitfalls before making the transition to working life. In addition, the connections the students make with the representatives of working life add to the students' future working opportunities and the development of their professional expertise in general. Besides the students, working in a research hatchery offers also the teachers and other employees a chance to enhance their vocational skills.

Project Hatchery: case AURAAMO

Project Hatchery is a concept of combining teaching and active learning into existing RDI processes originated in the companies. Project Hatchery consists of several advanced students' team (preferably from different study programs) which is operating with an assignment and tutored by the UAS teacher(s). Students are normally from 2rd to 4th class and earn credit points from their work, the average duration of the hatchery is three months.

Project Hatchery concept was piloted under the brand of AURAAMO. AURAAMO was a joint operation of Turku University of Applied Sciences and NOVIA University of Applied Science. It was originally planned to be a way of integrating students of Design Study Programme into companies' development projects. During the implementation and development of the AURAAMO concept, the whole approach was turned to be multi-disciplinary. Therefore in most cases companies got a multi-disciplinary team, e.g. students studying engineering, business, design to solve their RDI challenges. AURAAMO concept was co-financed by European Social Fund in the period of 2009-2011. Altogether around 25 companies took part of this AURAAMO operation and they paid 570 euros for getting a project hatchery team to boost their development activies.

These conclusions are based on a survey conducted by M. Soc. Sc (econ.) Harri Lappalainen during October-December 2011 and enriched with some remarks based on interviews of the target companies at Autumn 2010. Survey consisted of three separate internet inquiries where one was targeted to students (23 replies), one to teachers responsible for tutoring the students (13 replies) and one for companies (13 replies). All numeral grades are based on Likert scale 1-5 where 1 indicates lowest and 5 highest possible grade. Columns with Italic are quotations from replies.

Main conclusions can be summarized as follows in two categories: Added value for students' learning and added value from multi-disciplinary approach

From the students' point of view multi-disciplinary teams supported very well their learning, average was 3,9. Students appreciated a lot possibility to solve "real world problems" instead of conventional class room exercises. In some cases even though the project itself wasn't scored best when evaluating just the final results, students found executed project valuable for their learning; Project itself was not successful but it was nice to undergo everything that can be wrong in a "safe

environment". From the Innovation pedagogics' point of view learning experiences from projects were really encouraging compared to class room teaching.

This interesting aspect can be analyzed from three different perspectives: from the students, teachers and companies perspective.

In the inquiry's open questions one quarter of students spontaneously mentioned "getting familiar with people from other disciplines" as a most positive effect. They found it interesting and useful even though it is some cases it was difficult to realize own contribution to be meaningful for the rest of the team, e.g. the case could have been more suitable for marketing or technical drawing students, not that much for the students of design. Many useful innovation competencies were improved during the project, especially

When analyzing the overall added value from the AURAAMO concept, from teachers' point of view two issues were above others: the most important one was taking care of bureaucracy (average 4,0) and the other one "Added value for multi-disciplinary cooperation" (average 3,7). Traditionally there has been only a little cooperation between study programs in the execution of single study modules. Inter-disciplinary cooperation seems to be natural when target is in solving real cases , not only teaching own curriculum issues

Companies assessed the added value of getting multi-disciplinary team bigger than the extra work gained because of cooperating with the same team. The feedback especially from interviews was clear: fresh and broader ideas and solutions are more likely to stem from these teams. Some of customers are still - after finishing the assignment - cooperating with project hatchery team members. Hatchery can therefore be seen also as a recruiting channel.

Main development needs in the concept concern mentoring of students and marketing of project hatcheries.

The most remarkable issue to be developed in the forthcoming exercises is undoubtedly mentoring of students during the execution of the project. Actually students were quite critical is this matter. Obviously question is about resources of UAS but there are also some other elements to be discussed. Cooperation and especially division of tasks among personnel in UAS have to be better instructed and agreed before and during the project hatchery. The role of teachers hasn't been clear enough for all players. Especially in cases where the branch of business of the target company isn't familiar to mentoring teachers, we need the use of wider pool of teachers and RDI experts to act as co-mentors. We need also to develop guidance and internal training for mentors. Maybe a bit surprisingly this mentoring issue didn't – at least directly – reflect to the execution of those projects; companies' representatives didn't underline it.

Although companies were mainly satisfied with the added value gained by the project hatchery and the price was very reasonable, it was quite laborious to attract companies to start that cooperation with project hatcheries. Because of the wide range of study programs inside the faculty of Technology, Environment and Business, we can offer imaginative and beneficial group of students for many purposes. This

asset should be better used to gain added value for the cooperating partners as well as our students.

Overall AURAAMO operation produced a lot of useful information to be used in the development of Innovation Pedagogics approach. This project hatchery procedure can be utilized to gain new economical, social or environmental innovations, depending on the case. Customers can be from private or public sectors or NGOs. The most important thing is to increase students' competencies but at the same time we can fulfill our obligation to actively contribute to the regional development.

Conclusion

According to the principles of innovation pedagogy, main emphasis when implementing active learning methods at Turku University of Applied Sciences is to contribute through them to the development of students' innovation competencies. These competencies are formed according to the needs and expectations in working life where the needs are dynamic and under a constant change. The examples in this paper, the different hatcheries are developed according to the principles of innovation pedagogy. They provide a multidisciplinary learning environment and engage students in active learning and working together with companies and other working life organizations.

During the development process of these methods it has become obvious that a measuring tool – innovation barometer – is needed for the measuring of learning outcomes. A research group – control group setting is used in the piloting phase in order to evaluate how the aim of developing innovation competency succeeds when education is done applying hatchery work. Our aim is to confirm our belief that through this kind of learning, compared to more traditional lecture based learning, innovation competencies are reached better than earlier.

The development process in TUAS currently is not focusing only on the definition and assessment of innovation competencies but also emphasizing critical reflection of the definition, framework and implementation of innovation pedagogy. New learning and teaching methods are also constantly applied by the TUAS faculty, and their usefulness is tested once the innovation barometer is defined.

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Acerca de los autores

Dr. Liisa Kairisto-Mertanen (Turku University of Applied Sciences: TUAS) is dean at the faculty of technology, environment and business. Prior to joining the university she served in business life. She received Dr.Sc. in marketing in year 2003. Her special interest are in developing sales education both in the field of business administration as well as in the field of engineering in Finland and also contributing worldwide to the creation of Global Sales Science Institute (GSSI). Currently she is also involved in the development of a new pedagogical approach called innovation pedagogy. She has published several papers on the fields of both innovation pedagogy and sales work.

M.A. (Educ.) Meiju Räsänen has graduated in 2010. She has worked as a research assistant at Unit for Evaluation and Development of Education in University of Turku. At the moment Räsänen is working as a Project coordinator in Turku University of Applied Sciences. In addition to the coordination tasks she is counselling and teaching students. She is also involved in the Innovation Pedagogy team.

Dr. Jouko Lehtonen is Principal Lecturer at Degree Programme of Civil Engineering in TUAS. He has specialized to micropile technology since late 1980´s and he chaired the International Society for Micropiles in 2006 to 2009. Dr. Lehtonen has published several papers on new innovations in pedagogy, covering especially the research hatchery concept.

Soc. Sc (econ) Harri Lappalainen has worked since 1997 as a trainer and organizer of intensive training programs in Higher Education and also in adult education and vocational training. He has extensive experience on evaluation in several levels: EU programs, EU projects, educational institutes, EU project proposals as well as individual level assessments. Lappalainen holds a Certificate of Competence-Based Personal Evaluation, acknowledged by the Finnish Psychological Association. In addition to his Master's degree he has executed 1,5 years University-level "Consultative methods as tools in personnel development" intensive studies. Lappalainen has several years' experience on working in multicultural environment. At the moment Lappalainen is acting as a Special Adviser in the Innovation Pedagogy team in Turku University of Applied Sciences.