

## BUSINESS KNOWLEDGE TO DOCTORAL STUDENTS OF TECHNOLOGY

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### ABSTRACT

This practitioner-oriented case study describes how business knowledge is introduced to doctoral students of technology. In Finland people with doctoral degrees pursue increasing numbers of business careers. Still, doctoral studies prepare students for academic research and work. Business managers have keen interest in high level expertise but remain puzzled about how these competent experts are able to exploit their advanced knowledge to the benefit of business. To heighten doctoral students' awareness of business knowledge and problematics, the course "Mastering Business" was offered in the Graduate School in Electronics, Telecommunications and

Automation. In the course constructivist pedagogy informed teaching because it promotes learning as an active, cognitive and social process in which individuals build their view of the world by interpreting new information using their previous knowledge. The case shows that using constructivist pedagogy enables competent experts to explore new applications of their knowledge in business settings.

## **INTRODUCTION**

Recently, a new problem has emerged in Finland. People earn doctoral degrees in increasing numbers and only a minority of them can pursue academic career. Still, doctoral studies prepare students for academic research and work. But how these academic skills and knowledge should be used in business settings is an issue under discussion. Business managers have keen interest in high level expertise but remain puzzled by how able these competent experts are to exploit their advanced knowledge to the benefit of business.

To meet this challenge a two-module course “Mastering Business” was planned and offered to doctoral students of Graduate School in Electronics, Telecommunications and Automation, GETA at the Helsinki University of Technology. The course was aimed at promoting business knowledge and entrepreneurship among post-graduate students.

Entrepreneurial behavior has become more and more common, calling for better entrepreneurial skills and abilities for dealing with the current challenges and an uncertain future. There has been a structural and attitudinal change in educational institutions, including universities, making them reconsider their role as promoters of entrepreneurship and entrepreneurial ventures. (Heinonen – Poikkijoki 2006, 81) According to Cope and Watts (2000) such entrepreneurial learning can be promoted in “learning by doing”.

## **THEORETICAL BACKGROUND**

Expert knowledge can be divided in three main components: formal knowledge, practical knowledge, and self-regulative knowledge. Formal knowledge can be described as universal and explicit while practical knowledge also called procedural

knowledge manifests skills or “knowing-how”. Traditionally formal knowledge has been studied at educational contexts while practical knowledge in working-life contexts. In recent years knowing and doing are seen as inseparable. Self-regulative knowledge consists of meta-cognitive and reflective skills that persons use to monitor and evaluate their own actions. Attention has been paid to the integration of these three elements in recent years when building expert knowledge in learning. (Tynjälä 1999b,5)

Problem-solving is used as a tool when pursuing the integration of expert knowledge. Formal knowledge from text books and lectures will be transformed to a skill by solving problems. In Tynjälä (1999b) referring to Bereiter and Scardamalia, expertise is defined by “surpassing oneself in a process of progressive problem-solving” (p.10). Solved problems lead to a deeper understanding and mental resources. Such problem solving can be accorded to an investment of the expert’s best seen in scientific communities. The knowledge is shared by the members of the community. They support and help each other. Regardless of this universities have been criticized of being places for knowledge transmission. According to researches best results when building expertise have been reached by using constructivist view of knowledge and its pedagogical applications. (Tynjälä 1999b,11)

Collaborative learning is a popular topic in education. It refers to a fact that people are working together on a task. Recent studies have been focused on under what circumstances collaborative learning is more effective than learning alone. Important elements in collaborative interactions are: interactivity, synchronicity and negotiability (Dillenbourg 1999, 11). A main difference between collaborativeness and a hierarchical interaction is that a person has the right to argue for his standpoint, justify and negotiate. Persons learn by explaining to themselves (self-explanation) and when several individuals interactively explain to each other (interactive explanation) (Ploetzner – Dillenbourg – Preier – Traum 1999, 103). A theory of collaborative learning concerns of 1) criteria of defining the situation 2) the interactions 3) process, and 4) effects.

Often collaborative and cooperative learning are used as synonyms. Collaboration necessitates that participants are engaged in a coordinated effort to solve a problem or perform a task together (Littleton–Häkkinen, 1999, 21).

According to Tynjälä (1999b, 88) the difference between traditional and constructivist learning appears in the students' subjective descriptions of their own learning. Tynjälä continues, that constructivist learning emphasizes gaining ability to apply knowledge, developing critical thinking skills, changing conceptions of the topics studied and moving from dualism towards a more relativistic view of knowledge.

### **CASE: MASTERING BUSINESS**

The course "Mastering Business" was planned and organized in a project called WomEqual, financed by the European Social Fund. The project's aim is to promote women in technology fields and their innovation activities and entrepreneurship. The course was piloted in the largest graduate school in Finland GETA, Graduate School in Electronics, Telecommunications and Automation (67 positions). Other partners involved were Technology Industries of Finland (choosing IT companies) and Life Works Consulting Ltd (lecturing). Target groups were mainly post-graduate students in fields represented by GETA. The course was highly recommended to women. 50% of its 14 participants were women.

The aim was to make doctoral students aware of business knowledge and problematics. This is important in many ways and not only for the future entrepreneurs. Business knowledge will help in seeking employment opportunities in the private sector after graduation from the graduate school. The importance of leadership and management skills rises when a person is highly educated.

Innovativeness and creativity, new ways of thinking are introduced in the business course. Therefore, a perspective on knowledge building was necessary. Constructivist pedagogy was chosen because it promotes learning as an active, cognitive and social process in which individuals build their view of the world by interpreting new information using their previous knowledge. Learning is not seen only as passive

receiving of information. It is a process in which understanding instead of memorizing is emphasized. Interaction and collaboration are important ways of learning. This was to be proved in a real case problem set by four companies involved and solved as a groupwork.

The course "Mastering Business" consists of two modules: *Business perspective to technology (3cr)* and *Leadership in expert organizations (5cr)*. It was recommended to participate to both modules. The course combined residential periods (three contact teaching sessions of two days each six weeks apart from each other), independent study and team learning.

The course was carefully designed collaboratively in a team of five people representing the partners. The graduate school organizer provided the team with experiences and practices of the university, lecturers brought in their experience in teaching doctoral students of business and the representative of business association reflected upon the interests of business companies towards educating engineering PhD's in business.

Next, we describe eight principles of constructivist pedagogy by Tynjälä (1999a) and show how they were applied in the case of "Mastering Business".

*1. Students' previous knowledge effects their interpretation of new knowledge and should therefore be considered in teaching.*

When signing in, students wrote a short description of their previous knowledge or experiences in business. These descriptions were used in two ways: First, in designing the content and in formulating a pre-understanding of the students' level in business studies, and second, in assigning each student to a case-group closest to his/her own research interests.

*2. Teaching should foster students' desire to know by encouraging them to discuss, debate and examine critically their interpretations of a topic.*

Already in the first residential period students started to work with a real life business case. There were four case companies, which the lecturers had contacted and visited prior to the course in order to define the case problem together with the company manager. The company managers introduced their company and the case problem to all students, and then, had a discussion with the group assigned for the particular business case. The students asked questions to get an understanding of the scope of the case. Lecturers monitored each discussion group and helped, if needed, in wording the case problem.

*3. Student stake responsibility for their learning when teaching proceeds from support and external control to self-control and own initiative.*

At the beginning of the course, lecturing method was used to provide the students with a general framework of business knowledge. As the course proceeded, the interaction both amongst the students and between the students and lecturers increased. Group work put pressure on the students to share information and discuss their views on its applicability to the case problem. In the second residential period the students presented their views more actively and were also prepared to debate with the lectures and each other.

*4. Students seek opportunities to learn and think. Lectures provide basic knowledge and understanding; problem solving and assignments invite to own knowledge construction.*

In between the residential periods, students were instructed to work as teams. Each team worked on the business case. Supervision was provided via internet phone-call sessions for the whole group, and also, e-mail support was given. In the case work, students were encouraged to seek business literature from electronic libraries. Students were also assigned independent reading for the course before and during the course. They were asked to write summaries of some of the material they had read.

*5. Collaborative learning methods encourage students to reflection, knowledge sharing and peers support.*

The student feedback stated clearly that this course was among the few they had taken which was based on active interaction among the students and between the students and the lecturers. Students also became more active in discussions as the course proceeded. The interaction was considered as useful in a course where students have little prior knowledge of the subject. Also, students felt that understanding business problematics was difficult as no clear problems to be solved could be stated and as each phenomenon had several different theories explaining it, each from a different angle. In this confusion and even frustration, discussions and interaction was beneficial for the learning.

*6. Students feel that they learn when they succeed to put acquired knowledge into action in a novel situation.*

Students were excited to work with real life business cases. At the beginning of the course, when the students were just introduced to the new field, the students felt insecure of their expertise. As the course proceeded and students became more experienced in business problem solving they also became more confident of their competence. Working with a team assignment was a new experience for many and some teams managed to organize their working schedule better than others. The working method of the team reflected on the results of the teamwork. If the result did not meet the set criteria, the team was asked to rework it until the result was acceptable.

*7. Attention should be paid to the cultural preconditions of learning.*

The team decided that teaching will be in Finnish. The graduate school offers most courses in English due to doctoral students and lecturers who cannot speak and write scientific Finnish. However, it was reasoned that learning could be cognitively too demanding if the students needed to learn theories and analytical constructs of a new research field in a foreign language. Learning in the course required that students were able to use language as a thinking tool while listening and participating in class room interaction. The choice proved to be a good one. Students were able to ask even if they did not know how to formulate a question. It was easier to think aloud in native

language. Others were able to join in and suggest their own interpretations. This way, many questions were reconstructed and answered collectively.

Between residential periods an e-learning tool was used to facilitate group work. Communication and interaction over distance was needed because students represented far apart located universities from Southern, Western and Northern Finland. Free internet call software "Skype" was tested. At the beginning of the course, lecturers scheduled one-hour sessions with the groups. Between the residential periods groups also met over Skype. They circulated the report via e-mail, and one group used internet software to write the report. Clearly, the students were highly able and willing to take advantage of the internet.

#### *8. Evaluations should comprise both the process and results of learning.*

Several different evaluation methods were used. Students filled in a questionnaire with both numerical evaluations and open ended questions. Students also evaluated their own learning, and they were encouraged to include reflection. According to Heinonen and Poikkijoki (2006, 87) Mezirow's ideas of reflection are preconditions for the formation of ideas that will produce new activity. Also an exercised on-going evaluation of the team work was collected. Most participants considered the course as demanding, but fruitful and a learning experience. The students appreciated group discussions and highly motivated, excellent teachers. The schedule was too tight. Evaluations were discussed with the students, and ideas on how to improve the course were collected from the students.

The representative of business association contacted the business managers and discussed feedback and suggestions for improvement. The business managers found this kind of collaborative problem solving with post-graduate students very fruitful.

## **DISCUSSION**

Applying constructivist framework in practice requires a lot from the students but also from the teachers. The interactive and collaborative learning requires investing oneself to

the process of learning. The learning process needs to be managed and facilitated by the teachers. For the students the method can seem time-consuming but also very fruitful. Engaging in the discussion and discovery of new insights can be built on the previous expertise. Great benefit has been discovered in the interdisciplinary atmosphere which the course creates in the interaction of business and technology fields of science.

The expertise the post-graduate students have acquired during their education can be transferred to other fields, if it is genuinely recognized and appreciated. Our case enhances the possibilities of such expertise transfer and encourages the students to take more advantage of their knowledge and skills by exploring its applicability in other contexts.

Based on our experience we recommend constructivist pedagogy for introducing unfamiliar field of knowledge to competent experts. Constructivist pedagogy emphasizes active role of the learner and interaction. To be able to use his/her competence more fully in a new setting, an expert needs opportunities to discover how his/her way of knowing enables and restricts him/herself to make sense of the new context. This is best achieved when people feel encouraged to experiment and discuss their learning experiences. Finally, we strongly recommend teaching in the native language of the learners.

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