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Abstract

Place Technology Management is a unique program at Lund University, where a selected number (40) of students from the Faculty of Economics and from the Faculty of Engineering are taught together during their last 2 years of study. Their degree will be a Master's degree. Their views on problems and challenges in today's industry often complement each other. In addition it is important to complement their academic knowledge with insights about themselves and their own behavior. The introduction of so-called Learning Journals has proved to be a successful step in this direction. The learning journals are introduced in the course Project Leadership. Throughout the whole course (2 semesters) the students are writing learning journals and supervisors are commenting monthly. The learning journals have the purpose of 1) enabling personal reflection on the own process, 2) enabling reflection on the own position and part in the group, and 3) through the longitudinal effect of the course; it provides an opportunity to compare journals over time to become aware of and able to analyze the own learning process. In a newly performed Placement report, students that have graduated from the Technology Management programme the last 10 years, rate their education 4.37 out of 5. Some students even consider the Learning Journals among the most valuable parts of the whole programme in retrospect.

Introduction

The ultimate goals for Lund University in Sweden, as of most universities in Sweden and around the world, are to perform research, to assure education and to interact with the society outside university (LU 2006). Lund University was founded in 1666. Today it consists of 9 faculties with a total of approximately 39 000 students. The Faculty of Engineering (LTH) and the Faculty of Economics (EHL) are two of its largest faculties with about 5000 students each (Johnsson et al, 2006). The education at these faculties, as within the rest of the university, should be of best quality and prepare the students for their careers after graduation so that they will be able to work in high responsibility jobs in society, both nationally and internationally. After graduation, approximately 5% of the students chose to stay at the university performing research whereas the remaining 95% of the students look for an employment elsewhere. In many cases this implies finding a job in industry. One important educational goal is therefore to provide the students with useful knowledge, insights and material that they can apply in industry concerning various subject matters as well as concerning themselves and their own behavior.

Technology Management is a unique program at Lund University, where a selected number of students from the Faculty of Economics and from the Faculty of Engineering are taught together during their last 2 years of study. Their degree will be a Master's degree. Their views on problems and challenges in today's industry often complement each other. In addition it is important to compliment their academic knowledge with insights about themselves and their own behaviour. The introduction of so called Learning Journals has proved to be a successful step in this direction.

Technology Management

Academia traditionally offers, on the one hand, people with a deep knowledge of management and economics but lacking an understanding of the underlying technologies and, on the other hand, engineers with a thorough understanding of technology but with only little knowledge about business. A new academic Master's program – Technology Management – was initiated at Lund University in 1997 and involves 40 students each year.

Figure 1: Technology Management, Lund, Sweden

The program integrates Technology and Management in three dimensions; program curricula, students and teachers. The program has been developed in cooperation between Faculty of Economics (EHL) and Faculty of Engineering (LTH), both part of Lund University in Sweden. The aim is to provide the business students with an understanding of engineering and the engineer's way of thinking, and the engineering students with an understanding of management and economics (Sörgärde et al).

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The program can be divided in three phases:

- Phase I covers the first 3 years of the engineering students' program and the first 3 years of the business administration students' program.
- Phase II prepares the engineering students with rudimentary knowledge of business administration, management and economics, and the business administration students with a basic knowledge of technology and engineering. This is done by letting the business students attend a selected number of courses in technology, and engineering students in courses in management and economics. The duration of Phase II is about one year.
- Phase III is the fully integrated conclusion of the program with one and a half years of courses plus a 6 month master's dissertation. During Phase III, the students are working side-by-side engineering students and business students, giving ample room for understanding each other's way of thinking and working. The students find means of utilizing each other's differences in skills and interests and turn them into advantages instead of being obstacles for co-operation. The courses in Phase III are designed to include both engineering and management aspects. The participating teachers in a course come from different faculties, and cooperate in the joint teaching of the course. The master's dissertation is performed during a 6 months period by a group of two to three students with at least one student from each faculty.

After concluding the program, the students are awarded a Master's degree in Engineering or Business Administration depending on their academic point of origin.

The outline of the Technology Management program is shown in Figure 2.

There are seven courses included in Phase III; Market-Driven Product Development (MDPD), Project leadership Part1 (PL-1), Technology, Strategies and Structures (TSS), Innovation Engineering (IE), Project Leadership Part 2 (PL-2), Teamwork and Leadership (TL) and Master Thesis.

In each of the seven courses, teachers are involved from both the Faculty of Engineering and the Faculty of Economics. One example of this is the course MDPU in which product developmen is studied from a technical as well as a management and economical point of view, all in order to generate products that fullfill the market demands and are possible to realize from a technical as well as economical aspect. Most courses also include a contact with a real industrial company.

Good Academic Thinking

The Technology Management program is designed taking concepts such as of Good Academic Thinking (McCormick, 1997) into consideration. The concept of Good Academic Thinking highlight four aspect that are of importance for successful teaching and learning; Motivation, Knowledge, Strategies and Metacognition.

- Motivation: A student's motivation for following the program of Technology Management can be either extrinsic (threats and/or promises) and/or intrinsic (fun, interesting socially rewarding). It is important that the students find the intrinsic reasons for why they are studying. Already in the application to the technology Management program, the students are asked to reflect upon their source of motivation.
- Knowledge; In order for a student to grasp, understand and to find the subject matter knowledge interesting, it is important to understand the knowledge that the students enter the program with. If a course starts off with material "too far away" from the knowledge they have, there is no way for them to connect to the new material, this phenomena is referred to as the Zone of proximal development (Vygotsky).
- Strategies; the learning styles of students can be divided into deep learning strategies and surface learning strategies (Marton et al 1976), (Ramsden 1992). A student with a deep learning approach focuses on what is signified and constantly tries to relate previous knowledge to new knowledge, whereas a student with a surface approach to learning is more focused on trying to find out what the teacher wants and to provide this, information is simply memorized and the focus is often on unrelated parts.
- Metacognition: Metacognition means to have a helicopter view on ones own learning progress. Metacognition is intertwined into the program on several occasions. One example is the introductory-day for the newly accepted students to the program. This day coincides with the day the elder most students have their
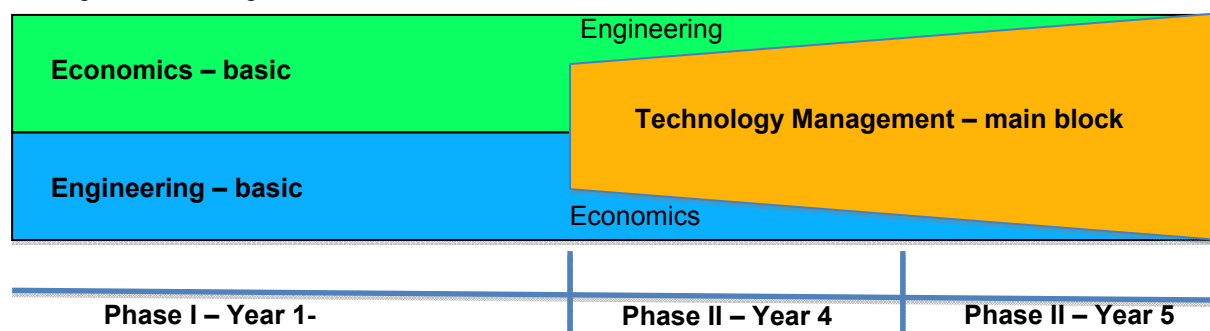

Figure 2: The outline of the Technology Management program.

Master theses presentations. One activity on the introductory-day is to spend about 1 hour attending the Master Thesis presentations, in this way the new students get to see what will become of them in two years time, and the elder students are reminded about their own start at the program. Metacognition also includes having a helicopter view on ones own personal development; this is supported by the Learning Journals.

According to the Bologna agreement all courses are described in terms of Learning Outcomes (Biggs, 2003). In addition to course specific learning outcomes there are also Program specific learning outcomes such as occasions for Metacognition etc. Due to administrative obstacles, program learning outcomes have to be listed as part of learning outcomes for a single courses. The program learning outcome regarding personal development, for which Learning Journals is a tool, is therefore included as a learning outcome for the course Project Leadership.

Project Leadership

The course Project Leadership starts the second term of the Technology Management program. The course is divided into two parts, encompassing one term each and with a total duration of a year. During the first part of the course the students perform an evaluation of an existing project in a firm or organization. During the second part students then carry out a project formulated by themselves together with their hosting organization. For these purposes the students work in groups in collaboration with companies. When the students enter the first part of the course they have already been divided into working teams or groups of five students per group, mixing students of both sexes as well as from engineering and business administration. The programme managers define the groups and the students have no say in the process. Each group is then allotted a supervisor who guides the group through both parts of the course. Also all groups are assigned a reference group amongst the remaining groups in the class. The combined two groups become a sounding board for each other throughout the course as a whole.

Before the course starts students are given the task to seek a mentor company, which means that the course is built on projects carried out in collaboration with organizations in existing industries. During the first part of the course the students perform an evaluation of an existing project in the particular firm or organization, comparing an existing project at the mentor or host company to the project management literature. During the second part of the course the students carry out a project formulated by themselves together with their hosting organization. The purpose of the course is thus twofold; firstly the students evaluate the methodology of existing projects and then carry out a real project. Secondly they learn how to manage themselves in a project group.

A significant purpose with the course is thus for students to practice and learn the craft of working in a project group and leading a project. The aim of the course is to dispense students with knowledge and skills of leadership in administrating different types of technology oriented projects while simultaneously developing individual and colleague teamwork. The course also aims at exposing students to different types of techniques and models and different types of psychological and social aspects while conducting a project. The course is thus focused mainly on project methodology and its opportunities and limitations in practice. Emphasis is also on engaging students in the psychological and social hindrances that may exist while conducting a project and how to overcome these obstacles. Further, special attention is given to how a creative and constructive project situation can be developed in practice.

The pedagogics used in the course, apart from the hands on projects, are learning journals, lectures by faculty and guest speakers and project seminars. In the project seminars the groups present their ingoing projects and get advice from their reference group and their supervisors.

A scale from fail to pass with distinction grades most courses on the program, but this particular course only has the grades of pass or fail. The main reason for this is the course's focus on learning. Firstly it would be difficult to grade the personal learning processes. Secondly the possibility of receiving a pass with distinction might take the students focus away from the learning process in the groups. A group can for instance fail in its project and/or its group process but make considerable efforts in analysing and understanding "what went wrong" and thereby make insightful experiences that will enhance their learning. The grading is thus, in a way, loosely coupled to the success rate of the projects and the group processes.

The grading of the course instead reflects the pedagogical idea of the course and of the learning outcomes of the course program, where emphasis is put on the importance of students learning to analyze both their personal but also the group's learning process. An essential part of the learning outcomes of the part are connected to the learning process, which is stressed both by the outlines of the course and by the compulsory assignment to write learning journals.

Learning Journals

To make the students aware of their own learning processes and to oblige them to document them they have to write a learning journal, individually continuously throughout both parts of the course and monthly collectively for the group.

Individual learning journals have been used in different educational contexts for some while. From our point of view though it seems as if it is seldom used in Technology Management Education. But when it is used it is mostly in e-learning situations. In a more general context the importance of reflection in individual an organizational learning has been pointed out by several practitioners and scholars (Ballantyne, R & Packer 1995, Boud, D; Keogh, R; & Walker, D, 1995, Brookefield, S. D. 1995, Kolb D. & Fry R. 1975, Loo R. and Thorpe K. 2002, Schon, D; 1987).

In the group journals the students reflect upon the project development, and the group dynamics. The individual journals should be written daily or at least three or four times a week and students are instructed to reflect over their project, their group process and their own experiences,

thoughts, doubts etc. and are allowed to express themselves freely. The only person reading the journals is the supervisor.

The individual journals that usually range between 5-10 pages, are sent in, by e-mail, to the given supervisor monthly. The supervisor then reeds each individual journal and gives comments, writing them into the student's journal, then returning the document through e-mail to each student. The group journal, usually a brief summary of the group process and dynamics, is also sent in monthly by mail to the supervisor. Shortly after the journals have been handed in, the group as a whole meets with their supervisor to discuss the proceeding of the project and other problems or matters in the group.

The individual journals are of course handled with complete confidentiality and the teachers/supervisors never bring up individual matters in the groups without the student in question asking for the matter to be lifted in a meeting. Here the group journals are of help as they reveal what matters can be lifted before the group as a hole. They can thus serve as agendas for the meetings. At the end of the course the students are asked to open and read their learning journals and then to write a resume-learning journal. The resume-learning journal should reflect what they have learnt over the year, how they have developed and what they have appreciated or disliked. This is an activity that helps the students to realize and reflect over if, and in such case, how much they have learnt about themselves and how they react in the group dynamic. Also they can evaluate how different project leadership methodologies and tools for feedback have affected their group dynamics.

The learning journals thus have the purpose of enabling:

- Personal reflection on the individual learning process.
- Reflection on the individual's own position and role in the group.
- Reflection on the how the group develops over time.
- Reflection on the way the group handles the relation to the assignment and the "client".

At the same time as this part of the course is considered "fuzzy" and hard to get a grip of by some of the students on beforehand, most of them consider it being one of the most valuable parts of it. In a newly performed placement report (Technology Management placement report, 2010), students that have graduated from the Technology Management programme the last 10 years, rate their education 4.37 out of 5. Some students even consider the Learning Journals among the most valuable parts of the whole programme in retrospect.

However reading and commenting the journals is a quite resource-consuming task in both time and engagement from the supervisors' behalf. At the same time this feedback has proved to be a resourceful tool to enhance students learning process as well as making their learning processes visible to both themselves and their supervisors. The students as individuals and as groups also become aware of the complexity and utter importance of group dynamics, as they continuously can build on their own previous comments and reflections.

Student reflections around Learning Journals

Below are some final reflections concerning learning journals given by three students at the end of the course.

Student-1: "My resume learning journal will be summarized under three headlines 1) My values 2) Feedback and Communication and 3) Joy. The reason I selected these three headlines is that I believe they represent the areas where I have developed the most under this last year."

Student-2: "The fog starts to clear, and during the last year the picture has become much brighter. I am so grateful to all of you that have participated in my personal development and helped me to be an easier person to collaborate with. It is my group and our collaboration-group. It is also all the teachers/supervisors at Technology Management that spend time to read my learning journals and our reports and that shows such engagement in us students!"

Student-3: "How have I developed as a project member and as a project leader?? The most important paramets is JOY. I have learnt that it really is so that joy or friendship with my colleagues is very important for me to be able to deliver and to be productive, but also for me to be able to feel accepted and relaxed. As Himot (2009) says it: Joy is a feeling of well-being that occurs when people's work environment, family, and community support and encourage them to develop and express their ideas, feelings, and skills in a way that helps themselves and others. The prescence of joy benefits situations, relationships and goals."

In order to find out the students thoughts about learning journals after graduation, Alumnis were asked to give comments. Below are a few of them, confirming that Learning journals are appeciated even after graduation.

Alumni-1 (2 years after graduation): " Writing journals during my masters' degree gave me a perspective on my current situation and forced me to reflect over the behavior of other team members. Now, 2 years later, I no longer write journals but I feel that I have gained valuable insights into what drives behavior and how people react on my actions. I use this insight every week to prepare, and execute, decisions and to convince colleagues, stakeholders or customers to take actions that support my agenda. Indeed time well spent."

Alumni-2 (1 year after graduation): " Being present in the moment and reflecting about how my actions create other's reactions, has provided me with a key differentiator in my career. As an example entering meetings, with individuals or groups, I try to identify what kind of personalities they are through using a personality framework. Through understanding if they are result or relationship oriented, and if they are introvert or extrovert I can easily reflect and change my behaviors and communication skills to fit the ones I'm talking to. Thus, I do not only benefit from my reflection,

further I help my message to reach the person on the other side in a way that suits them.

After important events, such as individual meetings, presentations, or just serendipitous occasions I try to reflect about what happened and why it happened. Learning from the situations I can draw conclusions about how I can change my behaviors in order to improve my work with other people, hence, improving the effectiveness of both myself and people around me. Standardizing the reflection framework, writing down reflection together with feedback, has further improved my skills. Nowadays, I see reflection as a prerequisite to change and improve my behavior, both in my career and as person, thus helping me to develop and grow."

Alumni-3 (4 years after graduation): "Reflection reports have given me the opportunity to identify patterns and structures in working processes that otherwise would have been hidden for me. For instance; I use reflection reports to better prioritize tasks within my projects. Details, which seem very important when your're working with them, might not always contribute to the overall project goal to such extent. When doing a reflection reports other priorities might be done, which then contributes to less waste of time and more efficient use of project resources."

Conclusions

Technology Management is a unique program at Lund University, where a selected number (40) of students from the Faculty of Economics and from the Faculty of Engineering are taught together during their last 2 years of study. Their degree will be a Master's degree. The program curriculum consists of 7 courses, Project leadership – part 1 and part 2 being two of them.

The concept of learning journals are introduced in the course Project Leadership. Throughout the whole course (2 semesters) the students are writing learning journals that supervisors are commenting monthly. The learning journals have the purpose of 1) enabling personal reflection on the own process, 2) enabling reflection on the own position and part in the group and 3) through the longitudinal effect of the course; providing an opportunity to compare journals over time and thereby becoming aware of and able to analyse the own learning process.

The student's attitude to the learning journals changes over time. When the course starts many students consider the learning journals "fuzzy" and are unsure why and how they should use them and what purpose the journals have. At the end of the course, the final reflections show that the students are satisfied with the learning journals and the effect it has had on their own self-awareness. Years later, interviews show that the students, now Alumnis, still benefit from having written learning journals. Some students still write learning journals (or reflection reports) in order to sort out their thoughts, others do not write anymore but use mental reflection as a tool to help them grow and develop professionally as well as privately.

From a education perspective, reading and commenting the learning journals is quite a resource-consuming task, both in time and engagement from the supervisors' behalf. However, the pleasure of seeing students grow and getting un-valuable insights is what makes it worth. And in addition - through each learning journal read, the supervisors also learn.

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