

Innovation during the Informatics study at Aalborg University.

10th Semester Informatics
Aalborg University
2005/2006

Titel:

**Innovation during the Informatics study
at Aalborg University**

Projektperiode: 1. februar 2006 - 26. maj 2006

Projektgruppe: d602a

Synopsis:

Deltagere:

Bogdan Constantin Sarbu

Vejleder:

Andreas Munk-Madsen

This master thesis treats the subject of innovation and innovation management and the employment of these subjects at the Informatics study at Aalborg University.

The aim of this project is to explore if the Informatics students learn about innovation during their study, and what can be done to ensure that the students do learn more about innovation and innovation management.

The research method consists of a literature study, text analysis, a questionnaire and an interview. The involved actors are Informatics students, supervisors and lecturers.

Even though the intentions are that the university should teach the students innovation skills, these are currently not fulfilled. However, some measures have been proposed to ensure the intentions will be fulfilled.

Oplagstal: 5

Sideantal: 106

Bilagsantal og -art: 6 stk. appendiks

Afsluttet den: 26. maj 2006

Table of Contents

1. Resume.....	5
2. Introduction.....	8
3. Research questions and definition.....	10
3.1. Research questions.....	10
3.2. Innovation and innovation management.....	11
3.2.1. Types of innovation.....	14
3.2.2. Incremental versus radical innovation.....	15
3.2.3. General definition.....	15
3.2.4. Innovation management.....	16
4. Research method.....	17
4.1. Text analysis.....	17
4.2. Questionnaire.....	18
4.2.1. Preparing the questionnaire.....	19
4.2.2. Final questionnaire.....	20
4.3. Interview.....	20
5. Theory.....	23
5.1. Theoretical model of creativity.....	23
5.1.1. Domain-relevant skills.....	23
5.1.2. Task motivation.....	24
5.1.3. Creativity-relevant skills.....	25
5.1.4. The components playing together.....	26
5.2. Generic innovation process.....	26
5.2.1. Search phase.....	26
5.2.2. Selection phase.....	28
5.2.3. Implementation phase.....	29
5.2.4. Learning and reinnovation.....	30
6. Empirical results.....	31
6.1. Text analysis.....	31
6.1.1. The Strategy of Aalborg University until year 2010.....	31
6.1.2. The General curriculum.....	33
6.1.3. The bachelor degree curriculum.....	33
6.1.4. The base year and master's degree curriculum.....	34
6.2. Questionnaire.....	34
6.2.1. Supervisor and lecturer specific questions.....	34
6.2.2. Student specific questions.....	35
6.2.3. Questions aimed at all respondents.....	37
6.2.4. Additional comments to the questionnaire.....	37
6.3. Interview.....	38
6.3.1. Reasons for not teaching/learning.....	38
6.3.2. Measures for more innovation.....	39
7. Discussion.....	42
7.1. Innovation and competencies of an Informatics student.....	42
7.2. The present level of innovation during the Informatics study.....	46
7.3. Innovation, projects and management.....	48
7.3.1. The project process and the innovation process.....	48

7.3.2. Management of project and innovation processes.....	49
7.3.3. Creativity and current project work.....	50
7.3.4. Problem-oriented project work and innovation.....	51
7.3.5. Summarizing.....	52
7.4. Measures for ensuring the acquisition of innovation skills.....	52
7.4.1. Lectures.....	53
7.4.2. New project structure.....	53
7.4.3. Mentality change.....	55
7.4.4. Updated curricula.....	56
7.4.5. Innovation camps.....	56
7.5. Critic of empirical method and experience.....	57
7.5.1. Text analysis.....	57
7.5.2. Questionnaire.....	57
7.5.3. Interview.....	58
7.5.4. Validity and generalizability.....	59
8. Conclusion.....	60
9. Bibliography.....	62
10. Appendix.....	65

1. Resume

Regeringen synes, at iværksætteri og innovation spiller en vigtig rolle for dynamikken og væksten i økonomien. De havde derfor udarbejdet et debatoplæg til Globaliseringsrådets møde den 19. og 20. januar 2006, hvori de blandt andet skriver, at alle skal tilbydes undervisning om iværksætteri på videregående uddannelser i Danmark. De mener, at hvis man har lært noget om iværksætteri og innovation, vil man være tilbøjelig til selv at blive iværksætter. Ved stigning i antallet af iværksættere, vil konkurrencen stige og der vil forekomme økonomisk vækst.

Som baggrundsmateriale til debatoplægget var der en henvisning til en undersøgelse fra Erhvervs- og Byggestyrelsen. Undersøgelsen kom frem til at i gennemsnit fulgte 20 procent af de studerende i USA og Canada en form for undervisning om iværksætteri. I Danmark var der derimod kun i gennemsnit 2 procent af de studerende der fulgte undervisning om iværksætteri og innovation.

Formål:

Intentionen med dette projekt var at udforske innovations og innovationsledelses placering i Informatikuddannelsen. Informatikuddannelsen er en tværfaglig uddannelse, hvor både teknologi og menneskelig interaktion er i fokus. Uddannelsen har sine rødder i Computer Science domænet, og de studerende har som mål at udvikle informationssystemer, der understøtter mennesker i deres arbejde, fritid og interaktion med andre mennesker eller computere.

Forskningsspørgsmålene, som blev besvaret i dette projekt, er:

→ Lærer studerende, hvordan man skal lede et innovationsprojekt, i løbet af

Informatikuddannelsen, og hvordan?

- Hvad siger studerende, vejledere og undervisere de gør?
- Hvad står der skrevet, at de studerende, vejledere og undervisere skal gøre?

→ Hvad kan der gøres for at sikre, at Informatikstuderende lærer om innovation og innovationsledelse?

- Hvad siger studerende, vejledere og undervisere, man kan gøre?
- Hvad står der skrevet at studerende, vejledere og undervisere kan gøre?

For at få en bedre forståelse af, hvad innovation er, blev der foretaget en analyse af forskellige definitioner af innovation. Resultatet af analysen var en definition af innovation, som var tilpasset projektets kontekst. Den endelige definition er:

“En innovation er en proces, et produkt eller paradigme, der implementeres; som samtidig er ny; og som er til gavn for et individ, en gruppe, en organisation, eller samfundet i helhed.”

Materiale og metoder:

For at besvare forskningsspørgsmålene, blev der foretaget en tekstanalyse af de officielle dokumenter, som ligger til grund for Informatikuddannelsen. De dokumenter, der blev analyseret var Aalborg Universitets vision og strategi, Rammestudieordning for Det Tekniske-naturvidenskabelige Fakultet, Basisårets studieordning for Det Tekniske-naturvidenskabelige Fakultet, studieordningen for Bachelor uddannelsen i Informatik, samt studieordningen for Kandidatuddannelsen i Informatik.

Derudover blev der udført en spørgeskemaundersøgelse, hvor de studerende, vejledere og undervisere blev spurgt, hvorvidt de har lært, inspireret eller undervist i innovation og innovationsledelse i løbet af Informatikuddannelsen. De blev ligeledes spurgt om, hvorfor de ikke lærte, inspirerede eller underviste i innovation, hvis det skulle forekomme.

Med udgangspunkt i resultaterne fra spørgeskemaet, blev en vejleder/underviser interviewet for at følge op på spørgeskemaet og for yderligere at udforske mulighederne for at sikre, at de studerende lærer om innovation i løbet af uddannelsen.

Resultater og konklusion:

Resultatet af analysen af de officielle dokumenter med fokus på, hvorvidt de studerende skal lære om innovation, er, at ifølge Rammestudieordningen skal universitetet *tilstræbe* at lære de studerende om innovation. Universitetet er ikke tvunget til at lære de studerende om innovation.

Spørgeskemaet blev sendt ud til alle aktive Informatikstuderende, samt til 35 vejledere og undervisere. Af dem svarede kun 13 studerende og 7 vejledere og undervisere. Respondenterne var pænt fordelt på næsten alle 10 semestre, af Informatikuddannelsen.

Selv om universiteterne skal tilstræbe at undervise i innovation, så svarer 10 ud af 13 studerende, at

de ikke har lært noget om innovation og innovationsledelse. Det passer godt med, at 5 ud af 7 vejledere og undervisere ikke inspirerer til eller underviser i innovation og innovationsledelse.

Nogle af grundene til, at der ikke bliver lært, inspireret eller undervist i innovation er at: innovation ikke har noget fokus i de mere Informatik-specifikke studieordninger; at nogle af kurserne ikke er velegnede til at undervise i innovation og ledelse; mentaliteten på Informatikuddannelsen ikke er for innovation; projektarbejdsformen er for struktureret, forudbestemt og tidsbegrænset.

Det problem-orienterede projektarbejde, som fylder godt i Aalborg Universitets undervisningsform, blev af respondenterne anset som værende den bedste situation for de studerende at lære om innovation og innovationsledelse. Projektarbejdsformen blev diskuteret ud fra Teresa M. Amabile's teoretiske kreativitetsmodel, samt den generelle innovations proces, beskrevet i bogen *Managing innovation* af Joe Tidd et al. Projektarbejdet kan føre til innovationer, hvis projekterne gennemgår de faser, den generelle innovationsproces foreskriver. På grund af tidsbegrænsning eller mangel om viden i dybden, kan de studerende være tilbøjelige til at undgå risiko og fravælge at forfølge nye kreative ideer, koncepter eller løsninger.

Med udgangspunkt i, hvad respondenterne foreslog af muligheder for at få mere innovation i undervisningen og suppleret med andet litteratur, er projektet kommet frem til følgende kategorier af løsninger til at lære, inspirere og undervise om innovation:

- ➔ Tilbyde undervisning om kreativitet og innovation, så de studerende ved, hvad de kan bruge i deres projekter.
- ➔ Variere projektarbejdsformen, med inspiration i Open Source udviklingsprocessen, således at man undgår ulemperne ved problem-orienteret projektarbejde.
- ➔ Arbejde for at få ændret mentaliteten omkring innovation blandt de studerende, vejledere og undervisere.
- ➔ Opdatere Informatik-specifikke studieordninger, som studieordningen for bachelor- og kandidatuddannelsen, så der skabes større fokus omkring innovation.
- ➔ En anden løsning kunne være, at man opfordrede de studerende at deltage i forskellige innovation camps, hvor de kan få mulighed for at beskæftige sig med nogle af faserne i den generelle innovationsmodel.

2. Introduction

This project is a 10th semester master thesis, subsequently mentioned as the project, at the Informatics study at Aalborg University. The project treats the subject of innovation and innovation management and the employment of these subjects at the Informatics study.

The government has chosen to focus on entrepreneurship and innovation, as means for maintaining and improving the welfare in the Danish society. The government has established a *Globalisation board* with the mission to propose measures to improve the welfare. On the 19th and 20th of January 2006, the Globalisation board discussed a discussion paper, compiled by the government, about the level of entrepreneurship in Denmark and which measures should be implemented. [32]

Entrepreneurs play an important role for the dynamics and growth in the economy. Through the new companies there is a constant testing of new ideas and new ways of doing things which challenge the existing companies and strengthen competition. Not least the entrepreneurs of growth – companies which rapidly create new workplaces and a high level of trade – which increase the economical growth. [32]

The government have as goals to make Denmark a leading country of entrepreneurship:

- Denmark shall continue to be among the European countries, where most new companies start-up, every year.
- Denmark shall in year 2015 be amongst the societies in the world, with the highest amount of entrepreneurs of growth. [32]

When one learns about entrepreneurship (innovation competences and business), one may be inclined to become an entrepreneur. The government have proposed, that the students at Danish universities shall have the possibility to learn about entrepreneurship.

The background material[33] for the discussion paper mentioned above, refers to a study conducted by *Erhvervs- og Byggestyrelsen*, in year 2004. The study explore the number of students that

received education about entrepreneurship during the study year 2002/2003.

The study consisted of questionnaires sent to and interviews with representatives from several American, Canadian and Danish universities, plus literature examination. In the questionnaires and interviews the representatives were asked about the number of students, at the particular university, that yearly attended and received education about entrepreneurship.

The results of the study states that in average 20 percent of the American and Canadian students receive education about entrepreneurship, while in Denmark only 2 percent on average received education about entrepreneurship.

The purpose of this thesis is to explore the placement of innovation and management of it, during the Informatics study, at Aalborg University.

I myself, being an Informatics student, have noticed a low focus on innovation during the study. I hope that this thesis will clarify whether there is low focus or not, and why.

This thesis will be based on written materials such as the university strategy and vision, general, base year, bachelor and master's curricula. Some empirical data will also be gathered to clarify the current state as seen from the supervisors, lecturers and students perspective.

I hope that this thesis will be used as a starting point for a change towards more focus on innovation during the Informatics study.

3. Research questions and definition

In this chapter I will briefly describe the context in which this project is residing, namely the Informatics study at Aalborg University. Based on the context and the intentions mentioned in the previous chapter, I will formulate some research questions that will be answered by this report.

Furthermore, I will deduce a definition of the term *innovation*, by analysing and discussing the definitions of others. I shall analyse the elements that compose other definitions and construct a general definition adapted to the context of this project.

3.1. Research questions

This thesis deals specifically with the Informatics study, at Aalborg University. The Informatics study is a inter-disciplinary study, where both technology and human interaction are in focus. The study have its roots in the Computer Science domain, where computer technologies and systems are dominant. The study prepare students to develop and implement computer systems, that help people in their work and interaction with other humans or computer systems.

The study is combined of education at the institute of computer science and at the institute of communications. The institute of computer science teach the students basic knowledge of computers and computer systems. At the institute of communication, the Informatics students learn about communications, at different levels.

The Informatics study is based on projects and project groups. Every semester, the Informatics students work on projects in small groups. Each project group decides which project they want to work on, within the possibilities described by the curriculum.

This thesis answers the following research questions:

- ➔ **Do students learn about how to manage innovation projects, during the Informatics study, and how?**
 - What do students, supervisors and lecturers say they do?

- What is written, that students, supervisors and lecturers shall do?
- ➔ **What can be done to ensure that Informatics students learn about innovation and the management of it?**
- What students, supervisors and lecturers say they can do?
- What is written, that students, supervisors and lecturers can do?

To answer the main research questions, I have chosen to deduce an answer formed by two elements. First, I will examine what the students, supervisors and lecturers *say* they do, in relation to teaching and learning innovation and innovation management. Secondly, I will conduct a text analysis on the official documents that lay the foundation of the Informatics study.

If only one of the perspectives were chosen, then the overall picture of the placement of innovation and innovation management, would be partly wrong. The reason is that not everybody do what it is written they should do. People sometimes take actions that are not written down.

3.2. Innovation and innovation management

There are various definitions of what innovation is. The various definitions deal with innovation from different perspectives. Some see innovation from an organizational perspective, others from the (future) users perspective, and some see it in a more general perspective.

I enumerate several definitions and discuss, and choose the definition that I find appropriate for this context. I will use the products iPod and iTunes¹ as cases for the discussion, as the iPod and iTunes in combination are in general seen as an innovation.

In the article "Innovation at work: Individual, Group, Organizational, and Sociohistorical [17]" by Michael A. West and Wieby M.M. Altink, innovation is defined as:

Def. 1: "... "the intentional introduction and application within a role, group or organization of ideas, processes, products or procedures, new to the relevant unit of adoption, design to significantly benefit the individual, the group, organization

¹ iPod is a music player. iTunes is an on-line music store. Both products developed and produced by Apple Computers. See <http://www.apple.com/ipod/> and <http://www.apple.com/itunes/> for more details.

or wider society."[17]

Innovation is discussed from different perspectives, such as individual, group, organizational or society.

The book "Managing Innovation" deals with the innovation process, and with the challenges that may appear during an innovation process at the project level as corporate level. The book enumerates following two definitions of what innovation is:

Def. 2: "*Innovation is the successful exploitation of new ideas.*" [3]

Def. 3: "*Innovation is the specific tool of entrepreneurs, the means by which they exploit change as an opportunity for a different business or service. It is capable of being presented as a discipline, capable of being learned, capable of being practised.*" [3]

Henning Sejer Jakobsen and Simon Olling Rebsdorf states in the book "Ideudvikling ved kreativ innovation" the following definition.

Def. 4: "*Innovation betegner indsatsen med at udvikle et allerede opfundet element til praktisk-kommerciel brug og få accepteret, at elementet indføres. Innovation kan være nye produkter, nye produktionsprocesser, nye markedsadfærd, nye råvarer eller halvfabrikata eller nye organisationsformer.*"²
[2]

"Ideudvikling ved kreativ innovation" describes the history of creativity up till modern-day. It describes how the definition of creativity has evolved during time.

The book "Innovation for ildsjæle & vandbærere", by Finn Kollerup and Jørgen Thorball, contains discussions of different cases that the authors have experienced, as well as theories. The book also contains methods for increasing the creativity level and in the end the level of innovation. The book defines innovation as follows:

Def. 5: "*Innovation er nyt, nyttig og implementeret.*"³ [1]

The word *innovation* owe its origin to the Latin word *innovare* which means *to renew or alter*. So the word in it self contains the aspect of novelty and change. Looking through the definitions some

2 See translated version in Appendix F, line 1.

3 See translated version in Appendix F, line 2.

similarities appear. Definition 1, 2, and 5 states that the innovation is based on a new idea. Where definition 4, states that innovation is based on an already invented element. Based on definition 1, it is not relevant how new the ideas, products or procedures are to the domain in which they are to be used, as long as they *are* new to the domain.

The iPod as a digital music player is not a new idea, in the music domain. The elements, that are new in an iPod, hence new to the domain, are a harddisk and a simple user interface. The elements in itself are not new either, but the combination of the elements makes the iPod idea/concept new to the domain of digital portable media players. The second part of the novelty is the possibility to buy music on-line by using iTunes, and almost automatically transfer the music to the iPod.

Several of the definitions state that an innovation have to deliver some benefit to the user of the innovation, see definition 1 and 5. Definition 3 states indirectly that an innovation should bring some benefit, by exploiting "... *change as an opportunity for a different business or service.*". By entrepreneurs exploiting changes, one may infer that they would benefit from the new and different businesses and services.

Using the iPod/iTunes as cases, and then analysing whether the iPod delivers some benefits, then it can be inferred that it does. Apple Computers that develop and produce the iPod and iTunes, gets a financial benefit from selling the iPod, and from people buying music through iTunes. The users of an iPod gets the benefit of being able to have a large collection of music with them at all times.

Another aspect in some of the above mentioned definitions is the aspect of an innovation being an idea that is implemented. Definition 1 states that an innovation should be *intentionally* introduced and applied. Definition 5 states shortly, that an innovation is implemented. The second definition states following: "... *successful exploitation of new ideas.*". *Successful exploitation* can be seen from different perspectives: the manufacturer of the innovation, and the user of innovation. From the manufacturers perspective it could be successful if the innovation could produce revenue, meaning that people buy or use the innovation. The successfulness corresponds with the *acceptance* of the innovation, as stated in definition 4.

iPod and iTunes are products that are implemented and are gaining popularity, so one may infer that the products are successful exploitations of a harddisk enabled digital media players, and on-line music store ideas.

3.2.1. Types of innovation

The definitions enumerated above defines different types of innovation. From definition 1, 3 and 4 we see that an innovation can be an idea, product, procedure, business or service, production process, market behaviour, new raw material or semi-finished products, or new organizational form.

In “Managing Innovation” there specified four broad categories of types of innovation – seen from an organizational perspective:

- ➔ product innovation
 - new products that the organization offers
- ➔ process innovation
 - new ways in how products are created and delivered
- ➔ position innovation
 - new contexts in which products are introduced
- ➔ paradigm innovation
 - new underlying models which frame what the organization does

The types of innovation specified in the 4 definitions (Def. 1, 2 and 4) can be categorized using the four categories.

One type that falls outside the categories, and the aspect of being implemented, is the type *ideas*.

Based on definition 1, innovation can be an idea. A definition of an idea is:

“An idea is a specific thought which arises in the mind.” [40]

So if an idea is a thought, then by implementing the thought, one may get a product, procedure, paradigm. Based on the aspect that an innovation should be an implementation of an idea, I find the type of innovation as idea a paradox. It is as if saying that by implementing an idea, one gets an idea, which is logically wrong.

3.2.2. Incremental versus radical innovation

Focusing on the degree of novelty of an innovation, gives us two categories of novelty: incremental and radical. Incremental innovations contains minor incremental improvements, where radical innovations are changes that may transform the way we think of and use products. [3,34]

An incremental innovation is characterized by being a new application to an already known product or service. An example could be using a frying pan as a hammer. Radical innovations are those that link different technologies and concepts in new ways, which result in never seen ideas and solutions. A radical innovation may seem insignificant to start with, but becomes the thing that shakes the domain in which it is used. An example is the Internet; when introduced it seemed insignificant, but in the modern-day it is used in different ways that have changed the society.

3.2.3. General definition

When choosing a general definition, it is important that it reflects the usage of it. The definition should contain the differentia, which are relevant in relation to the context.[12] The context in which this report resides, is the Informatics study, so the definition should be broad, because of the mixture of people, their positions and the usage of innovation.

From the above cited definitions, there are some elements that characterize innovation, which should be included in the general definition. According to these elements innovation should: be new, give benefit and be implemented. The definition should also include the types of innovation.

Looking through the above cited definitions, then definitions 2 and 3 use a business/organizational discourse. An iPod/iTunes user may not think about the product as a *successful exploitation of a new idea*. When choosing a general definition, then it should use a more general discourse, with which users of the innovation can get identify.

Definition 5 is simple, but does not state clearly which types of innovation it is referring to.

Definition 4 is not stating whether the basic element is new, either to the domain or in general. The definition would otherwise be a good candidate for a general definition.

A suitable candidate for an innovation definition is definition 1. It incorporates both the individual, the group, the organization and the wider society. It states that the innovation should be designed to benefit the stakeholders. It also states that the innovation should be new to the stakeholders. Definition 1 does, however, need an update in regard to the types of innovation and stakeholders.

The following general definition of innovation, is constructed using the Aristotelian format of definition [12]:

“An innovation is an implemented process, product or paradigm, which is new to, and benefits, an individual, group, organization or wider society.”

3.2.4. Innovation management

Innovation management is the management of the innovation process. It also contains the management of the creativity emerging during the innovation process.

The generic innovation process are composed by four phases: *Search, Select, Implement* and *Learn*. [3] See section 5.2 for a more thorough description of the innovation process.

4. Research method

The methodology used in this project is divided in three activities. First a text analysis was conducted. Afterwards a questionnaire was sent out to all students, supervisors and lecturers which had/have a relation to the Informatics study. Lastly an interview with a lecturer/supervisor was conducted.

The text analysis was conducted to find out the placement of innovation in the official documents, which lay the foundation for the Informatics study. The questionnaire was used to gather information about how students, supervisors and lecturers perceive innovation and innovation management, in relation to the study. The interview was used to follow up on the questionnaire, and explore some of the possibilities for teaching and learning about innovation and innovation management.

Through this report every quotation is cited in the original language. If the quotation is in another language than English, the quotation is translated to English, and can be find in Appendix F.

4.1. Text analysis

To answer the research question “*What is written, that students, supervisors and lecturers shall do?*” a text analysis was conducted on following documents:

- ➔ **AAU 2010 – Strategy of Aalborg University.** [26]
 - This document outlines the vision and strategy, that the university should comply to, in the coming years. The document outlines some goals that the university should reach in year 2010.
- ➔ **General curriculum⁴ for the Faculty of Technical Science.** [27]
 - The general rules that are applicable to all studies belonging to the Faculty of Technical Science, are described in this document.

4 Translated from the Danish word “Rammestudieordning”.

- **The curriculum for the *base year*⁵ of the Informatics study.** [28]
 - The purpose and rules for the first two semesters of the Informatics study are stated in this document.
- **The curriculum for the bachelor degree in Informatics.** [30]
 - The rules that are applicable only to the two year study that form the bachelor degree in Informatics, are enumerated in this document.
- **The curriculum for the master's degree in Informatics.** [31]
 - In this documents the rules concerning the two year study that forms the master's degree in Informatics, are outlined.

The text analysis consisted in counting the appearance of the words creativity and innovation – and management of the two phenomena - in the documents.

The analysis also contains an analysis on how the education should be formed so that the students obtain the envisioned knowledge.

4.2. Questionnaire

A questionnaire was used to answer the following research questions: “*What do students, supervisors and lecturers say they do?*” and “*What students, supervisors and lecturers say they can do?*”.

A ten-step method for preparing a questionnaire, described in the book “*Research Audiences*”, was used.[8] The method has been extended to also use *open questions*.

The ten-step method aimed at producing a quantitative questionnaire. I chose to produce a mixed questionnaire, where both quantitative and qualitative questions were asked. Quantitative questions had some finite possibilities of answers. The qualitative questions were open questions, where the respondent could answer freely.

The qualitative questions were dependent on the quantitative questions, and were used to give the respondent the possibility to write the reason for their action and choice.

⁵ Translated from the Danish word “Basisåret”.

4.2.1. Preparing the questionnaire

The method used to prepare the questionnaire is composed by ten steps:

1. Proposing a research question

- At this step a research question, theoretical issue, rationale and a hypothesis is described. Here the researcher describes the focus of the questionnaire.

2. Identifying variables

- Based on the research question more variables are identified. The variables will contain some information that will lead to an answer to the research question.

3. Defining variables

- Here the variables identified are defined, meaning that the researcher specifies how information should be associated with the variables.

4. Specifying the independent and dependent variables

- Here the researcher specifies the dependability among the variables.

5. Choosing the level of measurement

- The researcher specifies a measurement to every variable, stating which input the variable will have.
- It is here that I have extended the method, by allowing the use of open questions.

6. Designing the samples

- Here the target population of the questionnaire is chosen.

7. Mapping and analysing the data

- After the data is collected, it is analysed and relations are found. Where an open question has been used, a meaning condensation will be performed.

8. Model the causal relationship

- Gathered information is assigned to each variable.

9. Evaluating causal relationship

- The variables are evaluated, based on their dependability and the information gathered, and an answer to the research questions is deduced.

10. Reporting findings

- The answer to the research question is reported to relevant people, in a relevant manner.

The ten-step method have been used, and every step is documented. Appendix A contains the process of preparing the questionnaire.

The process of preparing the questionnaire, consisted also in conducting a pilot test of the first version of the questionnaire. The questionnaire was sent to two students and one supervisor and lecturer.

The comments and suggestion received from the pilot respondents were considered and some implemented.

4.2.2. Final questionnaire

The final questionnaire was transformed to a website, and the link to the questionnaire was sent to the respondents by e-mail. The e-mail contained a introductory letter, that told about the research and the purpose of the questionnaire. The respondents had approximatively one week to answer the questionnaire.

The final questionnaire can be seen at Appendix A. See Appendix B, for the introductory letter that was sent by e-mail containing the link to the questionnaire.

4.3. Interview

The interview was used to partly follow up on the answers from the questionnaire, and to partly explore further what that can be done to incorporate more innovation and innovation management in the Informatics study.

The interview tried to explore, is the reasons for not teaching/learning about innovation are true – i.e. based on reality - and why it is like that.

During the interview a large part of the time was used to explore the possibilities for incorporating more innovation and innovation management during the Informatics study. Secondly, it was used to explore the reasons for not doing that already.

The interview was audio recorded, and later transcribed word for word, so the interview is unedited for use in the analysis. During the analysis a meaning condensation is performed, and at the same the reasons for not teaching innovation are categorized, as well as the different possibilities for incorporating more innovation in the study.

The interview was prepared by using the seven stages method explained in the book *InterView* by Steinar Kvale.[9] The seven stages proposed by Steinar Kvale are outlined and described:

1. Thematization

- At this stage the purpose of the interview is formulated. The questions *why* and *what*, should be clarified.

2. Design

- This stage is about going mentally through every one of the seven stages, and preparing an interview guide. The interview guide should reflect the purpose of the interview, and how the desired information is to be gathered. The interview guide contains a description of the interview procedure, including the questions that should be asked.

3. Interview

- The interview is performed based on the interview guide.

4. Transcription

- If the interview has been audio recorded, the interview guide should state how the transcription will be performed, including the rules that guide the transcription.

5. Analyses

- The transcribed interview is analysed using the rules and principles described in the interview guide.

6. Verification

- Based on the analysis the generalizability, reliability and validity, of the analysed interview are determined

7. Reporting

- At this stage, the results from the interview are communicated using an appropriate medium.

The output from the above outlined stages is documented in an interview guide, that can be seen in Appendix D.

5. Theory

In this chapter I will describe theories that will be used later in the Discussion chapter. The key points of Teresa M. Amabile's theoretical model of creativity, are outlined. The theoretical model of creativity describes some components that, according to Teresa M. Amabile, should increase the probability of creating novel ideas when available.

A generic innovation process, presented by Joe Tidd et. al., is also described. The innovation process contains generic phases that lead to innovation. The phases deals with the process of observing changes in the environment, developing and selecting ideas and concepts, implementing and finally launching the innovation, so that stakeholders can benefit from it.

5.1. Theoretical model of creativity

Teresa M. Amabile presents a componential, theoretical model of creativity to describe which components constitute a creative individual [13]. If the components are available there will be a good probability of creating novel products.

The model has three components: domain-relevant skills, task motivation and creativity-relevant skills.

5.1.1. Domain-relevant skills

The domain-relevant skills component includes the different factual knowledge, technical skills and special talents in the domain the creativity process is carried out.[13]

Before starting developing a response to a given problem, the persons involved must acquire some basic knowledge about the domain in which the problem resides. The person must be familiar with the factual knowledge of the domain, such as: facts, principles, opinions about various questions in the domain, knowledge of paradigms and aesthetically criteria.

Much knowledge about the domain will result in more creative products, but only if the knowledge

is structured properly. If the knowledge is structured properly the process of finding new cognitive paths, will be more effective and easy.

Knowledge is not the only thing in this component, but technical skills are important as well. Technical skills can be knowledge about laboratory techniques, quantitative and qualitative techniques.

The ability to imagine how objects and structures can work together is a special talent that may be needed in the creative process.

5.1.2. Task motivation

When working on a task there is an amount of motivation, which drives the work. If the person offered a task is not motivated toward performing the task, the person may not perform it or perform it bad.

There are two forms of motivation factors, a group of intrinsic and a group of extrinsic motivation factors. Task motivation is composed by two elements:

“... the individual's baseline attitude toward the task and the individual's perception of his or her reasons for undertaking the task in a given instance”. [13]

The attitude toward the task is easily assessed, by the person making a cognitive judgement about whether the task at hand is matching his or her existing preferences and interests – those are intrinsic factors.

Extrinsic motivating factors are external and environmental factors that may influence the baseline attitude towards the task. Economic rewards, constraints and social rewards could be examples of extrinsic motivating factors.

Another element that influences the level of motivation is internal ability to cognitively cope with external factors. If the person is able to minimize the salience of an external constraint, it may influence the perception of the motivation towards the task.

The level of motivation toward a specific task varies from the intrinsic baseline attitude toward the

task, as a function of extrinsic environmental factors and the cognitive ability to minimize the extrinsic factors influence.

According to some theories the task motivation and its influence on creativity is summarized as:

“... a primarily intrinsic motivation to engage in an activity will enhance creativity, and a primarily extrinsic motivation will undermine it.” [13]

5.1.3. Creativity-relevant skills

The creativity-relevant skills are the component that determines the level of creative performance. If two persons with similar level of motivation and domain-relevant skills are working on the same problem, they may come up with different solutions. The various solutions are determined by their creativity-relevant skills.

This component is characterized by the person's cognitive ability to understand complexities and the ability to break set, during a task, which is a result of a particular cognitive style. There are some cognitive abilities that are relevant to the creative performance:

- breaking perceptual set
- breaking cognitive set, or exploring new cognitive pathways
- keeping response options open as long as possible
- suspending judgement
- using “wide” categories
- remembering accurately
- breaking out of performance “scripts”

The above mentioned abilities should increase the creative outcome. Like intrinsic motivation, the abilities help the person produce more creative products.

When breaking set and or exploring new pathways some heuristic⁶ knowledge may be needed.

Heuristic is considered to be of aid in approaching problems and tasks.

⁶ A definition of “heuristic”: “A heuristic can be defined as “any principle or device that contributes to a reduction in the average search to solution”” [13, page 365]

5.1.4. The components playing together

Teresa M. Amabile summarizes the three components relations and their influence like this:

“Task motivation can be seen in this context as the most important determinant of the difference between what a person can do and what he or she will do. The former is determined by the level of domain-relevant and creativity-relevant skills; the latter is determined by these two in conjunction with an intrinsically motivated state.” [13]

To perform better creative work, the three above mentioned components should be present. A person can perform *good* or *adequate* work, by having domain-relevant skills and motivation, but may not be creative. The creativity-relevant skills compose the component that adds the “something extra” to the solutions found by the persons engaged in the task.

5.2. Generic innovation process

Joe Tidd, John Bessant and Keith Pavitt describe in their book *Managing innovation* a generic innovation process. The perspective that the book has on innovation and innovation management, is that of a company. Innovation is seen as a generic activity associated with survival and growth of companies. The generic innovation process is based on phases that are common to all companies, that want to be innovative.

Different circumstances may focus more on several phases of the generic innovation process, but the underlying pattern of phases in the innovation process remains constant. Some companies may commit more resources to some phases, based on the business model.

The process is outlined as a sequence of phases, containing some activities distributed over time. However in the real life the innovation process do not always conform with the outlined sequence, but may be a cycle of activities repeated over time. Below follows a description of the phases in the generic innovation process.

5.2.1. Search phase

The first phase regards searching or exploring the environment for changes that may lead to an

innovation. Changes could be new technological opportunities, or changing requirements from users or customers. Change can occur in technology, markets, competitor behaviour, shifts in the political or regulatory environment, new social trends, etc.

Following are some of approaches that may be used when searching for changes:

- ➔ Defining the boundaries of the marketplace
 - This approach discusses the current and the potential market. It is about finding the market, in which the search for changes is going to be conducted.[3, page 350]
- ➔ Understanding market dynamics
 - One should get an understanding of how new potential markets arise as a consequence of various kinds of changes. For example, the cellular phone moved from being a high-price business tool into the general marketplace, as a result of both technological and cultural changes.[3, page 350]
- ➔ 'Trend spotting'
 - Markets spaces that currently do not exist or suddenly turn in a new direction, may be difficult to explore. By observing customer behaviour with different products, one may get early warnings of trends.[3, page 350 - 351]
- ➔ Monitoring technological trends
 - This approach deals with 'trend spotting' in technologies. As a result of new knowledge, existing solutions may be challenged, and result in new trends. By monitoring websites, chat rooms, visiting conferences, seminars and exhibitions and building close exploratory links to research labs, one may capture changes that creates a new trend.[3, page 351 – 352]
- ➔ Market/technological forecasting
 - By monitoring for example demographic, technological, political and environmental issues, one may get clues of features that may be demanded by the market. For example, the present concern for environmentally friendly products may decide the materials used in some innovation.[3, page 354]
- ➔ Integrated future search
 - By describing future scenarios in relation to technologies, markets, politics, social values and other elements, by use of the form of 'storyline', one may explore the possibilities

that one may have if the described scenario is true. One may have several storylines. Hence, the approach is to look through the storylines and explore the features that the future may demand based on the future scenario.[3, page 254 – 355]

→ Learning from others

- This approach compares the processes and products to other processes and products. The comparisons may contain other competitors, sectors, departments processes and products.[3, page 255 – 356]

→ Involving stakeholders

- Involving stakeholders in the process and ask them to provide information about which products, services and features they require, may give clues to elements that may lead to an innovation.[3, page 356 – 357]

→ Involving insiders

- By listening to colleagues and other people in the organization, one may get ideas that may lead to innovations.[3, page 359]

→ 'Mistakes management'

- New direction for innovation may be generated by mismanagement, failures, diversion or distraction from a planned innovation direction, may open up for new ideas, possibilities and in the end more innovations.[3, page 361]

→ Communication and connection

- The last approach is about communicating information, and knowledge to everyone in the organization. Maybe someone else may see potential in an idea, clue or issue.[3, page 361 - 362]

5.2.2. Selection phase

This phase evaluates the inputs from the Search phase, specially in regard to risk and competency, and develops an innovation concept that is to be implemented. One have to evaluate whether the individual, group or organization have the resources; i.e. marketing and technical knowledge, and knowledge and experience about implementing the concept.

An organization have to clarify the needed knowledge that is needed, to implement an innovation concept, before moving on to the next phase. Prior to selecting an innovation concept, the

organization should know where to acquire the lack of knowledge and experience.

5.2.3. Implementation phase

After choosing an innovation concept, the next phase is to actually implement the concept. At the beginning of this phase, there is a high level of uncertainty. While the innovation develops, problem-finding and -solving activities gradually remove bugs from the original concept and produce relevant knowledge around the innovation.

The implementation phase can be divided in the following sub-phases.

Acquiring knowledge resources

This sub-phase combines new and existing knowledge and develops an invention. An invention is here defined as the first materialized implementation of the ideas that defines the innovation concept.

This phase contains generations of technological knowledge and technological transfer. Generations of knowledge may involve creativity processes. Dependent on the novelty of the concept, there may be a need for more creativity to solve technical problems surrounding the concept. This phase contains the biggest amount of creativity during the innovation process.

If the required knowledge and expertise is not available, a technological transfer may be needed. This is the process of searching, selecting and negotiating knowledge from other places; i.e. from other departments in the organization or from outside the organization.

Executing the process

This phase takes up the most time in an innovation process. The input to this phase is a concept and some ideas for how to realise the concept. The output is an innovation that is ready to be launched.

This phase is characterized by a series of problem-solving loops dealing with expected and

unexpected difficulties in the technical and market areas, and it is at this phase that most of the time, costs and commitment are incurred.

Another important aspect of this phase is the communication of information between all the involved entities; e.g. marketing and technical departments, customers and other stakeholders. Commitment also has a big impact on the success of the final innovation. If the users, customers, developers, researchers, and other involved people are not fully committed to the development, important knowledge may not reach the appropriate people and hence may not be incorporated in the innovation.

Launching the innovation

This phase is about preparing the market for the innovation. An innovation process do not terminate before the market adopt the innovation. Activities in this phase contains collection of information from the market, problem-solving and focusing on the final launch of the innovation.

Information collected in this phase is communicated back to the development team, so that it can be incorporated in the innovation. Collection is about anticipating likely responses to new products, and using the information to design the innovation. It involves a sequence of activities that makes the market aware of the innovation, makes it interesting so the market tries it out and evaluates it. The knowledge from the evaluations are used to improve the innovation for an easier adoption.

5.2.4. Learning and reinnovation

During this phase collection of valuable information is gathered and evaluated. Information, knowledge and experience from the phases of innovation process is gathered and reflected upon, so that the process can be improved next time it is initiated. Learning from failures and successes, from the above outlined phases, is crucial for future development of innovations.

Learning from the innovation process may lead to a reinnovation, meaning that an innovation is improved based on the new knowledge gained during the process.

This phase is important for maintaining a high level of innovation in the organization.

6. Empirical results

This chapter presents the results found in the empirical research. First, the results from the text analysis of the official documents are outlined. Every official document has been analysed and fragments from the documents that contain the word innovation are presented here. Secondly, the responses gathered by the questionnaire were analysed and the results are presented here. The quantitative questions were counted to get an overview of the spread of responses, while the responses to the qualitative questions was used to make a meaning condensation. Lastly, the results from the interview are also presented and put up against the intentions behind the interview.

6.1. Text analysis

The order of the text documents that have been analysed, is based on their broadness. The documents that are more general in relation to the university, are analysed first. The more specific the documents in relation to the Informatics study, are analysed last.

The reason is that I wish to analyse down to the most specific document, and during this process observe if innovation and innovation management makes more appearances.

I will cut and paste fragments from the various documents that cite, explain or state something in relation to innovation and innovation management.

6.1.1. The Strategy of Aalborg University until year 2010

Right in the Introduction paragraph of the document it is written:

“The University Board has noted the Government's statement that Danish society needs universities that belong to the international elite in terms of the highest quality within research, education and innovation.”

Later in the same paragraph the following is stated:

“It is the expectation of the Board that the strategic basis of management decision-making contained in this document will provide the framework for the

efforts to be made by all stakeholders of Aalborg University in order to ensure that the university is capable of strengthening its position among relatively young innovative universities.”

The next paragraph that contains the word innovation is about Aalborg University's missions. One of the missions is innovation:

“Innovation. In this field the university will function as a knowledge-producing institution of cultural significance by contributing to technological, economical, social, and cultural innovation in the society through entrepreneurship as well as transfer, communication, and exchange of knowledge.”

Then among the visions of the University the following is stated:

“Aalborg University should be among the leading innovative universities internationally.”

Two of the enumerated *distinguishing values* are *Creativity* and *Openness*. Creativity is a sub-process, that is part of the innovation process. [1,4] In relation to the two values the following is written:

“The university is constantly striving for novel and creative solutions within research by challenging traditional scientific paradigms ...”

and

“The university considers openness to be a prerequisite for the continued realization of the university's creative and innovative potential.”

Among the *Underlying values* the following values are mentioned: *“Innovative, entrepreneurial, and creative approaches.”*

Among the *Strategic goals* the following extract is present:

“Aalborg University will be among the leading universities in Europe within innovation and academic entrepreneurship.”

When describing the *Strategic foundation* for Aalborg University, the following excerpts are present:

“Aalborg University will integrate an entrepreneurial culture in its programmes and encourage its graduates and researchers to try out ideas and inventions with a commercial perspective through new or existing enterprises.”

“Through cooperation and exchange of knowledge with the society in general, the university will function as a knowledge-producing institution of cultural significance, and it will contribute to technological, economical, social, and cultural innovation.”

“Aalborg University will strive to promote knowledge-intensive entrepreneurship and innovation ”

6.1.2. The General curriculum

Looking through the general curriculum for all the studies belonging to the Faculty of Technical Science, only one place the word innovation appears. It appears under the subsection *Skills*, where the skills that should be learned, are enumerated. The following excerpt is from the Skills subsection:

“For alle uddannelser ved Det Teknisk-naturvidenskabelig Fakultet skal det gennem en videreudvikling og nuancering af først og fremmest det problemorienterede projektarbejde, der er det bærende element i fakultetets uddannelser, tilstræbes, at de studerende opøves i evnen til: ... kreativ problemløsning; ... innovation og kommercialisering via entreprenørskab.”⁷

6.1.3. The bachelor degree curriculum

In this curriculum the word innovation do not appear. In the competence profile for the Informatics bachelor degree the following is stated:

“Den studerende skal i bacheloruddannelsen i informatik erhverve sig en basal viden om – og erfaring med – computeren som teknologi og medium, der sætter ham/hende i stand til: at arbejde systematisk og kreativt med løsning af centrale problemstillinger inden for design og realisering af moderne, avanceret

⁷ See translated version in Appendix F, line 3.

*informationsteknologi, ...*⁸

The student do not have to accumulate basic knowledge and experience about innovation, but about working creatively with solutions.

6.1.4. The base year and master's degree curriculum

Both the base year and the master's degree curriculum do not state anything about innovation, innovation management or creativity.

6.2. Questionnaire

Twenty respondents chose to answer the questionnaire of whom thirteen were students, five supervisors, and two supervisors/lecturers. The semesters represented among the answers to the questionnaire are: 2nd, 3rd, 4th, 6th, 8th, 9th and 10th, meaning that at least one of the respondents have a relation to the enumerated semesters. Hence, the answers received to the questionnaire are representative for a big part of the Informatics study.

Next a presentation of the answers received is conducted. The presentation is based on the order in which the questions appear in the questionnaire. For every question a meaning condensation of all answers is performed. See Appendix C for the raw data gathered from the questionnaire.

6.2.1. Supervisor and lecturer specific questions

Questions answered by the supervisors and lecturers.

Do/did you teach or inspire your students to use innovation and innovation management?

Two have answered that they do/did teach or inspire the students to use innovation. Five answered that they do not teach or inspire.

Those who answered that they do/did teach or inspire had to answer the following question:

⁸ See translated version in Appendix F, line 4.

How do/did you teach or inspire to more use of innovation and innovation management?

- The respondent teach or inspire through the discourse in teaching and in supervision.
- The respondent also points to relevant literature that may inspire to innovation.
- By offering “open” projects based on problem identification and problem-solving, the respondent inspire the students to be more innovative.

Those who do not teach or inspire the students to use innovation, had to answer the following question:

Why do you not teach or inspire innovation and innovation management?

The causes for not teaching or inspiring innovation and innovation management are:

- The lecture is not appropriate for teaching innovation. If the lecture is about mathematics or 3D modelling then innovation is not relevant.
- The department of Computer Science has explicitly asked the respondent to teach a traditional subject, and in traditionally fashion.
- During the lecture about project management, the respondent needs to focus primarily on technical and social skills development, and it is difficult to link these to innovation.

Some respondents have answered that they do teach creativity, but do not label it as innovation. Another has answered that he has actually just designed a lecture segment about innovation and creativity, but this will not be used until next time, he will teach the lecture.

6.2.2. Student specific questions

Questions aimed at and answered by the students.

Do/did you learn about innovation and innovation management in the course of you education?

Three students answered that they do/did learn about innovation, while the rest of ten answered that they did not. Those who answered that they do/did learn had to answer the following question:

How did you learn about innovation and innovation management?

- The supervisor has talked a bit about innovation.
- The student has heard about innovation during several projects, but has not had a specific lecture about innovation.
- Self study in connection with a project, plus that it is mandatory during the 5th semester.
- The syllabus of a lecture did not include innovation as a specific subject, but the students were encouraged to explore new and innovative solutions.

Those who do/did not learn about innovation, had to answer the following question:

Why do you think, you have not learned about innovation and innovation management?

The causes for not learning about innovation and innovation management:

- The lecturers do not work on a daily basis with task where innovation is incorporated in.
- Innovation management do not appear to be a priority to the study board.
- There are not any lectures with focus on innovation management.
- The student do not think that innovation can be taught in a class. Innovation classes would be difficult to fit into the Informatics education.
- Innovation probably do not seem very important on the lower semesters, where the projects are more strict as to what to write about.
- The university probably thinks that it provides the "tools" and the students the "work input" and here the innovation is under the work input. There is more focus on learning the basics eg. certain methods, than elaborating new or taking different approaches, probably a way of saying that you should know what there is out there before you make your own.
- There is no focus on innovation and the like in the curriculum.

Are you aware of innovation during your projects?

Eight students say that they are aware of innovation during their projects. Five answer that they are not aware.

6.2.3. Questions aimed at all respondents

Questions that were not specific to the type of respondent.

What can be done to increase the knowledge of innovation and innovation management, among the student?

- Students should be encouraged to think of the future i.e. implement ideas that aren't likely to be implemented for profit in the near future.
- There are already courses for people intending to start their own company where they get feedback from "experts". Besides that I don't think it is the university's role to facilitate that kind of innovation. If someone has a great innovative idea, they should have the possibilities to nurture it.
- More courses that include topics as "Including seemingly unrelated design into projects" Better understanding of metaphors and how they can be used in the context of a given problem to combine traditional solutions with metaphoric solutions.
- Offering courses on all educations is important. More important to integrate innovation and creativity into project work. Interdisciplinary projects late in the study may also promote creative and innovative thinking.
- The students need more than knowledge on innovation and innovation management. They need skills in innovation and innovation management, not theory about it. If they want skills within systems development, they can specialize in the subjects of the IS group, and they will learn plenty.
- I think it would be better to incorporate innovation and innovation management into some of the existing courses (e.g. product development courses?) in the early semesters and then perhaps a course devoted to innovation and innovation management later in the curriculum.

6.2.4. Additional comments to the questionnaire

One of the supervisors/lecturers had the following comment to the questionnaire in general:

“Seen according to systems development, innovation and especially organising innovation (management) is a management discipline, and when not specialising within Information Systems subjects, management is not part of the curriculum for

the education, and should not be. Informatics students need to learn at the Computer Science department how to produce systems.”

6.3. Interview

Only two of the lecturers and supervisors that answered the questionnaire, agreed to be interviewed. Because of lack of time the interview was only conducted with one lecturer/supervisor.

Associate professor Ivan Aaen agreed to be part of the interview. His interaction with Informatics students is by his role as an lecturer or supervisor. The interview lasted approximately 35 minutes, and was performed in the Computer Department's building, on Aalborg University campus.

During the interview some of the reasons, gathered by the questionnaire, for not teaching innovation and innovation management were discussed. In extension, some measures for incorporating more innovation were outlined and discussed.

6.3.1. Reasons for not teaching/learning

The discussion of the reasons for not teaching innovation, started with whether the mathematics lecture was appropriate for teaching innovation. One of the lecturers that answered the questionnaire, answered that the type of the lecture decided whether teaching innovation was relevant, that the mathematics or 3D modelling was not appropriate.

The respondent think that it is a good reason for not teaching innovation, if the lecture is not appropriate. For example the mathematics lecture is supposed to teach the students to think stringent and analytical with problem areas. The respondent do not think that the form of teaching during a lecture will have much influence on the student's ability to be innovative.

The respondent said following about the mathematics lecture's purpose and usage:

“Matematik er en fag hvor man lærer at analysere og forstå nogen logiske sammenhæng uafhængig af hvad de skal bruges til. Det er en meget abstrakt fag. ... Matematik er i vores anvendelse, der er det en redskabsfag. ... Formålet med matematik undervisningen er primært at få folk til at forstå de matematiske

principper, så de kan anvende dem selv. Forhåbentlig inden for IT.”⁹ [Appendix E, line 24]

The respondent responded on whether a type lecture, as the mathematics lecture, should be used to teach the students to think creatively:

“... vi har forskellige typer af kurser, vi har kurser som har til formål og træne folk i begreber og problemer, så har vi kurser der beskæftiger sig med abstrahere. Matematik kurset har typisk til formål at lære folk til at tænke stringent og analytisk omkring problemstillinger. Det svarer på mange måder til at lære at læse. og der kan man selvfølgelig sige: hvis folk, de lærer at læse mens de står på hovedet og gør alle mulige mærkelige ting, så kan det være de bliver mere kreative når de skal til at skrive noget selv, men det skal der lige argumenteres for at det er hensigtsmæssig. Det kunne jo godt være at man i første omgang skulle fokusere på at få folk til at lære og læse. Når de så kan læse, så skal man så prøve på at kalde på de kreative processer. Det er derfor jeg skelner mellem kurser og så projektarbejde. Jeg ser så projektarbejde som det væsentligste motor til at vænne folk til at tænke innovativ. ...”¹⁰ [Appendix E, line 34]

Other reasons for not learning about innovation was that projects are usual predetermined [Appendix E, lines 31 - 33], and the students see the projects as limited entities. The respondent said that the students may not have time to fully implement the ideas during one project:

“... Vi har faktisk et problem med – det har jeg faktisk snakket om i mange år – at alle vores projekter er ”brug og smide væk”. Vi løser et opgave, skriver en rapport, laver noget software, så går vi til eksamen, og så smider vi det væk. Hvis vi umiddelbart satsede på at det folk de lavede det var noget som havde en værdi ud over semestret, ud over eksamen, så kan det godt være at de også ville lave mere ved det.”¹¹ [Appendix E, line 36]

Because the students see projects limited to only one semester, then they may not finish implementing or developing their ideas further, and reaching an innovation. Consequently, the students may not learn to transform an idea to an innovation.

6.3.2. Measures for more innovation

From the interview three major categories of measures have been formed. The categories are: *Lectures about innovation, changes in project work and change of mentality.*

⁹ See translated version in Appendix F, line 5.

¹⁰ See translated version in Appendix F, line 6.

¹¹ See translated version in Appendix F, line 7.

A lecture about innovation is not dismissed, but the respondent do not think, that the students will gain much from such a measure:

*“... jeg vil ikke afvise at man skal have en kursus på 1, 2, eller 3 ECTS som omhandler innovations processer, det kan man forstille sig. Men det vil aldrig flytte de store linjer, ...”*¹² [Appendix E, line 36]

The second measure is to change the ways projects are done. The respondent thinks that by varying the form of project work, the students may be able to take advantage of each other, and also get motivated to develop something significant. The respondent said:

*“... Der er flere ting man kunne vælge og arbejde med. Den ene er tempo-skift, det vil sige og variere projekt ideen: små grupper, store grupper, flere leverancer, få leverancer, et semester, flere semestre, lave nogle variationer her så gør at formatet for et projekt skifter. Så kan man vælge og sige at der skal være flere om at løse en opgave, det vil sige at der skal være flere projektgrupper der skal arbejde sammen om fælles løsninger. Disse grupper kan være tværfaglige, så man kan få flere faglig-heder i sving. Man kan genopdage ideen om temarammer, i gamle dage der havde vi ikke bare projekt-emner, men også projekt-temaer for projekter. Det vil sige et eller andet der gjorde et indholdsmæssig fællesskab for projektgrupper, så de kunne drage nytte af hinanden, på tværs af projektgrupper. Oprindeligt var der noget der hed Memgrupper, hvor 3 – 4 grupper, de var sammen om at dele erfaringer ud fra den fælles ”vejledning”, som også kan bidrage til at give et løfte, give et variation i projektet, give en ambition om at lave et eller andet der er væsentligt. ...”*¹³ [Appendix E, line 36]

When asked why the form of project work was not realised, as the respondent outlined, he said that the university tried to make several project groups cooperate on a common project, but it failed, because they tried the different project work form to early in the study, and because of legal reasons. The respondent said:

*“Blandt andet fordi de studerende ikke vil. Det har vi erfaret, men engang vi prøvede at et projekt på tværs af flere projektgrupper, der gik det i opløsning, fordi de studerende blev for ambitiøse på egne vegne. Så er der det retssikkerhedsmæssigt, for hvor hvad nu hvis en del projekt går ned, og det andet projekt det lykkes, men man har 2 projekter der er afhængig af hinanden, risikerer man så at det ene projekt det sænker eller hæmmer et andet projekt. Så det er mere trygt at have nogle kendte spilleregler, 1 vejleder og 7 studerende, og det er så det, som ikke har så mange udefra kommende faktorer. ...”*¹⁴ [Appendix E, line 38]

12 See translated version in Appendix F, line 8.

13 See translated version in Appendix F, line 9.

The respondent said that a solution to the above mentioned problem is to try again to make several project groups cooperate on a common project, but try it at a later semester:

*“Lægge det på et senere semester. Det første gang vi prøvede med ... var det på 3. semester. Så fremover vil vi nok forsøge at lægge det på 7. semester eller senere.”*¹⁵
[Appendix E, line 40]

The last category is about changing the mentality of the students and supervisors towards creating different things. The respondent said:

*“... det store udfordring for mig, det er at fremme et mentalitet blandt studerende, og blandt vejlederne, som dyrker det at skabe noget anderledes. ...”*¹⁶ [Appendix E, line 52]

14 See translated version in Appendix F, line 10.

15 See translated version in Appendix F, line 11.

16 See translated version in Appendix F, line 12.

7. Discussion

The purpose of this chapter is to analyse and discuss what the Informatics students are supposed to learn. I will base this discussion on the official documents and relate my findings to innovation. Are the students, lecturers and supervisors obligated to learn, teach or inspire innovation during the study? By what means should the students obtain the skills and knowledge? The result from the analysis of what the students should be learning during the study, is put up against what the students, lecturers and supervisors say they do during the study.

The problem-oriented project work which is an important element of the education form that is currently active at Aalborg University, is discussed in relation to innovation, innovation management, level of creativity and the generic innovation process. Does the project work hinder the innovation process? Does the project work guarantee that the students obtain innovation skills?

The discussion continues on the measures that the students, lecturers and supervisors have proposed and is supplemented with some measures proposed by other literature. These measures are categorised, and discussed.

Lastly, a discussion of the empirical method is conducted in order to learn the from the process. The discussion will also contain solutions to mistakes made during the process. The validity and generalisability of the results in this report are also discussed.

7.1. Innovation and competencies of an Informatics student

What is an Informatics graduate supposed to have learned and which competencies should have been gained through the Informatics study?

The vision and strategy of Aalborg University states that the university should become an innovative university. It does not say directly that the university should teach the students about innovation, cf. section 6.1.1.

The purpose of the study, applicable to the Informatics study, stated in the general curriculum for the Faculty of Technical Science is:

“Bacheloruddannelsens formål er, jf. uddannelsesbekendtgørelsen, at kvalificere de studerende til at varetage erhvervsfunktioner med baggrund i naturvidenskabelige kundskaber og færdigheder og at give de studerende kundskaber og indsigt i metoder, der danner grundlag for overbygningsstudier. I studieordningernes faglige del fastsættes faglige mål for de enkelte bacheloruddannelser.”¹⁷ [27]

Kandidatuddannelsens formål er, jf. uddannelsesbekendtgørelsen, at kvalificere de studerende til selvstændigt at varetage erhvervsfunktioner med baggrund i naturvidenskabelige kundskaber samt indsigt i naturvidenskabelige teoretiske og/eller eksperimentelle metoder og at kvalificere de studerende til at deltage i videnskabeligt udviklingsarbejde. I studieordningernes faglige del fastsættes faglige mål for de enkelte kandidat uddannelser.”¹⁸ [27]

Some aspects that are significant to notice, are that the students have to learn *scientific theories and methods*, and that those should be used when *managing business work*. So if the business work necessitate innovation skills, should the university teach the students the skills? Not necessarily, because the purposes state the students should get qualified to manage the work based on scientific theories and methods. It does not state that the university should teach all the needed skills for a particular business work.

During the bachelor the students should also get prepared to be able follow the master's study. What also differentiates the master's study from the bachelor is that during the master's study the students have to get qualified to *independently* manage business work.

The general curriculum also states the skills that the students should acquire during the study:

“For alle uddannelser ved Det Teknisk-Naturvidenskabelige Fakultet skal det gennem en videreudvikling og nuancering af først og fremmest det problemorienteret projektarbejde, der er det bærende element i fakultetets uddannelser, tilstræbes, at de studerende opøves i evnen til:

- *at angribe nye problemstillinger*
- *logisk ræsonnement*
- *kritisk og selvstændig analyse*

¹⁷ See translated version in Appendix F, line 13.

¹⁸ See translated version in Appendix F, line 14.

- *forståelse for fagets videnskasteori*
- *tværfaglig syntese*
- *at fremme bæredygtig og etisk forsvarlig teknologi*
- *kreativ problemløsning*
- *anvendelse af moderne informationsteknologi*
- *kommunikation*
- *gruppe- og samarbejde*
- *ledelse*
- *forsat professionel udvikling*
- *innovation og kommercialisering via entreprenørskab*¹⁹ [27]

It is important to notice that the general curriculum states that the university should *strive* to teach the enumerated skills. It does not state that the university should mandatory teach the skills. One of the skills that the university should strive to teach is: *innovation and commercialization by means of entrepreneurship*. So the supervisors and lecturers, should strive, but are not obligated, to inspire and teach innovation. Seen in contrast to the vision of the university, regarding more innovation in the university, innovation do not get a high priority in the general curriculum, meaning that it is not mandatory to teach the innovation skills.

Another aspect to notice is the means of learning the enumerated skills. The general curriculum state that the students should learn the skills primarily through *further development* and *variation* of project work. Therefore, the general curriculum urge to variate and further develop the project work.

Supplementing the general curriculum, the curriculum for the base year of the Informatics study states the overall purpose as the following:

Basisårets overordnede formål er:

1. *At opøve de studerendes evne til, på et videnskabeligt og kontekstuel orienteret grundlag, at gennemføre og formidle et projekt arbejde af relevans for et teknisk-naturvidenskabeligt studium, samt at opøve de studerendes evne til at reflektere over læreprocessen.*
2. *At bibringe de studerende grundfaglig viden og forståelse af relevans for et teknisk-naturvidenskabeligt studium.*
3. *Gennem pkt. 1 og pkt. 2 at virke som del af et samlet studieforløb inden for de uddannelser, der henhører under Det Teknisk-Naturvidenskabelige Fakultet ved Aalborg Universitet.*²⁰ [28]

¹⁹ See translated version in Appendix F, line 15.

²⁰ See translated version in Appendix F, line 16.

The base year curriculum states at item 1 that the students should acquire the skills to *complete* and communicate a project. The students should also learn basic knowledge and understanding, relevant to a scientific study. The curriculum does not explain what is meant by skills to complete a project. When is a project completed? When the project objective is reached?

Moving away from the general and base year curriculum, and looking more specifically at the curriculum that is more specific to the Informatics study, the bachelor degree curriculum states:

“Den studerende skal i bacheloruddannelsen i informatik erhverve sig en basal viden om – og erfaring med – computeren som teknologi og medium, der sætter ham/hende i stand til:

- *at arbejde systematisk og kreativt med løsning af centrale problemstillinger inden for design og realisering af moderne, avanceret informationsteknologi, således at teknikkens potentiale til at understøtte mennesker i både arbejde og fritid udnyttes optimalt*
- *at anvende grundlæggende teorier, metoder og principper om udvikling, konstruktion og brug af informationsteknologi samt om kommunikation mellem mennesker i forhold til udvikling og anvendelse af informationsteknologi*
- *at opbygge og vedligeholde en grundlæggende teknisk kvalificering indenfor det datalogiske fagområde*
- *at gennemføre et studium på kandidatuddannelsen i informatik”²¹ [30]*

The master's degree curriculum states that:

“Den studerende skal i kandidatuddannelseni informatik opnå viden om – og erfaring med – organisatoriske og medierettede anvendelser af IT. I tilgift hertil skal den studerende kunne anvend, kritisk vurdere, og udvikle teorier fra datalogi og humaniora i forbindelse med udvikling og konstruktion af edb-baserede systemer. ”²² [31]

The students should during the bachelor study acquire fundamental knowledge and experience of designing and *realising* modern, advance information technology. The realised information technology should also support people in their work and spare time. The students should also learn and use fundamental theories, methods and principles about development, construction of information technology. Despite the fact that the bachelor and master's degree do not explicitly state

21 See translated version in Appendix F, line 17.

22 See translated version in Appendix F, line 18.

that the information technologies should be innovative, but because the general curriculum lay the foundation of the two curriculum, it could be argued that the student should strive for designing and developing innovative information technologies.

So one of the intended skills that an Informatics student should have at graduation is the ability to be innovative.

7.2. The present level of innovation during the Informatics study

The general curriculum states that all students studying at the Faculty of Technical Science, are intended to obtain innovation skills, primarily during the projects that they make during their study.

Despite that it is written in the official document, that lay the foundation of the Informatics study, ten out of thirteen students answered, in the questionnaire, that they did not learn about innovation and management of it. This corresponds well with the answers from the supervisors and lecturers, where five of seven answered that they did not teach or inspire innovation and innovation management.

Some students have heard about innovation during their projects, but not in lectures. Some supervisors have also urged the students to try new approaches.

The intention of teaching/learning innovation skills, written in the official documents, is not fulfilled, according to what the students, supervisors and lecturers say about the learning, inspiring and teaching innovation and management of it, during the Informatics study.

There are several reasons for the low level of teaching, inspiring and learning about innovation, during the study.

One could argue, that the supervisors and lecturers do not inspire or teach innovation, because the vision of having more innovation in the studies, is either not yet incorporated in the curricula or not mandatory to teach. Even if the visions and strategy are not yet transformed into the bachelor and master's curricula, the general curriculum is still applicable and clearly states the intention of that the students should learn about innovation.

A student also mentions, as a reason for not learning about innovation that there is no focus on innovation and the like, in the curriculum. If a person only reads the base year, bachelor and master's degree curricula, innovation does not get any attention.

One of the lecturers pinpointed that his reason for not teaching innovation was that the lecture that he held, was not appropriate for teaching innovation. The interview respondent agreed with the argument that some lectures may not be appropriate, like the mathematics and 3D modelling lectures.

One could wonder, that the reason is, that there is no tradition of teaching, inspiring and learning innovation during the Informatics study. Maybe the tradition of the Informatics study is characterized by routines, meaning that the mentality is “doing things as we always do”. This could be supplemented by the fact that one of the supervisors commented the questionnaire, and said that Informatics students should not learn about innovation (management) and instead learn to produce information systems. It proves that there might be a mentality that innovation is not an important element of the Informatics study, cf. section 6.2.4.

Another reason mentioned in the interview is that it is not always possible to go through the whole innovation process during one project. The interview respondent mention that he sees the current project structure maintaining the mentality of *make-and-throw-away* projects.

Students may go through the search, selection and partly the implementation phases of the innovation process. Many students do not fully implement the initial concept, and thereby no innovation is created.

The interview respondent acknowledge that the students do not learn about innovation through the lectures, but should be able to do that during their project work.

7.3. Innovation, projects and management

The interview respondent said that a possible way that students could learn about innovation is by project work, which is in compliance with the general curriculum. The respondent said that the project work leads to innovative thinking. Does project work make the students learn more about innovation, and make them think innovatively?

7.3.1. The project process and the innovation process

The term *project* is defined on Prentice Hall's online website as follows:

“Project: A planned undertaking of related activities to reach an objective that has a beginning and an end.” [38]

Another definition of the term project by Wikipedia:

“A project is a temporary endeavor undertaken to create a unique product or service. Thus, the end result sought may be distinct from the mission from the organization which undertakes it because the project specifically has a deadline and the endeavor is temporary.” [39]

A project is a process, that has a beginning and an end, and where there are some related activities which have the purpose to reach an objective. The definition does not state whether the activities are predefined, in a sequence or random. It also does not state anything about which activities there may be in a generic project.

In the context of this report, the organization mentioned in the last quotation is a university.

An innovation, as stated earlier, is a product, procedure, etc. that gives a benefit to the user; it is implemented; and at the same time it is new to the context in which the user uses the product.

The process of creating an innovation, is the innovation process, described earlier in the Literature chapter.

At first projects and innovation processes may seem similar, but according to *Managing Innovation*

the innovation process may be uncertain and random:

“Most innovation is messy, involving false starts, recycling between stages, dead ends, jumps out of sequence, etc.” [3, page 76]

An innovation process is not necessarily based in a time frame, meaning that it does not necessarily have a beginning or an ending based on a time scale. Although some projects may consist of some of the activities described in the generic innovation process, not all activities will be present in all projects. If a project has an established objective, it may not include the Searching and Selecting activities.

Therefore the relation between innovation and project is that a project may lead to an innovation, if it follows the activities described in the generic innovation process.

7.3.2. Management of project and innovation processes

Management in relation to an innovation process is described as follows:

“We are using the term 'manage' here not in the sense of designing and running a complex but predictable mechanism (like an elaborate clock) but rather that we are creating conditions within an organization under which a successful resolution of multiple challenges under high levels of uncertainty is made more likely.”[2]

Management in this context is not to control every aspect of the process, but to create the possibility of the different activities to happen. The success of the innovation and implicit the innovation process is based on the management of the resources available during the innovation process.

“Success innovation in appears to depend upon two key ingredients – technical resources (people, equipment, knowledge, money, etc.) and the capabilities in the organization to manage them. ”[2]

In relation to management of projects, Armand Hatchuel and Benoit Weil say:

“... that project leaders are more akin to reduce the innovative challenges of their projects in order to reach more easily their established goals: in other words like a plant manager a project leader avoids uncertainties and risks as much as possible for him.” [3]

The currently project work structure that is applied during the Informatics study, is based on one project in every semester, meaning that there is a time limit for every project. The projects usually

does not continue to the next semesters, and corresponds well with what the interview respondent said about the projects being make-and-throw-away projects. Because of the limited resources students may, during a project, reject to explore new opportunities, in exchange for less risky and known solutions and approaches. Furthermore, the fact that the projects may seem predetermined – as the interview respondent mentioned – does not encourage to try out new approaches.

7.3.3. Creativity and current project work

Creativity is a factor in the innovation process, because creativity lead to new ideas and concepts. The innovation process is about observing changes in the society, development of concepts and lastly implementing them. Teresa M. Amabile presents a componential, theoretical model of creativity, and it is composed by three components: domain-relevant skills, task motivation and creativity relevant skills.

Amabile states that, if the components are available, there will be a good probability of creating novel products.

Looking at the current situation in the Informatics study, there are three units where the students obtain some knowledge and experience: *Studieenhedskurser*, *Projektenhedskurser* and projects. *Studieenhedskurser* teach about core areas in disciplines that are central for the study. *Projektenhedskurser* teach about disciplines needed during the projects.

Trying to map Amabiles three components to the units mentioned above, the result is that:

- ➔ *Projektenhedskurser* and *Studieenhedskurser*, gives the students the domain-relevant skills.
- ➔ Project work, individual choice of subject, should give the students the motivation – i.e. more of the intrinsic motivation - for working on the project subject.
- ➔ What about the creativity-relevant skills?

According to the curriculum there are no lectures where the cognitive abilities that are relevant to the creative performance are learned or challenged. There is a lecture, *Samarbejde, læring og projektmanagement* (SLP) – referred to by a respondent in the questionnaire -, about project management during the base year. According to the Appendix to the base year curriculum, the only

heuristic activity that is taught during the SLP lecture is the activity of “Brain-storming”.

7.3.4. Problem-oriented project work and innovation

As mentioned above, the Informatics study is formed by projects and lectures. The ratio between the project work and lectures is 1:1, meaning that the projects should at least take up half of a semester, so the project work is an important element in the education form at Aalborg University. [14]

Project work is characterized by being *participant-controlled*, meaning that the project participants decide the problem and the work process that are used in the project. [7] The project work at Aalborg University is also *problem-oriented*, meaning that the project is *problem-controlled*. [14] Consequently, the students work with a concrete or theoretical problem, and decide the work process based on the problem. Other types of project work, are *syllabus-controlled*, where the project participants have to solve a problem by choice, but shall use specific theories and methods, outlined in a syllabus, or the problem is predetermined and the participants can choose the theories and methods.

Some advantages of the problem-oriented project work are that the students have the possibility to work inter-disciplinary, develop analytically and creatively. The students are more motivated, because they can choose the subject of the project. The project work also encourage the students to be active in their learning, because they get confronted with lack of knowledge needed to solve the problem at hand. Communication is also a skill that is learned during project work, when collaborating with other participants.[14]

A downside is that the students may risk not to learn the academic knowledge in depth, because of focusing on restricted areas of the domain. Other areas of the domain may be overlooked or imperfectly studied. The students may also risk to neglect theories and methods, because of restricted focus.[6,14]

The students learn, by performing project work, the skills to work inter-disciplinary, analytically and creatively which is needed in the sub-phase *Acquiring knowledge phase* of the generic innovation process, when generating knowledge. The skills are also needed in the *Executing the process* sub-phase, when dealing with the problem-solving loops. The communication skills are also needed

during the whole generic innovation process.

What about the other phases in the innovation process? It could be questioned whether the students acquire skills needed in the *Search* and *Selection* phases, during the project work. If the students do not have an enough in depth knowledge, then they may make an unqualified evaluation of the resources in the project, which is important in the *Select* phase.

Students may for instance focus primarily on the technical aspect of the solution developed during the project, and not focus in depth on other aspects. When making an analogy to the innovation process, students may focus more on the *Executing the process* sub-phase, than the *Launching the innovation* sub-phase. If this is the case, it may affect the usage of the solution developed.

If the project is *syllabus-controlled*, the students motivation may decrease, due to restrictions on theories or method. It may then affect the creativity during the innovation process. The restriction imposed by a syllable, may also affect negatively the *Search* and *Select* phases, by omitting to search for other possibilities.

7.3.5. Summarizing

Project work during the Informatics study may lead to innovations, if the project proceed the phases described in the generic innovation process. But because of limited time and/or lack of in depth knowledge, during the projects, the students may not take the risk, and choose to reject to pursue the more innovative challenges or focuses on specific aspects of the project. Beside that, the students do not learn about creative-relevant skills – according to the official documents – so based on Amabiles model, the probability of creating novel ideas and concepts is smaller. The project work may encourage the students to actively search for knowledge about creativity, but project work do not guarantee it will happen.

7.4. Measures for ensuring the acquisition of innovation skills

Based on the questionnaire, interview and articles some categories of measurements have been deduced, which could be implemented, and possibly help ensuring the students in acquiring

innovation skills during the Informatics study. The categories are: lectures, new project structure, mentality change and updated curriculum.

7.4.1. Lectures

When asked to mention measures that could increase the knowledge about innovation and innovation management, in the questionnaire, several mentioned a lecture about creativity and innovation as an option. Another option could be to incorporate more innovation and innovation management into an existing lecture, e.g. the SLP lecture, as it might be appropriate.

The interview respondent did not dismiss the possibility of introducing lectures with more focus on creativity and innovation, but said that he does not believe that it will make much of an impact.

As discussed in the section 7.3.3, the Informatics students should have the motivation and the domain-relevant skills covered by the project structure, and by the Projektenhedskurser and Studieenhedskurser. So by introducing a lecture about creativity and innovation, the creativity-relevant skills will eventually get covered, and increase the probability of creating new ideas and concepts.

7.4.2. New project structure

Some respondents answered, when asked about what could be done to increase innovation, that:

“The students need more than knowledge on innovation and innovation management. They need skills in innovation and innovation management, not theory about it. ...”, cf. section 6.2.3.

“Offering courses on all education is important. More important is to integrate innovation and creativity into project work. Interdisciplinary projects late in the study may also promote creative and innovative thinking.”, cf. section 6.2.3.

The interview respondent agrees with the point that projects are the most important units for obtaining creativity and innovation skills. The respondent proposed to change the current project structure that maintains the feeling of predetermine projects, and other constrains, like time limit. Following factors could be considered when changing the project structure:

- small project groups versus big project groups
- few deliveries versus many deliveries
- one semester versus several semesters projects
- few professional competencies versus many professional competencies in the group
- a single project group versus several project groups cooperating on the same project

The idea is to make variations to the project structure, to create conditions[1,3,4,5,13,18,36] for the innovation process to elapse. If a project group has two semesters to work on an idea or concept, the probability of the students going through the phases described in the generic innovation process, increases.

The interview respondent also told that the Computer Science department, under which the Informatics study is residing, tried to implement an alternative project structure where several project groups should cooperate and develop an information system. The experiment failed, partly because the students got too ambitious on their own and partly due to legal matters. What would happen if one of the project groups failed in fulfilling its task, while the other group succeeded, as the two groups are dependent of each other.

When changing the project structure during the Informatics study, one has to ensure that every stakeholder is involved and accepts the ground rules. Also the legal matters have to be resolved, in order to prevent problems later on.

In the context of changing the project structure, Brenton D. Faber[15] propose an Open Source educational model, which is based on the Open Source development processes. The educational model suggest the of following points which are relevant to educational settings:

1. Problem-Based Learning

- The students should work on projects that interest them and by working on interesting and meaningful projects they also learn correlative knowledge, skills and aptitudes.

2. Working from Texts, Working through Drafts

- Working drafts should be made public so other students can work on others work, and/or get inspired by unfinished solutions.

3. Encouraging Risk-Taking, Inquisitiveness, Invention

- The student should be encouraged to be curious and try new approaches, ideas and ways to solve a problem.

4. Handing Off Projects and Mentoring New Students

- The students should hand off their projects and mentor the successor. The other students should be encouraged to work further past projects. In this way projects can elapse several semesters.

5. User Testing

- The students should treat the users as co-developers, and use them to get inspiration and to debug.

6. From Drafts to Final Product

- The students should release their solutions often, so that they can get feedback and ideas and solutions from other students and users.

7. Collaborative development

- By collaborating with others, the project may have access to more resources. It solves the problem of not having the knowledge and experience with in the project group.

8. Rewarding and Building from Failure

- When trying out new ideas and solutions, some may not have the intended outcome or fail. The students should be encouraged to build on the outcome and failure, with the intention to learn and get inspired.

The points cover some of the factors outlined above. The educational model should be explored further, used as inspiration for when refactoring the Aalborg University project structure.

7.4.3. Mentality change

As the interview respondent mentioned in the interview, one big challenge for him was to encourage a mentality of creating something new. According to him, the students, supervisors and lecturers in general are not pro changes and innovation. The situation is proven by a supervisors comment – from the questionnaire - stating that innovation is not an important issue during the Informatics study, cf. section 6.2.4.

7.4.4. Updated curricula

In section 7.2 it was stated that the vision of more innovation in the studies at Aalborg University, is not transformed to all curricula. It may have the effect, that some lecturers and supervisors do not find it necessary to teach or inspire innovation, because it is not written in the bachelor or master's degree curricula, and is not mandatory.

If the base year, bachelor and master's degree curricula are updated to cope with the condition that the students should learn about innovation, the lecturers and supervisors might feel urged to teach and inspire innovation more.

The updated curriculum should not only contain changes in the purposes of the base year, bachelor and master's sequence, but also add, if necessary, lectures to cope with the creativity-relevant skills (cf. section 7.4.1).

7.4.5. Innovation camps

Another possibility for students to get knowledge and skills about innovation is by attending various innovation camps. An innovation camp is usually a 48 hour event, where students in groups have to come up with new solutions to a given problem - the problem is usually from the real world. The students get an introduction to some creative methods and tools that may help the idea generation. After developing their ideas and concepts, the groups write creative conceptualized solutions that may solve a given problem. The students usually do not have the resources to also implement the solution during the event. In comparison with the generic innovation process, such camps only covers the process partly, and consequently the students do not experience every phase of the innovation process.

There are various camps available for the students. The Computer Science study, arranged camp called Datalogi Camp 2005, during the Dat. 7 semester, September 2005. Datalogi Camp 2005 was mandatory for the Computer Science students.[41] Another camp is SICEF Innovation 2006, which is arranged by "C3, ledelse og økonomi – studerende" a student organization. Students have to file an application to get selected to participate.[42]

7.5. Critic of empirical method and experience

Here are some comments on the research method used, and some experience gathered during this project.

7.5.1. Text analysis

The first experience that I have got from the text analysis is that the documents are not all updated. For example, the *Strategy of Aalborg University* is from July 2005, whereas the general curriculum is from January 2005, meaning that the general curriculum may not have been updated since the new Strategy of Aalborg University.

The other curricula, base year, bachelor and master's degree curricula are from August 2005, so those may have been revised to contain the visions described in the Strategy of Aalborg University.

In this project, I have focused on the words *innovation*, but it may be a good idea in the future projects to also focus on the elements that model innovation, for example looking for words like creativity, openness, more risk taking, etc.. It may be possible that the curriculum does not state explicitly innovation, but still mentions the elements that constitute innovation.

7.5.2. Questionnaire

An experience is that it is good to run a pilot-test of the questionnaire, before broadcasting it to the respondents. The pilot test revealed some aspects of the questionnaire that seemed strange to some of the respondents. For example, the first version of the questionnaire also asked the students to fill in their name, which they found strange. This was changed in the second version of the questionnaire.

A respondent thought that the questionnaire contained an overwhelming amount of associated text to every question, but the respondent still acknowledged that it was a positive thing, because the text clearly described the intention of and how to answer the questions. A problem that could arise is that due to the amount of associated text, the respondents may not have been inclined to read all the

text through, and responded shortly, and not how it was intended.

Some respondents also answered that it was hard to come up with reasons and examples to some of the questions, which can also be seen in the responses from the questionnaire; that in some places the respondent have answered shortly, and gave few reasons or examples when asked.

Another solution could be that the questionnaire should contain more questions, so that the questionnaire explore from several perspectives, and at the same time minimises the impact if the respondents answer shortly.

The method for preparing the questionnaire was extended to contain open questions. The respondents are of the opinion that the mixture of closed (quantitative) and open (qualitative) questions was good. A respondent wrote that the mixture made it easy to answer – using the close questions – and at the same time one was compelled to write some qualitative answers to related questions. So the mixture was a good choice.

Some students have acknowledged that the questionnaire was relevant, and was presented in a good fashion. On the other hand some of the supervisors and lecturers had problems understanding the meaning of the project. The main problem was due to the lack of a better definition of innovation and a better description of how innovation should be seen in relation to the Informatics study.

In a future questionnaire, the relation between innovation and the Informatics study should be stated more clearly, so that the respondents can see the relevance of the project, and answer thereby.

Demographic informations should also be gathered, to get an overview of the different research fields, in relation to teaching and inspiring innovation. The demographic information could be used to deduce from which research field, the supervisors and lecturers inspire and teach innovation or not.

7.5.3. Interview

Only two of the supervisors and lecturers, that answered the questionnaire, agreed to be interviewed. Due to workshops etc., it was only possible to interview one of the supervisors/lecturers. The

respondent had previously worked with innovation and had a good understanding of the subject. During the interview the respondent started to ask me questions about what I meant and how I defined innovation, and the relation to the Informatics study. Therefore, the interview got deviated from the flow intended and written in the interview guide.

I used a relatively big amount of the interview clarifying my definitions and what I meant. This may be an effect of the fact that the definition used in the questionnaire was not appropriate, and the relation between innovation and the Informatics study was not described properly.

I understand the respondent's reaction of asking clarifying questions.

Next time I will try to better define and describe what innovation is in this context, and its relation to the Informatics study.

7.5.4. Validity and generalizability

Because of the low number of people that answered the questionnaire – seven supervisors/lecturers and thirteen students – the results deduced in this report should be used as an indication of the placement of innovation in the Informatics study.

The questionnaire was sent to 35 supervisors/lecturers and only seven answered, meaning a response rate of 20%. It cannot be said that the answers is representative for the supervisors and lecturers associated with the Informatics study. The same is valid for the interview, where only one supervisor/lecturer was present.

The questionnaire was also sent to all currently active Informatics students. Only thirteen students answered the questionnaire, so again the results are not representative for every student. Due to the lack of information on the number of active students, it is not possible to calculate the response rate.

The results should be considered an indication of the current situation at the Informatics study, in relation to innovation and innovation management.

8. Conclusion

The board of Aalborg University has created a document with the vision and strategy for the university. The vision states that the university should be among the top innovative universities, internationally. However, this does not mean that the university is obliged to teach innovation.

In contrast to the vision of the university, innovation does not get much attention in the curricula. The general curriculum, as the only curriculum, states that one of the intended skills that an Informatics student should have at graduation is the innovation skill. The supervisors and lecturers, should *strive*, but are not obligated, to inspire and teach innovation during the education. The means of acquiring the skills is by project work.

The majority of the students, lecturers and supervisors asked, answered that they do not learn, teach or inspire innovation during the Informatics study. Some of the reasons are that it is not mandatory for the students to learn about innovation, some lectures are not appropriate for teaching innovation, or the current project work does not support an innovation process.

A minority of the students have heard, or learned about innovation during their project work. Furthermore some of the supervisors have answered that they teach or inspire innovation through the discourse in teaching and in supervision, and that they also point to relevant literature that may inspire innovation.

The intention of teaching/learning innovation skills, as written in the official documents, is not fulfilled according to the majority of the students, supervisors and lecturers.

To ensure that the students can acquire innovation skills during their study, some measures could be implemented:

- ➔ Lectures about creativity and innovation processes, theories and methods.
- ➔ Variation of the project structure, to cope with the limitation of the current structure.
- ➔ Change the mentality towards innovation, among the students and university staff.

- Update the curricula, and assign more attention to innovation.
- Arrange camps, where students can try different aspects of the innovation process, besides the project work.

9. Bibliography

(Directly or indirectly used literature)

Books:

- [1] West MA; "Developing Creativity in Organisations", The British Psychological Society, 1997
- [2] Jakobsen HS, Rebsdorf SO; "Ideudvikling ved kreativ innovation", Gyldendal, Erhvervsfaglig redaktion, 2003
- [3] Tidd J, Bessant J, Pavitt K; "Managing innovation", John Wiley & Sons, Ltd, 2005
- [4] Mauzy J, Harriman R; "Creativity, Inc.", Harvard Business School press, 2003
- [5] Kollerup F, Thorball J; "Innovation for ildsjæle & vandbærere", Børsens Forlag, 2005
- [6] Wagner KD; "Universitetspædagogik: En grundbog", Akademisk Forlag, 1994
- [7] Tofteskov J; "Projektvejledning – og organisering af projektarbejde", Samfundslitteratur, 1996
- [8] Schrøder K, Drotner K, Kline S, Murray C; "Researching Audiences", Arnold Publishers, 2003
- [9] Kvale S; "InterView: En introduction til det kvalitative forskningsinterview", Hans Reitzels Forlag a/s, 2003
- [10] Mogensen KÆ; "Creative Man", Institutet for Fremtidforskning, 2005
- [11] Lindholm MR, Møller K; "Slip innovationen løs", Børsens Forlag, 2005

Articles:

- [12] Munk-Madsen, A.; "Define Project", in B.E. Munkvold et al. (eds.) "Proceedings of the 28th IRIS Conference"; Kristiansand Norway: Agder University College.
- [13] Amabile TM; "The Social Psychology of Creativity: A Componential conceptualization", Journal of Personality and Social Psychology, Vol.45 nr.2, August 1983
- [14] Algreen-Ussing H, Keiding TB, Kolmos A; "Pædagogisk omstilling, læringsopfattelser og organisatoriske rammer"; Pædagogisk Udviklingscenter og Videncenter for Læreprocesser Aalborg Universitet.; 1999

- [15] Faber BD; "Educational Models and Open Source: Resisting the Proprietary University", SIGDOC'02, October 20-23, 2002, Toronto, Ontario, Canada
- [16] Potgieter BC; "Change and Innovation We Expect of ICT Teaching staff", Conferences in Research and Practice in Information Technology, Vol.30 (ACE2004), Editors Raymond Lister & Alison Young
- [17] West MA, Altink WMM; "Innovation at Work: Individual, Group, organizational, and Socio-historical perspectives", European Journal of Work and Organizational Psychology, 1996, 5(1), 3-11
- [18] Hatchuel A, Weil B; "Design-oriented Organizations – Towards a unified theory of design activities", 6th International Product Development – Management Conference, Churchill College, Cambridge UK, 1999
- [19] Robinson MA, Sparrow PR, Clegg C, Birdi K; Design engineering competencies: future requirements and predicted changes in the forthcoming decade, Design Studies 26 (2005) 123-153, [<http://www.elsevier.com/locate/destud>]
- [20] Evald MR, Kirketerp A; Evaluering af undervisning og underviseres kompetencer inden for iværksætter/innovation ved de videregående uddannelsesinstitutioner, april 2006, www.idea-demnark.dk
- [21] Denning PJ; Educating a new engineer, Communications of the ACM, December 1992, Vol.35, No.12, s.83-97
- [22] Tew AE, Fowler C, Guzdial M; Tracking an Innovation in Introductory CS Education from a Research University to a Two-Year College, SIGDOC'05, February23-27, 2005, St. Louis, Missouri, USA
- [23] Rickards T; The Management of Innovation: Recasting the Role of Creativity, European Journal of Work and Organizational Psychology, 1996, 5(1), 13-27
- [24] Dalton B; Creativity, Habit, and the Social Products of Creative Action: Revising Joas, Incorporating Bourdieu, Sociological Theory 22:4 December 2004
- [25] Taylor-Cummings A; Bridging the user-IS gap: a study of major information systems projects, Journal of Information Technology (1998) 13, 29-54

Web content:

- [26] Aalborg University; "AAU 2010 – Strategy of Aalborg University: Strategic basis for management decision-making", 2005, [<http://en.aau.dk/GetAsset.action?contentId=795977&assetId=795982>]
- [27] Aalborg Universitet; "Ramestudieordning", 2005, [<http://auaw2.aau.auc.dk/fak-tekn/regler/rammestudieordning.pdf>]

- [28] Aalborg Universitet; "Basisåret, Studieordning", 2005, [http://tnb.aau.dk/stud_info/studieordning/SO_2005_uden_appendix_foreloebig.pdf]
- [29] Aalborg Universitet; "Basisåret, Appendix til studieordning", 2005, [http://tnb.aau.dk/stud_info/studieordning/SO_2005_appendix_foreloebig.pdf]
- [30] Aalborg Universitet; "Bacheloruddannelsen i Informatik", 2005, [http://www.math.aau.dk/f- sn/338/infbach_aug2005.html]
- [31] Aalborg Universitet; "Kandidatuddannelsen i Informatik", 2005, [http://www.math.aau.dk/f- sn/infkand2005_aug2005.html]
- [32] Regeringen; "Flere vækstiværksættere – vision og strategi", Globaliseringsrådet, 2006, [http://www.globalisering.dk/multimedia/Debatopl_g_iv_rks_ttere_final1.pdf]
- [33] Regeringen; "Bilag om uddannelse i entrepreneurship i det danske uddannelsessystem", Globaliseringsrådet, [http://www.globalisering.dk/multimedia/Bilag_om_uddannelse_i_entrepreneurship_6.pdf]
- [34] Darsø L; "Findes der en formel for innovation?" Børsen Ledeshåndbøger , [http://www.cs.aau.dk/new_education/Dat/7/formel.pdf]
- [35] Rasmussen P; "Kreativ og innovativ kompetence I", Det Nationale Kompetenceregnskab", [http://www.cs.aau.dk/new_education/Dat/7/kreativ.pdf]
- [36] Hansen S; "Hvad skaber kreativitet i projektarbejde?", Aalborg Universitet, [http://www.plan.aau.dk/~sh/Publikationer/Hvad%20skaber%20kreativitet%20i%20projektarbejdet.pdf]
- [37] Aaen I; "Survival Kit – Project Supervision and Evaluation", Aalborg University, 2003, [http://www.plan.aau.dk/~sh/Publikationer/Hvad%20skaber%20kreativitet%20i%20projektarbejdet.pdf]
- [38] Prentice Hall's online website; "Definition of project", [http://cwx.prenhall.com/bookbind/pubbooks/valacich/chapter1/custom1/deluxe-content.html]
- [39] Wikipedia; "Definition of 'project'", [http://en.wikipedia.org/wiki/Project]
- [40] Wikipedia; "Definition of 'idea'", [http://en.wikipedia.org/wiki/Idea]
- [41] Datalogi Camp 2005; [http://ivaerksaetter.emu.dk/lvu/paed-didak/datalogi_camp/index.html]
- [42] SICEF Innovation 2006; [http://www.yc.dk/content.aspx?itemguid={7C371A1F-00E9-478C-BBB9-B81E7EE095F4}&menu=blue&mainmenuguid={7FE6BDD0-BFD3-43A7-B59F-89CE9BB70ED7}&type=1]

10. Appendix

A

Questionnaire for P10 (Innovation in the Informatics education).

I used the ten-step method for preparing a questionnaire, presented in “Researching Audiences” by Kim Schrøder, Kirsten Drotner, Stephen Kline and Catherine Murray, pages 180 – 202.

Step 1: Proposing a research question:

- 1) Do students learn about how to manage innovation projects, during the Informatics education, and how?
- 2) What should be done to ensure that Informatics students learn about innovation and the management of it?

Theoretical issue:

Should Informatics students learn about innovation and how to manage it?

Rationale:

According to Strategy of Aalborg University, one of the major goals is that Aalborg University should be one of the worlds most innovative universities.

The general curriculum (Rammestudieordning) for the educations under the faculty of science, states that the students should train their abilities to creative problem solving and innovation. Cause the Informatics educations is part of the faculty of science, then the general curriculum should apply to it.

Hypothesis: Informatics students do not learn about innovation management, during the education.

Step 2 and 3: Identifying and defining variables:

Variable 0: Respondent name.

Variable 0.1: Respondent work title(s).

Variable 0.2: Respondent current semester(s).

Variable 1: Do lecturers/supervisors teach/inspire innovation and innovation management.

Variable 1.1: Why lecturers/supervisors do not teach/inspire innovation and management of it.

Variable 1.2: How lecturers/supervisors teach/inspire innovation and management of it.

Variable 2: Do students learn about innovation and innovation management.

Variable 2.1: What students think the reason for not learning innovation and innovation management.

Variable 2.2: Where students learn about innovation and innovation management.

Variable 2.3: Awareness about innovation during students project processes.

Variable 3: Means of teaching/inspiring innovation and management of it.

Questions:

Variable 0: Just the respondent name. If the respondent is a lecturer, then the name is used to map the answers from the questionnaire, with the syllable for the courses that the respondent is holding.

Variable 0.1: The respondents should tell what work title it currently have/had during their work with Informatics students. The respondent shall chose among: student, lecturer, supervisor or ls (lecturer and supervisor).

Variable 0.2: Students have to inform about which semester they are studying at the current moment. Lecturers and supervisors have to inform about in which semesters they interact with Informatics students. This variable is used in relation to the name to map the answers to the courses syllable they are teaching.

Variable 1: To measure whether the lecturers/supervisors teach/inspire innovation, the researcher ask directly if they do or not. There should be a third possibility among the binary answer possibilities (yes and no), so the respondent have the possibility to express an alternative factors that he thinks contribute to some knowledge towards innovation and its management. If the third answer possibility is chosen by the respondents, a text field should be provided, so the respondents can write about what may add to the knowledge about innovation.

Variable 1.1: To answer why the lecturer/supervisor do not teach/inspire innovation, a “open”-question is asked. There should be a text field, where the respondents can write freely the reasons for not teaching/inspiring innovation.

Variable 1.2: If the lecturers/supervisors teach/inspire innovation, then there should be a text field, where the respondents can write freely about the methods, procedures, means for teaching/inspiring innovation and its management, during the respondents interaction with the students from the Informatics education.

Variable 2: To measure whether the students learn innovation, the researcher ask directly if they do or not. There should be a third possibility among the binary answer possibilities (yes and no), so the respondent have the possibility to express an alternative factors that he thinks contribute to some knowledge towards innovation and its management. If the third answer possibility is chosen by the respondents, a text field should be provided, so the respondents can write about what may add to the knowledge about innovation.

Variable 2.1: To answer what the students think the reason for not learning about innovation, a “open”-question is asked. There should be a text field, where the respondents can write freely what they think is the reason for not learning about innovation.

Variable 2.2: If the students learn about innovation, then there should be a text field, where the respondents can write freely about the ways the are learning about innovation and its management. This can be about what lecturers and supervisors do or say, or the course syllabus the students read during the education.

Variable 2.3: To find out if the students are aware about innovation during their projects during the Informatics education, a yes-no question is asked. A text field should be provided, so the respondent can elaborate on what makes them be more aware about innovation and how it is managed.

Variable 3: To collect the means, that may be used during the Informatics education, there should be a text field, where the respondents can write freely what they think may be a way of teaching, inspiring and learning about innovation and innovation management.

Step 4: Specifying the independent and dependent variables:

Variable 0: independent variable

Variable 0.1: independent variable

Variable 0.2: independent variable

Variable 1: independent variable (depend on variable 0.1)

Variable 1.1: dependent variable (depend on variable 1)

Variable 1.2: dependent variable (depend on variable 1)

Variable 2: independent variable (depend on variable 0.1)

Variable 2.1: dependent variable (depend on variable 2)

Variable 2.2: dependent variable (depend on variable 2)

Variable 2.3: independent variable

Variable 3: independent variable

Step 5: Choosing the level of measurement:

Variable 0: Text field

Variable 0.1: Nominal scale (student, lecturer, supervisor, ls); ls = lecturer and supervisor

Variable 0.2: Nominal scale (Sem. 1, Sem. 2, Sem. 3, Sem. 4, Sem. 5, Sem. 6, Sem. 7, Sem. 8, Sem. 9, Sem. 10)

Variable 1: Nominal scale (yes, no, other) and text field

Variable 1.1: Text field

Variable 1.2: Text field

Variable 2: Nominal scale (yes, no, other) and text field

Variable 2.1: Text field

Variable 2.2: Text field

Variable 2.3: Nominal scale (yes, no) and text field

Variable 3: Text field

Step 6: Designing the sample:

The questionnaire sample is composed by all currently active lecturers, supervisors and students at the Informatics education. A list of all supervisors and lecturers at each semester is retrieved from the semester secretary, including their e-mails. The Informatics semester group e-mail is used to send to all Informatics students, including those currently studying at the base year.

Step 7, 8 and 9: Mapping and analysing the data, and Evaluating causal relationships:

After the data is collected the quantitative questions will be counted, to get an overview of how many answered a certain answer. A meaning condensation is performed based on the answers to the qualitative (open) questions.

Step 10: Reporting findings:

The original results from the questionnaire are attached as appendix to the project report. The evaluated results will be reported within the project report.

Concrete questionnaire: (Version 1)

The following questionnaire explores the placement of *innovation* and *innovation management* during the Informatics education at Aalborg University.

The questionnaire should take approximately 30 – 45 minutes to fill out.

Read the comments associated with every question before answering. The comments may contain examples or other relevant information about how to answer.

Should you have any doubts on how to answer some questions, then contact me at bogdan.constantin.sarbu@gmail.com or call me at 51 88 26 62.

Bogdan Sarbu
Informatics, Inf. 8.

Definitions:

The definition of innovation is that it is the intentional introduction and application within a job, work team or organization of ideas, products or procedures which are new to the that job, work team or organization and which are designed to benefit the users.

Innovation management is the management of the innovation process. That also contains the management of the creativity emerging during the innovation process.

What is your name? [text field]

What is your work title?

Mark the appropriate category. [student, lecturer, supervisor, ls = lecturer and supervisor]

Which semester(s) are you currently working at?

If you are a student mark the current semester. If lecturer or supervisor, then mark the semesters at which you interact with Informatics students. [Sem. 1, Sem. 2, Sem. 3, Sem. 4, Sem. 5, Sem. 6, Sem. 7, Sem. 8, Sem. 9, Sem. 10]

IF LECTURER/SUPERVISOR:

Do/did you teach or inspire to innovation and innovation management?

Answer 'yes' if you specifically mention the words innovation during your work, 'no' otherwise. If uncertain, chose 'other' and use the following text field, to specify what you else do, to contribute to the students knowledge about innovation and its management. [yes, no, other, text field]

Why do you not teach or inspire innovation and innovation management?

Try to mention at least 3 factors that hinder you from teaching innovation. Ex.: “The syllable that I teach do not contain any innovation.”, “There is not much time to experiment with new ideas.”

If you chose earlier, that you do teach or inspire to innovation, then you may use the text field to mention some factors that may hinder you in teach and inspire more. [text field]

IF TEACHING:

How do/did you teach or inspire to more innovation and innovation management?

Try to mention at least 3 ways to teach and / or inspire to innovation and innovation management.

Ex.: "I ask my students to find 3 different solutions to a particular problem.", "I urge my students to try alternative paths to a solution." [text field]

END IF:

END IF:

IF STUDENT:

Do/did you learn about innovation and innovation management during your education?

Answer 'yes' if you specifically have heard the word innovation during your education (classes, supervisor meetings, literature, etc.), 'no' otherwise. If you chose 'other' above, use the following text field, to specify what other things occurring during the education that have contributed to your knowledge about innovation and its management. [yes, no, other, text field]

Why do you think that you haven't learned about innovation and innovation management?

Try to mention at least 3 reasons that may hinder you from learning about innovation. Ex.: "The syllable that I read do not contain anything innovation.", "No one ask me or my group to be innovative (creative) during our projects."

If you chose earlier, that you do/did learn about innovation, then you may use the text field to mention some reasons that may hinder you in learning more about it. [text field]

IF LEARNING:

How do/did you learn about innovation and innovation management?

Try to mention at least 3 ways you learn or have learned about innovation and innovation management. Ex.: "My supervisor ask me and my group to find 3 different solutions to a particular problem.", "My supervisor urge me to try alternative paths to a solution.", "I attend a course about project management, where innovation is a major part." [text field]

END IF:

Are you aware about innovation during your projects?

Answer 'yes' if you are aware about how innovative your projects are, 'no' otherwise. Use the following text field, to mention some factors that keep you aware about innovation during your projects. Ex.: "The future users keep saying that the solutions have to be radical new." [yes, no, text field]

END IF:

What can be done to increase the knowledge about innovation and innovation management, among the students?

Try to mention at least 3 ways that can add to the students knowledge about innovation and its

management, during the Informatics education. Ex.: “A course about creativity and innovation at the beginning of the education could be a solution, because ...” [text field]

If you have any comments to the survey and / or the subject (innovation and innovation management) then use the text field. [text field]

May I contact you for a short (30 minutes) interview?

If yes, then I ask you to fill in you name, phone number and / or e-mail, so I can contact you and negotiate a date for the interview. [text field]

Thank you for taking time to fill out the questionnaire! I appreciate your help! :-)

Changes and comments from the Pilot test of the first version of the questionnaire:

The first version of the questionnaire was sent to two students and a lecturer (and supervisor).

There were not many comments from the respondents, after the pilot test. One of the students asked what their name was to be used to. I chose to move Variable 0: till after Variable 0.2: and make it dependent on Variable 0.1: The name will be used only if the respondent is a lecturer, to identify the courses that the lecturer holds during the Informatics study.

One of the students also pointed out that there missed some introductory text, which told about what the questionnaire was about and in which context it was in. I chose to write and send an introductory e-mail, containing a minor description about the purpose of my thesis.

Every question got revised by a couple of students, and corrected the major grammatical errors, and some of the sentences were rewritten.

The resulting questionnaire follows below.

Concrete questionnaire after Pilot test: (Version 2)

Innovation during the Informatics education.

The following questionnaire explores the placement of innovation and innovation management during the Informatics study at Aalborg University.

The questionnaire should take approximately 15 – 20 minutes to fill out.

Please read the comments associated with every question before answering. The comments may contain examples or other relevant information about how to answer.

If you are in doubt about how to answer any of the questions, please contact me at bogdan.constantin.sarbu@gmail.com or call me at +45 51 88 26 62.

Bogdan Sarbu
Informatics, Inf. 8.

Definition of innovation and innovation management:

Innovation is defined as the intentional introduction and application within a job, work team or organization of ideas, products or procedures which are new to the that job, work team or organization and which are designed to benefit the users.

Innovation management is the management of the innovation process. That also includes the management of the creativity emerging during the innovation process.

What is your work title?

Mark the appropriate category.

[student, lecturer, supervisor, lecturer and supervisor]

Which semester(s) are you currently (working) at?

If your are a student mark the current semester. If lecturer or supervisor, then mark the semesters at which you interact with Informatics students.

[1. sem., 2. sem., 3. sem., 4. sem., 5. sem., 6. sem., 7. sem., 8. sem., 9. sem., 10. sem.]

#IF LECTURER:

What is your name?

Your name will only be used to identify your lectures/courses held during the specified semester(s).

[text field]

#END IF:

#IF LECTURER/SUPERVISOR:

Do/did you teach or inspire your students to use innovation and innovation management?

Answer 'yes' if you specifically mention the words innovation during your work, 'no' otherwise. If uncertain, please choose 'other' and use the following text field to specify what you do to contribute to the students knowledge about innovation and its management.

[yes, no, other]

You chose 'other'. Please specify how you contribute to your students knowledge about innovation.

[text field]

Why do you not teach or inspire innovation and innovation management?

Try to mention at least 3 factors that hinder you from teaching innovation. Ex.: “The syllabus that I teach does not contain any innovation.”, “There is not much time to experiment with new ideas.”

If you chose, that you do/did teach or inspire to innovation, then please use the text field to mention some of the factors that may prevent you from teaching it and/or inspiring you students to use innovation more.

This question is mandatory, if you have not touched upon innovation during your work!

[text field]

#IF TEACHING/INSPIRING:

How do/did you teach or inspire to more use of innovation and innovation management?

Try to mention at least 3 ways to teach and/or inspire to use innovation and innovation management. Ex.: “I ask my students to find 3 different solutions to a particular problem.”, “I urge my students to try alternative paths to a solution.”

[text field]

#END IF:

#END IF:

#IF STUDENT:

Do/did you learn about innovation and innovation management in the course of your education?

Please answer 'yes' if you specifically have heard or read about the subject ‘innovation’ at some point during classes, supervisor meetings, literature, etc. 'No' if you have not. If your are uncertain, chose 'other' and use the following text field, to specify what other things has occurred during the course of your education that have contributed to your knowledge about innovation and innovation management.

[yes, no, other]

You chose 'other'. Please specify what has contributed to your knowledge about innovation.

[text field]

Why do you think, you have not learned about innovation and innovation management?

Please try to mention at least 3 reasons that may have prevented you from learning about innovation. Ex.: “The syllabus of my courses does not contain anything about innovation.”, “No one has asked me or my group to be innovative (creative) during our projects.”

If you chose in the question above, that you do/did learn about innovation, then please use the text field to mention some reasons that may prevent you in learning MORE about it.

This question is mandatory, if you have not learned about innovation!

[text field]

#IF LEARNING:

How do/did you learn about innovation and innovation management?

Please try to mention at least 3 ways, in which you learn or have learned about innovation and innovation management. Ex.: “My supervisor asked me and my group to find 3 different solutions to a particular problem.”, “My supervisor urged me to try alternative paths to a solution.”, “I attended a course about project management, where innovation was an important part of the course.”

[text field]

#END IF:

Are you aware of innovation during your projects?

Please answer 'yes' if you are aware of how innovative your projects are or 'no' otherwise. Use the following text field to mention some of the things that keep you aware of innovation during your projects. Ex.: “The future users keep saying that the solutions have to be radical and new.”

[yes, no, text field]

#END IF:

What can be done to increase the knowledge of innovation and innovation management, among the students?

Try to mention at least 3 ways that can add to the students knowledge about innovation and innovation management, in the course of the Informatics study. Ex.: “A course about creativity and innovation at the beginning of the education could be a solution, because ...”

[text field]

Please write any comments to the survey and/or the subject (innovation and innovation management) that you may have. [de kan vel se at der er et text field ;)]

[text field]

May I contact you for a short (30 minutes) interview?

If yes, then please fill in your phone number and/or e-mail, and I will contact you and set a date and time for the interview.

[text field]

B

Hej,

Du har fået denne email fordi, du på en eller anden måde har relation til Informatik uddannelsen på Aalborg Universitet.

Jeg er Informatik studerende på 10. semester, ved Aalborg Universitet, og er i gang med at skrive speciale inden for innovation. Mit speciale går ud på at undersøge hvordan det står til med læring af innovation og innovations ledelse på Informatik uddannelsen på Aalborg Universitet.

Spørgeskemaet skal give mig et indblik i hvorvidt (og hvordan) innovation bliver brugt i undervisningen på Aalborg Universitet, af såvel de studerende som underviserne og vejlederne.

Jeg håber du vil hjælpe mig, ved at bruge ca. 15 - 20 min. til at udfylde et spørgeskema. Spørgeskemaet findes online på følgende web adresse:

<http://www.bogdansarbu.net/phpsurveyor/index.php?sid=2>

Du bedes besvare spørgeskemaet inden torsdag d. 30. marts 2006.

Deltagelse i undersøgelsen er naturligvis frivillig, men for at få en korrekt viden om sammenhængen mellem innovation og Informatik uddannelsen er det vigtigt, at så mange som muligt deltager.

Skulle du have spørgsmål til spørgeskemaet eller andet, er du altid velkommen til at kontakte mig på bogdan.constantin.sarbu@gmail.com eller +45 51 88 26 62.

Det ville ligeledes hjælpe mig, hvis du kunne stille op til en kort (ca. 30 min.) interview, for at følge op på svarerne fra spørgeskemaet.

Blandt alle returnerede og udfyldte spørgeskemaer trækkes lod om 3 gaver. Anfør deres navn og email sidst i spørgeskemaet, hvis du vil være med i lodtrækningen.

På forhånd tak.

Bogdan Sarbu

Tlf.: 51 88 26 62

E-mail: bogdan.constantin.sarbu@gmail.com

C

Results from the questionnaire.

Question 1: What is your work title?	
Respondent	Answer
1	student
2	student
3	student
4	student
5	student
6	lecturer
7	student
8	student
9	lecturer
10	lecturer and supervisor
11	student
12	lecturer
13	lecturer
14	student
15	lecturer
16	student
17	lecturer and supervisor
18	student
19	student
20	student

Question 2: Which semester(s) are you currently (working) at?	
Respondent	Answer
1	2.sem.
2	2.sem.
3	10.sem.
4	10.sem.
5	10.sem.
6	2.sem.
7	2.sem.
8	8.sem.
9	2.sem.
10	4.sem., 10.sem.
11	4.sem.
12	3.sem.
13	2.sem.
14	4.sem.
15	2.sem.
16	6.sem.
17	3.sem., 9.sem., 10.sem.
18	10.sem.
19	10.sem.
20	10.sem.

Question 3: What is your name?	
Respondent	Answer
1	
2	
3	
4	
5	
6	Axel Kristensen
7	
8	
9	Jørgen Riber Christensen
10	Ivan Aaen
11	
12	Gitte Tjørnehøj
13	Frances Jørgensen
14	
15	Michael Holm Andersen
16	
17	Jan Stage
18	
19	
20	

Question 4: Do/did you teach or inspire your students to use innovation and innovation management?	
Respondent	Answer
1	
2	
3	
4	
5	
6	no
7	
8	
9	no
10	yes
11	
12	yes
13	no
14	
15	no
16	
17	no
18	
19	
20	

Question 5: Why do you not teach or inspire innovation and innovation management?	
Respondent	Answer
1	
2	
3	
4	
5	
6	Kurset primære mål er at give de studerende matematiske forudsætninger for at følge senere kurser i informatik. Kontakt evt. Jiri Srba for nærmere information. Dept. of cs har explicit bedt mig undervise traditionelt og i traditionelt stof.
7	
8	
9	But I have actually just designed a new course segment about innovation and the creation of ideas. It will however, not be used until next time I run this course.
10	
11	
12	I touched upon innovation in the receiver organisation as a goal developing systems, in this introductory course on system development. I teach about how to be innovative in the projects and in project management; but do not specifically use the word innovation. Also, because the course I teach is an introductory course in project management, I need to focus primarily on technical and social skill development and it is difficult to link these to innovation
14	
15	Det er ikke umiddelbart en del af kurset, som primært omhandler undervisning i 3D og programmet 3D Studio Viz r3.0
16	
17	I teach ideas for creativity but I do not label them as innovation.
18	
19	
20	

Question 6: How do/did you teach or inspire to more use of innovation and innovation management?	
Respondent	Answer
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	Part of the discourse in teaching and in supervision. Also point to relevant literature. Offer "open" projects based on problem-identification and problem-solving
11	
12	Innovation of innovation management is not the subject of the course I teach, so it is not appropriate to teach it. But the study projects is all about innovation, I hope, since the students are learning all the time and hopefully incorporate the new skills in their working habits.
13	
14	
15	
16	
17	
18	
19	
20	

Question 7: Do/did you learn about innovation and innovation management in the course of your education?	
Respondent	Answer
1	no
2	yes
3	no
4	no
5	no
6	
7	no
8	no
9	
10	
11	yes
12	
13	
14	no
15	
16	yes
17	
18	no
19	no
20	no

Question 8: Why do you think, you have not learned about innovation and innovation management?	
Respondent	Answer
1	Jeg kan ikke huske at have hørt om innovation, og er lidt i tvivl om hvad det egentlig er, bortset fra "evnen til fornyelse" (som jeg fandt i ordbogen)
2	At der ikke undervises i innovation fremover. At underviserne ikke til daglig arbejder med opgaver, hvor innovation indgår.
3	Inovation management doesn't appear to be a priority to the study board :-/
4	There are not any courses with a focus on IM. I think there have been courses with large innovation aspects, but not on the management part.
5	I don't think Innovation can be taught in a class. Indirectly Innovation can become part of e.g. semester projects, however, I think formal Innovation classes would be difficult to fit into the Informatics education.
6	
7	The syllabus of the courses did not include innovation as a specific subject but we were encouraged to explore new and innovative solutions.
8	I believe that the course was offered, but i wasn't present, so it's only me there is to blame.
9	
10	
11	
12	
13	
14	It probably doesnt seem very important on the lower semesters where the projekts are more strict to what to write about.
15	
16	
17	
18	There was no focus on innovation in the courses The university probably thinks that it provides the "tools" and the students the "work input" and here the innovation is under the work input.. just my guess there is more focus on learning the basics eg. certain methods, than evolving new or taking different approaches.. probably a way of saying that you should know what there is out there before you make your own..
19	Der er ikke fokus på innovation og lignende i studieordningen. Jeg kan forestille mig at emnet som teoretisk studie ville være mest relevant på INF5 (organisationskommunikation). Hvis det skulle implementeres praktisk i uddannelsen ville det høre naturligt sammen med det kursus vi havde på 1. semester om gruppearbejde.
20	

Question 9: How do/did you learn about innovation and innovation management?	
Respondent	Answer
1	
2	Vores vejleder har snakket en smule om innovation - at det er de, der får de gode idéer, som klarer sig godt. Ellers har der været lidt snak om innovation i VIT, om designet og indførelsen af elektroniske patientjournaler.
3	
4	
5	
6	
7	
8	
9	
10	
11	We have heard about it during more than one project. It is relatively easy to create traditional software that rely on basic rules and principles or in other words look alot like existing software. Now, the key is to be innovative, take chances and maybe create something new and unseen- innovative software. This is how the phenomena innovation has been "used". Or maybe one can say that we hear about it in many different contexts. So yeah, we have heard about it. But no specific courses in innovation management.
12	
13	
14	
15	
16	self study in connection with the project + mandatory in the 5th semester
17	
18	
19	
20	

Question 10: Are you aware of innovation during your projects?		
Respondent	Answer	Comments
1	yes	Ja jeg er lidt opmærksom på det, idét vi i vores projekt laver en promotion af et band.
2	yes	I vort nuværende projekt, som handler om at lave en promo-cd-rom til et soulband, siger vores vejleder at vi skal forsøge at gøre det på en ny måde. Men at få de gode, nyskabende idéer synes jeg er meget svært.
3	yes	I always try to do something that hasn't been done before.
4	yes	
5	no	
6		
7	no	
8	no	
9		
10		
11	yes	Yes, I'm aware of it during the process. However, this semester, we are making a system, that has to manage contents in a bar. There is not so much focus on being innovative, instead the client focus on usability, given the fact that the system is to be used by many different employees.
12		
13		
14	no	
15		
16	yes	we work with development of new ideas in every project
17		
18	yes	i like to do research in new areas that have not been explored that much. it motivates me.. but i dont know if that is innovation. I am currently working on an innovative project and i find it very interesting.
19	yes	Ja; men det kommer an på projektet. Ved en kommunikationsanalyse hvor man skal lære en metode er det måske ikke så smart at være alt for innovativ. Innovation kan være meget godt, men vi skal også huske på at formålet med projekterne er at lære os teori og metoder.
20	no	

Question 11: What can be done to increase the knowledge of innovation and innovation management, among the students?	
Respondent	Answer
1	Ved ikke
2	Ja - som det nævnes så tror jeg faktisk et kursus i helt konkrete teknikker til at komme på ideer i starten af uddannelsen ville være en fordel. Man kan også gennemføre nogle obligatoriske gruppeøvelser hvor man arbejder med innovation - fx forestil dig, at it-systemet var en hund, hvilke egenskaber ville det så have? Altså fx sammenstillinger af objekter, der normalt ikke hører sammen.
3	Students should be encouraged to think into the future i.e. implement ideas that aren't likely to be implemented for profit in the near future.
4	A specific focus on IM, in courses would be nice.
5	There already are courses for people intending to start their own company where they get feedback from "experts". Besides that I don't think it is the university's role to facilitate that kind of innovation. If someone has a great innovative idea they should have the possibilities to nurture it.
6	Ikke relevant for Mat 2B
7	More courses that include topics as "Including seeming unrelated design into projects" Better understanding of metaphores and how they can be used in the context of a given problem to combine traditional solutions with metaphoric solutions... And ofcourse a course where the student is encouraged to drink heavily.
8	A course in innovative project management could be offered at first semester, probably as a supplement to the SLP-course.
9	See above
10	Offering courses on all educations is important. More important is to integrate innovation and creativity into project work. Interdisciplinary projects late in the study may also promote creative and innovative thinking
11	I think, that a specific course about innovation management could help us improve creativity and take advantage of it in development processes.
12	They need more that knowledge on innovation and innovation management. They need Skills in innovation and innovation management, not theory about it. If they want skill in doing that with in systems development they can specialize in subjects of the IS groupe, and they will learn plenty.
13	I think it would be better to incorporate innovation and innovation management into some of the existing courses (e.g. product development courses?) in the early semesters and then perhaps a course devoted to innovation and IM later in the curriculum.
14	as a starter, what is innovation manangement. It could be practiced more within the projects and courses.
15	*
16	lectures about it & working with it
17	I don't see this as a separate subject. It should be integrated where it is relevant.
18	I think that the university could start by giving an introduction to what innovation is, inspiring the students to be more innovative and maybe give them tools to increase their innovation.
19	Det kunne være en god ide at inddrage det i kurset om projektarbejde på første semester. Det er der at jeg kan forestille mig at det er mest relevant. Evt. også i kurset om designm og evaluering af brugergrenseflader. Det bør tilknyttes kurser hvor der i forvejen er fokus på innovation.
20	Måske man kunne inddrage en organisation som Kickstart mere i uddannelserne. Men det er jo svært at få plads til det i studie ordningerne.

12. Additional comments?	
Respondent	Answer
1	no comments
2	Jeg synes det for så vidt er en relevant undersøgelse - som måske også kunne gøre gavn udenfor informatik-feltet. "Innovation" er en lidt svært håndterbar størrelse, men nyskabning er jo altid interessant. Brugervenlighedsmæssigt er skemaet her ganske godt.
3	
4	The innovation and IM concepts er a bit unclear.
5	I like the layout of the survey system :) The questions seem rather leading towards certain answers that you'd might want for your project (for instance the example answers you mention).
6	---
7	
8	
9	
10	
11	Good luck with the project. I think it is an exciting subject.
12	I think it will not help you. There are flaws in it. fx. I do not currently work at INF . but I do every autumn. Most working at INF is both supervisors and lectures, And we will all answer differently - because what practice is that you want to teach innovation an innovation management according to? Seen according to system development, innovation and especially organising innovation (management) is a management discipline, and when not specialising with in IS-subject management is not part of the curriculum for the education .- and should not be. INF student need to learn at CS HOW to produce systems - So - I do'nt quite get it - and I actually think this won't help you. Have you done a test of a prototype of the questionnaire? That would have revealed all these comments I am sure... Well hope you succeed in your effort anyhow
13	
14	
15	Generelt er der jo rigtig meget information på nettet om innovation, opstart af egen virksomhed - jeg ved ikke om det er noget eleverne underviser i/bliver informeret om - hvis ikke kunne man jo starte der.
16	
17	
18	Der var en artikel i ingeniøren om innovation den 24. marts, men den har du nok set.
19	
20	Der er flere der forsker i iværksætteri her på stedet. F.eks PhD Suna Sørensenovre på Hum

13. Want to be interviewed?	
Respondent	Answer
1	the.waterdog@gmail.com
2	Nej - det er jeg ikke interesseret i.
3	
4	
5	Sure, but I am rather busy the next while and like you might have read from my answers in the questionnaire, I am not sure how much I have to contribute with about the subject of Innovation. E-mail: villemann@cs.aau.dk, Phone: 20715513
6	Næppe relevant
7	yea.. Kasper Witttrup 31 23 71 14 witttrup@cs.aau.dk it@workout-fit.com
8	sorry im very busy right now.
9	No, sorry.
10	Yes
11	Yes you may. Cellular : 60601032 Email: jesper@roedkjaer.com
12	We'll I'm in the states until june 10 , so it will not be convenient, but you can always mail me
13	yes, but I am only very slightly involved in the IT education, teaching SLP, so I'm not sure I could offer much data for your project frances@jprod.aau.dk
14	mikbund@cs.aau.dk phone: 22 15 58 32
15	Nej
16	
17	
18	lh@cs.aau.dk
19	Selvfølgelig må du det :) /Eva
20	No thanks

D

Interview guide

Thematization

Background:

From the text analysis it is given that Aalborg University has as vision to be among the leading innovative universities. The general and bachelor degree curriculum states that the students should train their creative and innovative skills.

From the questionnaire it is given that only two of seven lecturers and supervisors did/do teach about innovation and or innovation management. At the same time three of ten students answered that they have heard about innovation, mainly from their supervisors or self study.

Purpose:

This interview will partly follow up on the answers from the questionnaire, and explore further what can be done to incorporate more innovation and innovation management in the Informatics study.

The interview will try to explore if the reasons for not teaching/learning about innovation are true. True in the sense that it is based on reality, and why it is like that.

During the interview a larger part of the time will be used to explore the possibilities for incorporating more innovation and innovation management during the Informatics study. And secondly to explore the reasons for not doing that already.

Design

The interview will be performed in Aalborg University's buildings, mainly in the respondents office. The interview will be performed with two lecturers or supervisors, that have answered the questionnaire. Because of the limited resources and time, only two respondents will be interviewed.

The interview will be exploratory and semi-structured, meaning that the aim of the interview is to create a discussion between the interviewer and the respondent. The interview will be starting with some "easy" questions to ease and create a positive atmosphere.

The interview will be divided in two parts. The first part will contain questions based on some answers from the questionnaire. The respondents will be asked to express their thoughts about some of the answers.

The second part will be about what the university, students, lecturers and supervisors could do to teach/learn more about innovation and innovation management. At the same time the second part will be used to discuss why it have not been done that already, and what other obstacles there are that prevent the incorporate more innovation in the study.

The interview will be audio recorded and afterwards transcribed.

The interview will be performed in Danish, because the respondents are Danish speaking and to avoid misunderstanding and a strange atmosphere.

Interview

1. The purpose of this interview

The interview is used to reflect upon some of the answers from the questionnaire. The interview will also be used to discuss the different possibilities of incorporating more innovation and innovation management during the study, and why and how it should be done.

2. Presentation of interviewer (briefing)

Short presentation of the interviewer.

My role: To ask elaborating questions, and to round up the discussion.

3. Introductory questions

3.1. What is your name?

3.2. What position do you currently possess?

3.3. In which way do you interact with Informatics students?

3.4. How do you define innovation?

3.5. How do you see innovation in relation to the Informatics study, based on official documents (AAU vision, curriculum)?

4. Questions regarding the questionnaire

4.1. The reasons for not teaching/inspiring/learning about innovation, based on the questionnaire, are: ... (enumerate the answers from the questionnaire – see the analysis of the questionnaire)

4.1.1. Are the reasons reasonable? Meaning that the answers make sense and are a good excuse for not teaching/inspiring?

5. Questions regarding the solutions

5.1. Should there be more teaching about innovation and innovation management?

5.2. How can innovation and innovation management be taught during the study? (enumerate the answers from the questionnaire – see the analysis of the questionnaire)

5.2.1. Why haven't it been done yet? What are the obstacles?

5.2.2. Who should/could be responsible for the action?

6. Rounding-off the interview (debriefing)

6.1. Do you have other or undetermined questions?

6.2. Thank you for allocating time for this interview.

Transcription

The interview will be transcribed word for word, so the interview is unedited for the analysis.

Analysis

The transcribed interview will be used to perform a meaning condensation. At the same time a categorization will be performed to characterise the different types of possibilities for incorporating more innovation in the study. The categorization will include, as much as possible, the type of action, the reason for not doing that already and who may be responsible for the action.

Verification

The results should be seen in the limited context in which it is performed. Based on the few respondents the results should be used as indication for usage in future discussion and research.

Reporting

The results will be published in a report about the placement of innovation and innovation management during the Informatics study.

The report will be published on the online library, and everyone can access it.

E

Transcription of the interview:

1) Bogdan: Tak fordi du gerne ville stille op til interviewet. Dette interview tager udgangspunkt i de svar jeg har fået fra spørgeskemaet, og så køre lidt videre med dem, og prøve at finde på måder at få mere innovation i uddannelsen. Jeg håber at vi kan få en diskussion i gang. Først så vil jeg spørge om hvad din navn er og hvad det er du arbejder som her.

2) Ivan: Ivan Åen og jeg er lektor.

3) Bogdan: Ok. Hvordan interagerer du med Informatik studerende. Hvad er din rolle i forhold til dem?

4) Ivan: Jeg er kursusholder og vejleder.

5) Bogdan: Hvordan vil du definere innovation?

6) Ivan: Det er at omsætte en ide til noget anvendeligt. Så i min optik så er det sådan at der er invention – opfindelse -, og så er der innovation som handler om at omsætte opfindelsen til noget der kan bruges. Og diffusion det er så der udbredelsen på markedet og i alt almindelighed.

7) Bogdan: Og hvordan ser du innovation i relation til denne uddannelse – Informatik uddannelsen?

8) Ivan: Det forstår jeg ikke.

9) Bogdan: Hvordan kan innovation ses i forhold til uddannelsen, det vil sige skal det være sådan at de studerende skal komme med nye gode ideer eller skal de hen til og implementere og udnytte de her nye ideer?

10) Ivan: Begge dele. Jeg forestiller mig ikke at man kan være innovative uden og vide en hel del om hvordan ting realiseres.

11) Bogdan: Og de skal realisere i løbet af en projekt?

12) Ivan: Ja, .. i løbet af et projekt? Det spurgte du ikke om. Du spurgte ikke om hvordan jeg så et informatik projekt, og specielt hvordan jeg ser innovation i forhold til en uddannelse. Og det er ikke sikkert at man kan nå inden for det samme projekt og nå begge dele, det vil sige både at få ideen og realisere. Måske kan man nå at realisere dele af en ide.

13) Bogdan: Men du siger at de skulle helst i løbet af uddannelsen også have erfaring med at realisere en ide, og ikke bare ...

14) Ivan: ... ellers så kan jeg ikke se vi har en kompetence vi kan sælge.

15) Bogdan: Jeg fandt ud af i løbet af spørgeskema undersøgelsen ... der spurgte jeg blandt andet om grundene til at lærerne ikke lærte de studerende om innovation og ledelse af innovations processer. Og så spurgte jeg også de studerende om hvorfor de troede at de ikke lærte mere om det.

16) Ivan: Hvorfor de ikke troede?

17) Bogdan: Ja. Hvad de kunne se var grundene til at de ikke fik hørt mere om det. Nu vil jeg lige læse nogle af dem op. og så vil jeg gerne at vi snakkede lidt om der er hold i nogen af dem, om de giver mening, om der er noget realitet i grundene til at lærerne ikke underviser mere i det.

18) Ivan: Jeg mener at de underviser ret meget i innovations processer, projekt arbejdet er innovativ i sin grund ide. Så hvad mener du med innovation her?

19) Bogdan: Det er - som du sagde tidligere – at implementere en ide, eller få produceret nogle mere radikale ideer. Projektarbejde er innovativ i sig selv, at man laver noget nyt. Men jeg tænker mere på radikale innovationer, hvor man går lidt længere end bare at tilføje nogle features.

20) Ivan: Og du er sikker på at de studerende har svaret på den samme forudsætning?

21) Bogdan: Nej. Nogen har, nogen har ikke. Der er mange af de studerende der har svaret at nogen af deres vejledere har opfordret dem til at få nogle andre ideer, end dem der forekommer naturlige så at sige. Hvor de studerende så har sagt at de ikke rigtigt har prøvet at udvikle noget helt vildt nyt. Her nogle af grundene til at lærerne ikke underviser i innovation: kurserne er ikke ... appropriate ... for at lære innovation. For eksempel hvis det er matematik, så føler de ikke at de har nogen grund til at lære innovation. Så var det at jeg tænker: hvis det nu er et fag som matematik, hvorfor er det så at lærerne så ikke stadigvæk igennem deres undervisning ... prøver at lave deres undervisning mere utraditionel, på den måde at få de studerende til at tænke i andre baner generelt.

22) Ivan: Hvad har det med innovation at gøre?

23) Bogdan: Jeg tænker på at innovation er ikke bare noget man kan læse i en bog om, det er nærmest en tankegang som man skal have, man skal prøve at se på flere løsninger og vælge den bedste. Men hvis det er sådan at alle de fag de nu bliver undervist i, virker meget traditionelle i deres udformning, så kan det godt være at det går op for dem at innovation godt kan bruges ... at de får den tankegang i hovedet at de skal prøve forskellige ting, og se hvad der sker – en påmindelse om at de skal tænke anderledes.

24) Ivan: Matematik er en fag hvor man lærer at analysere og forstå nogen logiske sammenhæng uafhængig af hvad de skal bruges til. Det er en meget abstrakt fag. Jeg er ikke sikker på hvad det er du spørger om. Jeg laver lige en analogi: du uddanner en tømre og du fortæller tømret om hvad han skal bruge en hammer til, så fortæller du ham hvordan man bruger en hammer, hvad en hammer er for en størrelse, hvad for en hammer man bruger til hvilke opgave. Kan man forstå den type undervisning som værende innovativ eller ikke innovativ? Det tvivler jeg stærkt på. Matematik er i vores anvendelse, der er det en redskabsfag. Så hvad er det for en fornyelse du gerne vil have i matematikken? Formålet med matematik undervisningen er primært at få folk til at forstå de matematiske principper, så de kan anvende dem selv. Forhåbentlig inden for IT.

25) Bogdan: Det er jeg også enig i, at matematikken i sig selv ikke skal fornyes, men der er mere måden man videregiver informationen på, for eksempel i stedet for at man bare står ved tavlen ...

26) Ivan: ... hvorfor det? Hvorfor måden?

27) Bogdan: Hvorfor måden? ...

28) Ivan: ... Hvorfor er det så interessant?

29) Bogdan: For jeg synes at ... i den tid jeg har gået på Informatik uddannelsen ... mange af de fag de virker meget ensformig så at sige. Der er en der holder et eller andet oplæg, og så kan det godt være at vi laver nogle øvelser ved siden af, altså før næste lektion. Hvor jeg kunne tænke mig at få rusket lidt op i måden at undervise på, således at man får skabt et atmosfære, en tankegang hvor man ikke bare skal have ensformighed hele tiden. Jeg kan godt se at matematik som værktøj ikke kan fornyes, men måden man videregiver det på. For eksempel ved at man går ud i naturen og prøver at beregne på et eller andet flagstang, eller nogle træer, med et eller andet matematisk formel. Og på den måde at indarbejde i de studerende, gennem undervisningen, at tænke på alle mulige baner end bare at holde en præsentation oppe fra tavlen.

30) Ivan: ... Der hvor jeg ser de store muligheder for at lære er i projekt sammenhæng. Så du kan godt se at opgaven er sådan set og kunne tage det man har lært fra projekt kursus og selv gå ud og kigge på flagstangen, hvis det er det der interessere i, og selv analysere det. Det er projektarbejds opgave at gøre.

31) Bogdan: Det minder mig faktisk om at en af de studerende svarede: the university probably thinks that it provides the "tools" and the students the "work input" and here the innovation is under the work input. There is more focus on learning the basics, for example certain methods, than evolving new or taking different approaches, probably a way of saying that you should know what there is out there before you make your own. Det minder meget godt om det du siger, med at projektarbejdet skal fremme innovationen og lære om innovation. Men hvorfor kan man ikke også i selve kurserne, prøve at få ændret det, så at man giver ... for jeg har snakket med nogle andre studerende og de siger at meget af deres projektarbejde er meget forudbestemt, og ...

32) Ivan: ... enig, det er vores store problem foreløbig ...

33) Bogdan: ... men samtidig så føler de sig heller ikke inspireret til at prøve nye ting eller projekter, fordi mange af de kurser er sådan mere: du skal gøre på den her måde – agtig. Hvor jeg så tænker: hvis man så udfordrer det undervisnings måde således at man inkorporere den måde at tænke på, altså prøver forskellige ting, ikke nødvendigvis at man ændrer studieordningen, men at man for eksempel har nogle andre måder at videregive viden på til de studerende. Og på den måde at få de studerende til at tænke i andre baner end bare: nu har I fået af vide sådan og sådan skal det være.

34) Ivan: Det tror jeg virkeligt ville være godt hvis du havde et teori apparat, med de overvejelser om ... altså hvad er sammenhængen mellem redskabs-betonet undervisning og så det at kunne tænke innovativ og kreativ. Det er i bedste fald en omgåelse af det vi snakker om, at man bliver kreativ mens man ser på hvordan man løser for eksempel en overvejelse omkring en kompleksitets beregning. Og så bruger man de erfaringer man har fra undervisningen over i projekt sammenhæng. I første omgang så mener jeg at mange vejledere ... vi har forskellige typer af kurser, vi har kurser som har til formål og træne folk i begreber og problemer, så har vi kurser der beskæftiger sig med abstrahere. Matematik kurset har typisk til formål at lære folk til at tænke stringent og analytisk omkring problemstillinger. Det svarer på mange måder til at lære at læse, og der kan man selvfølgelig sige: hvis folk, de lærer at læse mens de står på hovedet og gør alle mulige mærkelige ting, så kan det være de bliver mere kreative når de skal til at skrive noget selv, men det skal der lige argumenteres for at det er hensigtsmæssig. Det kunne jo godt være at man i første omgang skulle fokusere på at få folk til at lære og læse. Når de så kan læse, så skal man så prøve på at kalde på de kreative processer. Det er derfor jeg skelner mellem kurser og så projektarbejde. Jeg ser så

projektarbejde som det væsentligste motor til at vænne folk til at tænke innovativ. For generelt så kan man selvfølgelig forestille sig, man har kurser i innovative processer og man åbner nogle horisonter op, altså det vil sige ved siden af et specifikt kursus, men jeg skal jo nok lige have set, hvad skal vi sige, det stor mønster før jeg mener at en forudsætning for at vi har innovative studier, at matematik undervisningen også meddeles på en måde, hvor innovativ er en essentiel del.

35) Bogdan: Ok. Så går vi over i hvad man kan gøre for at få mere innovation ind i uddannelsen. Vi kan nok blive enig om der skal gøres mere ved det. Men hvad kan der så laves for at få mere innovation ind i uddannelsen? Skal man holde et kursus som omhandler nogle af de elementer som kan hjælpe til succesfulde innovationer.

36) Ivan: Nej, ikke som hoved strækning ... jeg vil ikke afvise at man skal have et kursus på 1, 2 eller 3 ECTS som omhandler innovations processer, det kan man forstille sig. Men det vil aldrig flytte de store linjer, give større parat viden i projekt sammenhæng, men det er projekterne som er det bedste instrument for mig. Der er flere ting man kunne vælge og arbejde med. Den ene er tempo-skift, det vil sige og variere projekt ideen: små grupper, store grupper, flere leverancer, få leverancer, et semester, flere semestre, lave nogle variationer her så gør at formatet for et projekt skifter. Så kan man vælge og sige at der skal være flere om at løse en opgave, det vil sige at der skal være flere projektgrupper der skal arbejde sammen om fælles løsninger. Disse grupper kan være tværfaglige, så man kan få flere faglig-heder i sving. Man kan genopdage ideen om temarammer, i gamle dage der havde vi ikke bare projekt-emner, men også projekt-temaer for projekter. Det vil sige et eller andet der gjorde et indholdsmæssig fællesskab for projektgrupper, så de kunne drage nytte af hinanden, på tværs af projektgrupper. Oprindeligt var der noget der hed Memgrupper, hvor 3 – 4 grupper, de var sammen om at dele erfaringer ud fra den fælles ”vejledning”, som også kan bidrage til at give et løfte, give et variation i projektet, give en ambition om at lave et eller andet der er væsentligt. Vi har faktisk et problem med – det har jeg faktisk snakket om i mange år – at alle vores projekter er ”brug-og-smide-væk”. Vi løser et opgave, skriver en rapport, laver noget software, så går vi til eksamen, og så smider vi det væk. Hvis vi umiddelbart satsede på at det folk de lavede det var noget som havde en værdi ud over semestret, ud over eksamen, så kan det godt være at de også ville lave mere ved det.

37) Bogdan: Hvorfor er det ikke sådan ... hvorfor har man ikke implementeret de ting du lige har nævnt?

38) Ivan: Blandt andet fordi de studerende ikke vil. Det har vi erfaret, men engang vi prøvede at et projekt på tværs af flere projektgrupper, der gik det i opløsning, fordi de studerende blev for ambitiøse på egne vegne. Så er der det retssikkerhedsmæssigt, for hvor hvad nu hvis en del projekt går ned, og det andet projekt det lykkes, men man har 2 projekter der er afhængig af hinanden, risikerer man så at det ene projekt det sænker eller hæmmer et andet projekt. Så det er mere trygt at have nogle kendte spilleregler, 1 vejleder og 7 studerende, og det er så det, som ikke har så mange udefra kommende faktorer. Så en del af problemet med at indføre det her, det er sådan set at vi efterhånden har opbygget et studie-maskine op, som har maskinens karakter med at tingene er forudbestemte ... der er for meget struktur for øjeblikket.

39) Bogdan: Men hvis man skulle prøve at indføre det igen, det der med grupper der skal arbejde sammen, hvad skulle man så gøre for at det, det næste gang, bliver en større succes?

40) Ivan: Lægge det på et senere semester. Det første gang vi prøvede med ... var det på 3. semester. Så fremover vil vi nok forsøge at lægge det på 7. semester eller senere.

41) Bogdan: Hvad erfaring har I med innovation, kreative læring, læring om kreativitet på de tidligere semestre? For nogle af de studerende har svaret at der ikke er så meget på de første semestre hvor det måske kunne være relevant i forhold til SLP kurset som er om projektledelse, projektarbejde. Kunne det være nyttig at smide noget undervisning i starten, så de studerende vidste lidt om det, inden de kom videre hen i forløbet?

42) Ivan: Det er jeg ikke overbevist om. Jeg er en klart tilhænger af at folk har en faglig viden, før de begynder at være tværfaglig, hvis de for alvor skal til at arbejde tværfaglig. Man skal kunne kende de grænser for hvad ens egen fag kan, det forudsætter noget faglig viden. Så det er den faglig-ramme, så man har nogle kontante fag, og de bliver meddelt hver for sig, så man ved hvad man har at bygge med. Så vil jeg gerne have projekt-rammen til at tage de her bygge elementer og sæt dem sammen til et eller andet innovativ. Der tror jeg på at hvis vi snakker indlæring af disse bygnings elementer, skal vi nok køre forholdsvis snæversynet i starten, og så kan vi flade ud bagefter.

43) Bogdan: På de senere semestre vil de, som du siger, have mere faglig viden, og så prøve at eksperimentere med det på et senere semester. Vil de studerende få ... jeg tænker bare på hvor meget de får ud af det, for eksempel hvis vi nu siger at de på 7. semester begynder at lave noget tværfagligt, innovativ projektarbejde, om de vil lære at ... om det vil være noget de vil føle sig godt tilpas med, eller om det bare vil være en engangs foreteelse. Ja, at de ikke rigtigt føler at de har fået det inkorporeret det så meget i deres tankegang. Kunne det være en ... ikke en problem, men kunne det være et minus ved at de ikke starter tidligere med det? Nu tænker jeg på OOA&D for eksempel. Det første semester vi havde om det, der fik vi det prøvet og der fik vi et indtryk i hvad det var, men semestret efter der brugte vi det ikke, fordi vi ikke følte ikke rigtigt at det gav os det vi gerne vil have ud af det. Det kan godt være at vi misforstod OOA&D, men vi fik ikke rigtigt sat os ind i den tankegang der var med OOA&D, da vi kun fik det prøvet en gang. Så jeg tænker på at når de studerende skal ud herfra, og når de nu kun har på deres 6., 7. og 8. semester lært at arbejdet tværfagligt, om det vil være noget de vil kunne bruge senere. Om det så vil have gjort en forskel i forhold til at lære dem om innovation, som noget de kunne bruge bagefter.

44) Ivan: Jeg forstår ikke helt sammenhængen mellem innovation og så OOA&D.

45) Bogdan: Nej. OOA&D det er en metode, en måde, til at udvikle et system på, som vi så skulle lære i løbet af et semester. Der fik vi så kørt den der bog igennem, og fik lavet alle de der processer, men semestret efter kunne vi vælge om vi ville bruge XP eller OOA&D. Det var igen det at vi ikke tænkte i OOA&D baner, det vil sige at vi har læst en bog, vi har brugt et semester på det, men det var ikke sådan at vi følte os i OOA&D's ånd. Så var det jeg tænker med innovation, hvis det var sådan at man lægger det lidt sent, og man får lov til at arbejde tværfagligt og imellem flere grupper, om det så også vil være noget man vil kunne bruge senere hen, altså identificere sig med den måde at arbejde på.

46) Ivan: Forhåbentlig kan man lære noget på alle semestre, men hvis man forsætter med at lave det samme det næste semester, som man lavede på forrige semester, så lærer man ikke så meget. Så det skræk scenario som vi har, er det er sådan set det som vi for nogle år tilbage, da vi startede op Informatik uddannelsen, der havde vi usability på 1., 2., 3. og 4. semester. Det var da ramlende vanvittig. Folk lavede det samme projekt 4 gange i rap. Så jeg kan godt forstå frustrationen som går på: nu har man lært et eller andet og så skal man ikke bruge det videre i studiet, medmindre man tilfældigvis falder over det og lejlighed til at gøre det. Men formålet med uddannelsen er sådan set at dække et forholdsvis et stort areal af faglig viden.

47) Bogdan: Jeg snakkede også med nogle af de dataloger som var med til den der ”innovation camp”, de der 2 dage, og en af dem sagde blandt andet at han syntes at det var sjovt at prøve, og så spurgte jeg om det var noget han kunne bruge senere. Han sagde at det var sjovt nok, men han vidste ikke helt hvordan han kunne få det sat ind i hans hverdag. Det er bare sådan at jeg tænker på om hvor meget nu man skal lære om innovation i løbet af uddannelsen, om det var noget man kunne bruge senere. Nu er der godt nok meget i samfundet om at man skal være innovativ, og så videre, men om man nu også kan bruge det senere, fordi man nu har prøvet det et par gange.

48) Ivan: Jeg tror nu godt at vi kan lave den camp lidt bedre næste gang, end vi gjorde første gang af hensyn til bedre faglig forudsætninger, men ellers så tror jeg generelt at der er meget lidt man kan håbe at få gennem kurser, ufatteligt lidt. Det er projektarbejde, det handler om. Og så er det ikke alle studerende der er lige minded for at deltage i camp'en, mange ser det som en luksus hyttetur, andre så det i høj grad som noget de kunne bruge.

49) Bogdan: Så man kan sige, at man skal begynde på at arbejde lidt på de studerendes mentalitet i forhold til innovation.

50) Ivan: Det var det camp et forsøg på. Det er en event, der er 48 timer, du kommer ikke hjem som et nyt og anderledes menneske. Du kan håbe på at blive skubbet nogen i den retning, for nogen lykkedes det, for andre ikke.

51) Bogdan: En anden løsning kunne være at ... med reference til hvad du sagde tidligere med at I prøvede at lave det der tværfaglig, tvær-gruppe projekter, hvor de studerende ikke ville, eller var så opsatte på det. Så man kunne sige at man skal arbejde på de studerendes syn på innovation, altså at være tværfaglig og at de ikke skal se den der camp som en luksus hyttetur, men forberede dem sådan rent holdningsmæssige til innovation. Var det ikke noget man kunne arbejde med?

52) Ivan: Jo, vi kan ændre på vores projekt, som jeg lige har skitseret. Vi skal lige huske på at, vi skal nok ikke satse på at alle vores studerende, de ender med at blive super innovative. Dels er der forskellige forudsætninger, og dels de arbejdsopgaver de får, er noget forskelligt. Og så hvis alle render i hver sin retning, fordi de er oh så kreative, så er det ikke sikkert at de vil fungere særlig godt i en arbejdssituation. Det kan godt være at vi skal have nogen som er rigtig gode, med gode ideer, er meget stædige, holder fast i lige præcist de ting som de har tænkt sig at arbejde med. Andre skal bruge kræfter på andet. Man skal i høj grad satse på at udvikle evnen til at være innovativ og kreativ i hold-sammenhæng, gruppe-sammenhæng. Det medfører at vi skal lægge stor vægt på hvordan vi planlægger vores projekter. Så det store udfordring for mig, det er at fremme et mentalitet blandt studerende, og blandt vejlederne, som dyrker det at skabe noget anderledes. Ikke nødvendigvis ved at bruge det, faktisk også ved at man kan demonstrere, at de gode ideer kan omsættes til nogle kommercielle løsninger. Hvis vi kun har studerende som tænker kreativt og ikke har en kina-mands ide om hvordan de skal realiseres, så er jeg sikker på at de ender på socialkontoret, uden arbejde. Det er vigtigt at kunne prøve begge dele.

53) Bogdan: Jeg tror ikke jeg har så meget mere. Har du nogle andre bemærkninger eller spørgsmål?

54) Ivan: Nej, jeg har det jeg ville sige.

55) Bogdan: Tak for interviewet så.

F

Translated quotations:

1. “Innovation marks the effort of developing an already invented element to a practical commercial use and obtain acceptance towards the introduction of the element. Innovation may concern new products, new production processes, new market behaviour, new raw materials or new semi-manufactured articles or new organisational forms.”
2. “Innovation is new, useful and implemented.”
3. “For all educations at the Faculty of Technical Science it must through further development and differentiation of mainly the problem solving project work, which is the primary element in the faculty educations, be kept in view that the students are trained in the abilities of: ...creative problem solving; ...innovation and commercialising through entrepreneurship.”
4. “The student must during the bachelor in Informatics acquire a basic knowledge of – and experience with – the computer as a technology and medium that enables him/her to: work systematically and creatively with solutions of central problems within design and realization of modern, advanced information technology, ...”
5. “Mathematics is subject where one learns to analyse and comprehend logical connections independent of what they should be used for. It is a very abstract subject. ...mathematics is, in our employment, a tool subject. ... the purpose with mathematics lessons is primarily to make people comprehend the mathematical principles so that they can use them themselves. Hopefully within IT.”
6. “...we have different types of courses, we have courses with the purpose of training people in concepts and problems, then we have courses that deals with abstract thoughts. The purpose of the mathematics course is typically to teach people to think logically and analytically regarding problems. This corresponds in many ways to learning to read and there one can of course say: if people learn to read while they are standing on their heads and do all sorts of strange things, then they might become more creative when they have to write something themselves, but of course you have to argue for that this being appropriate. Maybe you should start of by focusing at making people learn to read. Then when they have learned to read, then you can try to bring out the creative processes. That is why I differentiate between courses and project work. I see the project work as the most important drive to accustom people to think innovatively. ...”
7. “... We actually all have a problem with – I have been trying talk about this for years – that all our projects are “use and throw away”. We solve a task, write a report, make some software, then we take an examination, and then we throw it away. If we immediately counted on that what people made held a value apart from to the semester, to the examination, then it may be that they would also continue working on it.”
8. “...I will not exclude the possibility of having a course at 1, 2 or 3 ECTS that deals with innovation processes; that you can imagine. However, it will never extend the boundaries, ...”
9. “There are several things that you can choose to work with. One is a change of pace, i.e. to vary the project idea: small groups, big groups, several deliveries, few deliveries, one semester, several semesters, make some variations here so that the format of a project

changes. Then you can choose to that there should be more people to solve a task, i.e. more project groups should work together making joint solutions. These groups may be interdisciplinary so that you can have more sorts of professionals working. You can rediscover the idea of theme limits, in the past we had not only project subjects but also project themes for projects. That is something that constituted a contents community for project groups, so that they could profit from each other across the project groups. Originally, there was something named Mem groups where 3-4 groups were joint together to share experiences from the joint guidance, which can also contribute to make a promise, make some variation in the project, achieve an ambition to do something that is important... ”

10. “Among other things, because the students doesn’t want to. This is our experience, but once we made an attempt with a project across several project groups that went into pieces, because the students became too ambitious on their own behalf. Then there is the aspect of law and order, because what if one project falls apart and the other project succeeds, but then you have two projects that are dependent on each other, do you then risk that one of the projects lowers or impedes the other project. Then it is safer to have some known ground rules, 1 supervisor and 7 students, and then that is it, so you don’t have to many external factors...”
11. “Place it a later semester. The first time we tried... was on the 3rd semester. So in the future we will probably attempt to place it on the 7th semester or later.”
12. “ ...the great challenge for me is to promote a mentality among the students and among the supervisors who practise creation somewhat differently...”
13. “The purpose of the bachelor education is, cf. the education order, to qualify the students to attend to commercial duties due to the scientific knowledge and skills and to give the students knowledge and insight in methods that form the basis of the master’s degree. In the academic part of the curricula, academic objectives are determined for the individual bachelor educations.”
14. “The purpose of the master’s degree is, cf. the education order, to qualify the students to independently attend to commercial duties due to the scientific knowledge, and insight in scientific theoretical and/or experimental methods and to qualify the students to participate in scientific development work. In the academic part of the curricula, academic objectives are determined for the individual master degrees.”
15. “For all educations at the Faculty of Technical Science it must through further development and differentiation of mainly the problem solving project work, which is the primary element in the faculty educations, be kept in view that the students are trained in the abilities of:
 - Handling new problems
 - Logical reasoning
 - Critical and independent analysis
 - Understanding for the scientific theories of the subject
 - Synthesis across subjects
 - To promote viable and ethically defensible technologies
 - Creative problem solving

- Employment of modern information technology
- Communication
- Group work and collaboration
- Management
- Continuous professional development
- Innovation and commercialising through entrepreneurship.”

16. “The purposes of the base year are:

1. To train the abilities of the students, on a scientific and contextual orientated basis, to carry through and arrange a project work of relevance to a technical scientific study, and train the ability of the students to reflect on the learning process.
2. To give the students basic academic knowledge and comprehension of relevance for a technical scientific study.
3. Through point 1 and 2 to act as a part of a total course of studies within the educations that belong to the Technical Scientific Faculty at Aalborg University.”

17. “The student must during the bachelor in Informatics acquire a basic knowledge of – and experience with – the computer as a technology and medium that enables him/her to:

- work systematically and creatively with solutions of central problems within design and realization of modern, advanced information technology, in such a way that the potential of the technique to support humans in both work and spare time are exploited in the best way possible.
- To use basic theories, methods and principles on development, construction and use of information technology and on communication between people with regards to development and utilization of information technology.
- To build up and maintain a basic technical qualification within the subject area of computer science.
- To carry through a study at the master’s degree in informatics.”

18. “The student must during the master’s degree in Informatics acquire knowledge of – and experience with – organizational and media related deployments of IT. In addition to this, the student must be able to use, critically estimate, and develop theories from computer science and the humanities in connection with development and construction of electronic data processing based systems.”