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Medialogy – Interdisciplinary Education Challenge with Focus on PBL and Students’ Learning.

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***Abstract.** The paper investigates the problems of establish an understanding of the competence connected to a new interdisciplinary program called Medialogy. The program is introduced and a definition and understanding of an interdisciplinary education and competence is discussed. One of the questions raised in the paper are: How do students carry out and combine the different disciplines in an interdisciplinary way when working with their projects? We are analysing 6 semester projects as cases to find how the students are dealing with the PBL approach and the interdisciplinary nature of their study. The conclusion is that the projects are dealing with Medialogy competences in an interdisciplinary way and that PBL is an effective method to achieve interdisciplinarity.*

1. Introduction

Different new educations in the field of media and technology are constantly developing worldwide. Searching on the Internet almost every university has programs in both media and communication. Several universities are discussing the challenges to offer double degrees, so the students can combine an individual education according to their interests. Other universities are offering interdisciplinary educations in the field of media technology. Having worked with those interdisciplinary engineering and science educations for several years, it seems to be a challenge to define the students’ key competences, and the ability of such educations to provide new scientific paradigms and disciplines.

This paper investigates the challenges connected to a new interdisciplinary science and engineering program: Medialogy at Aalborg University. The program includes Bachelor and Master level educations and combines humanistic, sociological and technical aspects of media technology. The focus in this paper is on the students and their way of using the interdisciplinary aspects in their study. Some of the overall questions dealt with are: How do students understand and use the interdisciplinary approach and how do they carry out and combine the different disciplines when working with a problem in their projects?

In the paper we describe how the students are using the interdisciplinary nature of Medialogy in their 6th semester projects. First we will introduce Medialogy, and then we will focus on the interdisciplinary nature of the program and establish a simple model for understanding the special interdisciplinary profile of the Medialogy knowledge. Next we introduce the B.Sc. Medialogy program and the Problem Based Learning (PBL) approach. Finally we analyze and discuss the interdisciplinary content

of 6th semester projects from a year group. For the analysis we use Bloom's taxonomy and the aim described in the study plan.

3. The Medialogy study

Media Technology or Medialogy as it is called in everyday language is an education started at Aalborg University in August 2002. The goal of the education is "to develop problem solvers in a digital media age independent of tasks" (Nordahl, 2007). This goal is achieved by merging creativity, arts and technology through the development and cross-combination of areas and topics within the field of engineering technologies, computer science, psychology, sociology and arts. Such areas have until recently been kept apart by conventional standards. The education is concerned with the current and future needs of society, culture, industry, hardware and software. The purpose of the program is to provide students with a solid foundation in areas within new media comprising both technical and creative aspects. Students graduating in Medialogy will be able to integrate and combine different fields of new media technologies. In Medialogy, students typically are faced with questions such as: to which extent can computer games be made more interactive or to which extent can the borders between man and machines be overcome? How can colours and pictures support the deaf people to get an understanding of sound and music? Or how can an interactive program support disable kids age 7 – 14 to train their muscles?

Medialogy is a 3 year B.Sc. program followed by a 2 year M.Sc. program. The first year is called a Basis year and provides students with adequate knowledge and experience with the Problem Based Learning (PBL) approach. During the first basis year students learn to work in groups, to manage a project and to cooperate and organize the work in a group. Furthermore the students learn to find a motivating and adequate problem area for which they make a problem analysis and on that background define a problem statement and a method to solve the problem. The students complete a project each semester and choose their project within a semester theme (See Busk Kofoed et al 2004).

4. The interdisciplinary and transdisciplinary Medialogy approach

It is a challenge to design an interdisciplinary or transdisciplinary curriculum (Adamczyk and Twidale 2007, Mackey 2004). Many interdisciplinary educations are merely a combined effort of different competences from several faculty members put together. The terms interdisciplinary and crossdisciplinary or multidisciplinary are often used without considering their meaning. It is important to have a clear definition and understanding of those words when being in an environment trying to establish a common understanding of a new education with a new combination of disciplines. In this paper we will use the definition proposed by Meeth in 1978. Observing the confusion in defining what an interdisciplinary education is (Meeth 1978), Meeth proposed a hierarchical classification. At the bottom he placed intradisciplinary studies i.e. studies composed of a single discipline. At the next level he placed crossdisciplinary studies i.e., studies in which one discipline is viewed from the perspective of another. Crossdisciplinary studies are relatively easy to establish according to Meeth, since they allow faculty members to remain in their own disciplines. Multidisciplinary studies are placed at the next level where each will offer their own viewpoint, but not necessarily

with any integration. The next level shows interdisciplinary studies in which the attempt is to integrate several disciplines which allow solving particular problems. The highest level of integrated studies is transdisciplinary studies. This approach goes beyond disciplines, since they start from a problem and using problem solving, they bring the knowledge of those disciplines which contribute to the solution (Meeth 1978). As also argued by Meeth, transdisciplinary studies are hard to design, since they require highly prepared and intellectual mature faculty members. The question is if Medialogy at the current state can be named a transdisciplinary program.

Most of the faculty members at the Medialogy program are young. They are brilliant within their field and are fascinated by the possibilities working with a new education. But most of them have had a very hard time trying to define their role in the new education. A discussion about definitions of the above classification of interdisciplinary studies has helped quite a lot. Even if all faculty members have the common goal of establishing a new transdisciplinary education, this appears to be an extraordinary effort. There has been several activities to support the teachers understanding of the transdisciplinary program, and now there is more clarity, but we can still improve the common understanding of the Medialogy profile (Nordahl and Kofoed 2009).

5. The B.Sc. Medialogy program and the Problem Based Learning (PBL) approach

Our presumption is that the PBL approach represents an ideal framework to design an interdisciplinary education close to being transdisciplinary in the sense defined by Meeth (1978), where transdisciplinarity is viewed as the ability to define a problem and find the relevant disciplines which allow solving it.

Aalborg University is using the concept Problem Based and Project Organized Learning (Kolmos et al 2004), and an additional pedagogical challenge has been to introduce this educational paradigm within the new program.

The institute of Media and Technology is relatively new, being established in 2005, so it can be defined as a developing community of practice which is not strong enough in its own apprehension and has not developed a common sense of identity (Wenger et al 2002). This state of the institute with many new teachers is one of the pedagogical challenges because there is not a genuine common understanding among the teachers about the PBL approach. All faculty members are expected to follow a pedagogical course, which is a mandatory course for assistant professors at Aalborg University (PUC 2006). Even after having followed this course, lots of pedagogical problems occurred because of old habits from different educational cultures. Working according to the study plan and discussing the plan, has been an efficient tool (Nordahl and Kofoed 2009)

The study plan for the B.Sc. program has been changed several times, and each new version is an improvement, but it is an important tool which supports the teachers and students to see the professional profile of the study.

The PBL approach means that each semester has a theme which defines the frames of the projects and half of the courses have to be directed towards this theme.

The students have to complete a project each semester as a group of 3-7 students. A theme could be: “Designing from both side of the screen” (2. semester) or “Integrated design – Intelligent systems and computer games” (6. semester). The theme establishes the frames and conditions for the projects, and related courses, and the project count about half of the semester time (15 ECTS for projects and 15 ECTS for courses) with the course amount falling during the study from 15 in the first semester to 12 ECTS in the 6th semester.

The following competences are described in the Medialogy study plan.

“The B. Sc. Medialogy student has to acquire expertise knowledge and experience which give:

- Understanding of the basic function of the human senses and their interaction with the perception of the context in general and the medias in particular
- Understanding of the duality between computer based recording and analysis of digital signals (pictures, sound, tactile information etc) respectively computer based generic/synthesis and presentation of corresponding signals
- Understanding of the interactive process between human, computer and machine
- Understanding of structures for narrative styles and communication in relation to medias and the characteristics of media technologies
- Understanding of the interaction between form and content when using new media technological effects as a basic for development of own creativity in this area of tension
- Understanding of media history and the basic for including cultural, ethnographic, social and sociological perspectives in solution of the problem
- The foundation for designing interactive systems with regard to both the communicative- as well as the user perspectives and the technological possibilities
- The foundation for analysis, synthesis and evaluate techniques and methods for development of media systems inclusive animation technology, virtual reality technology and computer games on both new and well known platforms
- The foundation for carry out a synthesis and evaluation of media systems” (Medialogy Study Plan 2008)

Furthermore there is a set of common academic competences such as ability to resonate, learning - and innovation competences as well as general professional competences such as: problem analysis - and problem solving - competences, communication competences, cooperation - and management competences (Medialogy study Plan, 2008). We see those competences as process competences and the technical as well as non-technical- competences specific professional competences, but the whole set of competences are Medialogy competences.

In the study plan each semester is described in details regarding courses, their objectives and contents, and the descriptions are made according to Blooms' Taxonomy (Bloom 1956).

According to the study plan, students should have opportunities to achieve an interdisciplinary or crossdisciplinary competence profile as described by Meeth.

Terry Winograd claims that to get design into effective practice, one need to train designers and also to teach the people they work with how to understand, incorporate and foster design (Winograd 2008). This philosophy is also at the heart of new programs around the world like the Stanford d.school which talks about creating T-shaped people (Stanford Institute of Design 2007).

Such people maintain the depth and focus of single disciplines, while integrating them and adding a crossbar of process knowledge and experience that drives the integration of multiple perspectives into solving real problems.

During the Bachelor education, students are exposed to different topics within media technology, ranging from technical implementations of input-output systems, to psychology, measurement of user experience and media sociology (Medialogy study plan 2008). This knowledge establishes the vertical line in the T and we call it the specific Medialogy competence.

The knowledge and experience connected to the academic competences mentioned in the study plan and the knowledge related to project management, learning abilities, communication skills, cooperation combined with an understanding of Medialogy in general establishes the horizontal line in the T, and we call them Medialogy process competences.

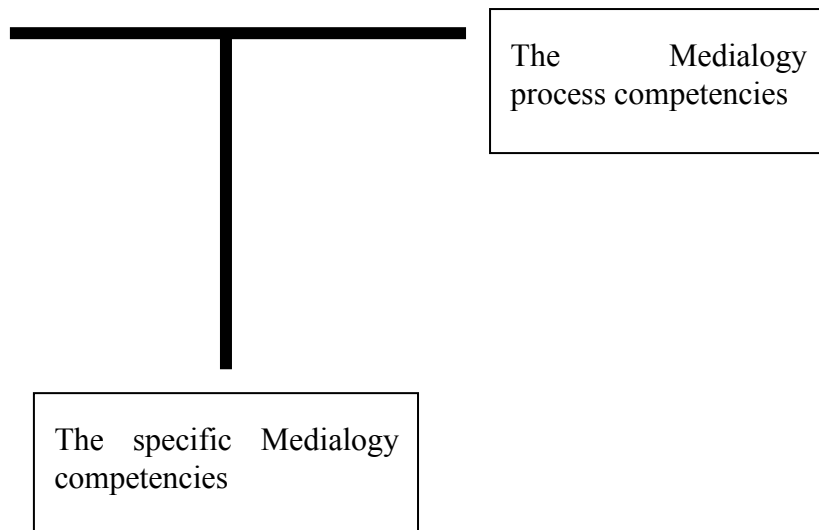


Figure 1: The T-shape model illustrates the B.Sc. Medialogy profile.

The T-shape can differ. The horizontal line can be shorter or longer related to the broad knowledge, experience and understanding of the process competences. The vertical line also can be shorter or longer related to how deep the specific Medialogy specialization is. We know that Medialogy Master Graduates either have a broader or longer vertical line depending on development of their specific knowledge area. For

example, some Master graduates are very specialized within sound and related communication aspects, and some are broader in their knowledge area using sound, computer graphics and virtual reality. The challenge for teachers and students is to find the balance of the T related to the goal of the education. The faculty members also need to understand their special knowledge as part of the T- model. They have to be aware of their special expertise as well as their broad knowledge so they keep their balance as well. Some faculty members are so specialized that they cannot relate to and understand others' expertise when working in a cross disciplinary fields. Other faculty members are so eager to learn about the broad perspective in such a way that their vertical line will become too short, and they lose focus on their own expertise. One cannot work in a crossdisciplinary environment if (s)he doesn't have enough expertise with which s (he) can contribute. So faculty members as well as students have to keep the balance of the T when developing their knowledge and expertise (Kofoed 1997). The study plan is developed with the aim to support the T-shape competence profile, and the PBL approach is a necessity when using the competences in action meaning when the groups of students are making their projects and prototypes.

Evaluation methods

We have used the Medialogy study plan 2008 as reference for the content of the interdisciplinary program. We have also adopted the Problem Based Learning (PBL) approach as it is used at Aalborg University as part of the analysis; because this knowledge area is integrated in the competence profile (see Figure 1). We will carry out two analyses: The first is about how the PBL is used in the project. Are the students actually analyzing and solving any problems etc? The second is about the way the students use and work with the different knowledge areas connected to their problem solving. To analyze students' projects operationally according to the PBL approach and the content of the projects, we have chosen the cognitive domain in Bloom's taxonomy (Bloom 1956). In this paper we do not describe Bloom's classification criteria, but just mention the 6 categories:

1. Knowledge
2. Comprehension
3. Application
4. Analysis
5. Synthesis
6. Evaluation

We considered the problem analysis in each project report evaluated as belonging to one of the 6 categories in Bloom's taxonomy. Furthermore we are using the aims in the study plan to evaluate the problem statement and which Medialogy knowledge areas are needed to solve the problem.

The 6th semester Medialogy projects

We are choosing the projects from the 6th semester 2008 as a case to analyze because those students are the first batch who have started with the basis year where many process competences are dealt with (previous 6th semesters have started on the 3rd semester because of merits from other institutions). So this 6th semester should be able

to fit to the T-model because they have had the PBL approach from day one. At this semester the students have completed 6 major projects all organized as group work.

The theme for 6th semester is: Integrated Design – Intelligent Systems and Computer Games. The workload is 20 ECTS of project work and project unit courses. The purpose is that the students shall understand the background and the current trends concerning interactive media systems, including how to use such knowledge and skills to produce a new design of an interactive media system.

The objectives are stated as examination requirements:

- Analyze previous research and current trends concerning interactive and converging media.
- Use such an analysis to synthesize the design of an interactive media system involving auditory and visual feedback and alternative input devices (i.e. computer vision or physical interfaces)
- Apply fundamental techniques from game problem solving and artificial intelligence in the interactive media system

The project should be documented in a report and an AV-production illustrating and summarizing the project should be delivered.

12 projects were completed and 1 is confidential, so 11 projects are analyzed.

All projects are performed in groups and are finished to dead-line. All groups have made a good presentation of their projects, and the methods and structure in the reports show that the horizontal line in the competence profile in general is covered. The students have designed a project plan and carried out their project according to their own goal set in their problem statement. So we can conclude that the Medialogy process competences are acquired.

Problem analysis

All projects have made an analysis of the problem area finalizing or concluding with “Final problem statement”. In this section students start with a motivation for a problem they want to analyze and trying to find a solution to. They investigate what have been made, they take contact to a user group if necessary, they make pilot testing on a very early prototype – everything to understand the problem so they can make an operational problem statement, which they have to solve. 50% of the projects have a problem analysis at Blooms Analysis level. 30% are at the synthesis level, they work up new ways of combining different technical aspects or e.g. different game approaches. And 20% come up with prioritized recommendations for their projects, so they are at the highest level on Blooms taxonomy.

The projects final problem statements and the solutions

All projects have a final project statement which shows the solution the students want to work with when solving the problem. The demands for problem statement are that it is operational and it should be implemented and tested. All students have accomplished the demands at different levels. They also have different structures of their chapters before reaching the problem statement. Their problem statements and solutions are as follows:

1. How can a hybrid between a board- and computer game, which combines the social and physical elements of board games, and the auditory and graphical elements of computer games be created and will this hybrid preserve the appeal of these elements? *The solution became a combination of board- and computer game in a hybrid application combining social and physical aspects with strategy and teamwork.*
2. How much can interactive out-of-home advertising be more attractive than the out-of-home non-interactive advertising? *The solution was to make two identical commercials: interactive and non-interactive and then test the results.*
3. How can narrative intelligence conveyed through a commentator entity be utilized as a tool for story generation in the context of a single player, first shooter death match – and will it result in measureable user constructed narratives and/or a higher level of perceived intelligence in the computer controlled participants? *The solution became an intelligent framework for creation of narrative content to heighten narrative potential in games as well as relieve the exponentially increasing burden from game developer's shoulders.*
4. Can we make the WH40K tabletop game more immersive in terms of putting more focus on the empathetic insight which the players obtain in the fictive Warhammer universe while playing, so as to heighten the imaginative- and sensory immersion by eliminating obstructive factors in the game using digital functionality and AV feed-back? *The solution became an interactive application referred to as the Warhammer Tec Table which is designed with audiovisual feed-back to allow the players to keep focus on the gaming platform.*
5. How can we design and implement our concept in a game context in a way that it conforms to the mentioned criteria for fun? *The solution became a game made up of the three factors: game play, game mechanic and interface leading to the essentials used to refine the concepts.*
6. How will a co-located collaborative multiplayer game utilizing affordance of a multi-touch tabletop interface affect the player experience? *The solution was to create a co-located collaborative game for a multi-touch tabletop. The development is user-driven. GameFlow framework is used to investigate player experience. A table-top game is build and tested.*
7. How can we help students prepare for oral examination situations by measuring voice factors and given real-time feedback in a virtual environment? *The solution was to develop a system which takes vocal input analyses it and use the data to control a 3D modeled audience reacting real-time to vocal input.*
8. How is a player's experience of a game altered by affective gaming with measurement of muscle activity and exposure to haptic feed-back? *The solution was to change the speed of a 2D platform game and through gaming to measure the muscle activity and haptic feed-back from a gaming vest to test how the player's experience of the game is altered.*
9. How can mixed reality in a collaborative environment be used in the field of chemistry to enhance the understanding of scientific modeling of molecule structures? *The solution became to use SciVi, an interactive augmented reality application used for building and visualizing molecule structures and chemical bonding between atoms.*

10. How can we use an audio-visual memory game to measure the difference of cognition between the graphical and auditory elements? *The solution became a 4-4 level game in two parts. One is audio and one is visual. Players have to use his cognitive abilities to complete the game. This gives an opportunity to test difference between two stimuli.*
11. What changes and additions in avatar control are afforded and what changes could be introduced to the derived game play when using a Head-Mounted-Display in combination with head tracking in First-Person- Shooters? *The solution contains HMD and head-tracking as a means of interfacing with FPS games for home users, and establishing a new game-play. The solution resulted in a FPS game scenario where it is possible to change the orientation of the view, lean forward/backward/left/right/ and look over and under obstructing objects by the use of the players actual head.*

All projects had an implementation and a test of their solution according to their plan.

6 projects did use further knowledge areas than mentioned in the study plan. They also showed a new and creative way to integrate the knowledge in a new solution, so we can say they solved the problem in a cross disciplinary way. They had a good balance of the T-profile.

3 projects did use several knowledge areas within the study plan when solving their problem, and derived a solution which was acceptable but in an interdisciplinary way. They had a good balance in their T-profile.

2 projects did a rather good problem analysis but the intentions shown in the final problem statement was not delimited so the group's solutions were not based on sufficient knowledge. They tried to use knowledge in an interdisciplinary way, but the vertical line in their T- profile was not deep enough.

5. Conclusions

In this paper we have analyzed the foundations of the Medialogy education, and discussed different Bachelor projects together with their approaches to interdisciplinarity.

The projects described did implement successfully Meeth's notion of interdisciplinarity, and show how PBL is an effective pedagogical method to achieve interdisciplinarity. The PBL approach assures that the students are forced to get knowledge about the problem area they want to work with in their project so they have established a good problem understanding as a basis for choosing the sufficient knowledge elements and combine them in an interdisciplinary way to get the best solution of their chosen problem. Furthermore the PBL approach support and strengthen their T-profile, so they obtain the qualifications connected to their Medialogy profile.

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