Universal Design 2016: Learning from the Past, Designing for the Future
H. Petrie et al. (Eds.)

doi:10.3233/978-1-61499-684-2-10

Cross-Professional Cooperation in a University Setting

Evastina BJÖRK[1] and Stig OTTOSSON
NTNU, Gjøvik, Norway

Abstract. In 2015, a research study on student product development projects was conducted at the Norwegian University of Science (NTNU) in Gjøvik. The student projects lasted eight weeks and were done by twenty-four third year occupational therapy students and twenty-four third year industrial design students forming eight cross-professional project groups. The theme was welfare technology from a Universal Design perspective. Problems to work on for each group were given by the occupational therapy students, based on problems they had experienced or identified while doing their practice training periods in municipal healthcare facilities and in the homes of patients. A general objective of this study was to build a knowledge base for increased cross-professional cooperation among students in higher education. One aim was to better prepare the students for their future professional roles. Another aim was for the students to acquire knowledge, understanding, and experience on how to work in a project with issues related to the knowledge and skills they had previously acquired in their education. Another aim was to reinforce their capabilities and competences regarding use of Universal Design in the area of welfare technology. The main result of the study is extended knowledge on how to form and carry out cross-functional project work in a university environment.

Keywords. innovation, project work, Universal Design, cross-professional cooperation, welfare technology

1. Introduction

New technology has the potential to enable people to live at home and remain self-sufficient and safe, despite illness or reduced functionality. To make students aware of the new possibilities and to prepare them take advantage of sustainable innovations, their training, including cooperation in mixed teams, needs to be prioritized in the university system. That can be done, for example, by bringing students with a social science background together with students from institutions engaged in the technological development of products and services.

At NTNU in Gjøvik, sustainability, innovation and Universal Design are the three important, strategic focus areas in education and research. With the objective of implementing this strategy in education, all second year BA students at NTNU (about 700) do a mandatory twenty-four hour activity called “Idelab 24”. Students from three departments in Gjøvik are mixed in about 120 groups, each containing two students from health science, two from information & technology, and two from the engineering

[1] Evastina Björk, NTNU in Gjøvik, Teknologiveien 22, Postbox 191, N-2802 Gjøvik, Norway. Email: evastina.bjork@ntnu.no

& management department. The students are given a mission to create and develop an innovation concept around a given theme within twenty-four hours. In 2015, the theme was the "Internet of things" and in 2016, it will be "Smart textiles". Thus, Idelab 24 strives to give students some experience of creative and innovative interdisciplinary cooperation.

To follow up on the Idelab 24 activity, a more comprehensive cross-professional pilot project was carried out in 2015 with twenty-four third year students from the health science department, and twenty-four third year students from the engineering & management department at NTNU in Gjøvik. This paper is about experiences and reflections from the pilot project.

2. The Student Projects

The student projects were carried out over eight weeks. The theme was to develop an innovation concept incorporating welfare technology and Universal Design. The problems to solve were specified by the occupational therapy students, based on problems they had experienced or identified during their practice training periods in municipal healthcare facilities and the homes of patients. Each project group selected one problem upon which to work.

3. Project and Product Development Theory

3.1. Project Theory

A project is an appropriate form for the development of new products and services in which cross-professional competences are required to meet the stakeholders' needs and expectations [1]. Team members are independent in their achievements and the results are affected by their interaction [1]. Ideally, members of a team should have the same goals and be collectively responsible for the achievement of these goals. In order to achieve successful collaboration, team members should share the same objectives and have the same value systems [3].

To work effectively in cross-professional teams, the team members need to possess an understanding of their own role as well as the roles of others [4]. They also must possess the flexibility and ability to think innovatively [5]. The outcomes of student learning and their capabilities should be based on the domains of knowledge in practice, communication, ethical practice, and reflection [3]. Differences in background education can be a weakness and/or strength. Team members' respect each other and their willingness to listen to each other can lead to better results. Trust is a vital ingredient in collaborative projects. Building and maintaining collaboration across professional cultures presents particular challenges for building trust. Trust in cross-professional teams is based on norms, information, sanctions and controls [3].

Actively working in teams is best handed over to those who have a strong professional identity and "newly developing professionals must have a professional identity strong enough to represent their discipline, and at the same time be flexible enough that they will not resist collaborative practice" [6]. According to Schön [7], the capacity of professionals to practice in multi-professional environments depends primarily upon their ability to understand and respect cognitive patterns - in other

words, to understand the way in which others conceptualize problems and interventions as well as the values of all of the professions.

The term multi-professional learning (MPL) is used to indicate representatives of two or more professional groups that are learning new spheres together. The term inter-professional learning (IPL) refers to a part of educational process in which individual participants learn each other roles and move towards collaboration [3]. The student projects presented in this paper can be positioned in the multi- professional learning segment.

The path that most teams follow on their way to high performance is described in five phases (see Figure 1). During the *orientation phase,* which is a socializing phase, the group members approach each other to get an understanding of how the other team members work and react, as well as their knowledge and opinions on different topics. The team then comes to the *conflict phase*. If the team members cannot settle on the basic decisions, and if a strong project leader does not make the decision, sub-groups can develop. The *conflict phase* can evolve into the *approaching phase* when some of the team members take the initiative to solve the problems that have been created between some other team members or sub-groups during the previous phase. The *cooperation phase* is characterized by trust and constructive discussions and the team members can exchange information in a rather prestige-free way. In this phase, efficient work takes place. When the group has completed the task, or when it is clear that a new project needs to be set up, the *separation phase* has been reached, which can be troublesome for the team members during long-lasting projects.

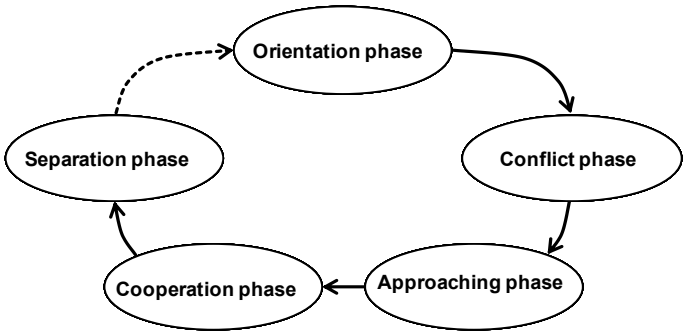

Figure 1. Five phases a project team often go through in a new product development project ([8] based on [9]).

3.2. Sustainability in Product Development

The project team strongly influences the environmental impact during the whole Product Life Cycle, and this is also true for the supplementary products. When the products reach the market, a new *use phase* contributes significantly to the total environmental impact of the product's life cycle. This impact is partly determined by user behavior [10].

Seen from a user's point-of-view, a product had different important values. Three central ones are listed below [8]:

- *Functional values* are dependent on the technical solutions that are mostly hidden inside the product. To achieve good functional values, satisfying usability is important in the product development phase. According to ISO [11], usability is "the effectiveness, efficiency and satisfaction with which specific users can achieve specified/particular goals in particular environments".
- *Sustainability values* are the long-lasting environmentally responsible values for the users, the society, and the providers (the business).
- *Perceptory/sensory values* are based on what we experience with our senses (see/hear/taste/touch/smell) from outside and/or in contact with a product.

When the *functional values* have been satisfied, other product values can be satisfied successively in new creative processes. Here, creativity is understood as the ability to create meaningful new ideas, forms, methods, interpretations, etc., which is in accordance with the statement that "creativity involves the production of novel useful products" [12].

To develop a functional design, taking into consideration the different usability aspects, the systematics of Brain Aided Design (BAD), Pencil Aided Design (PAD), Model Aided Design (MAD), and Computer Aided Design (CAD) have been shown to be fruitful in practical work [8]. The student projects in this study used these systematics in the creation of innovative solutions. (See Figure 2).

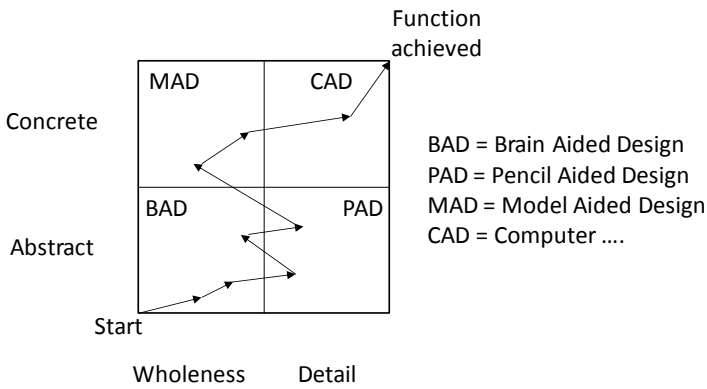

Figure 2: How the principle of BAD-PAD-MAD-CAD can be used for a new product development process [8]

3.3. Universal Design Implications

Many political documents address the importance of Universal Design (e.g., [13]). These are concerned with the task of making "homes and surroundings suitable for the elderly and people with reduced functionality". However, the principles for user-friendly solutions and Universal Design are also important for less tangible issues, such as services and software that uses welfare technology so that a "barrier free world" for all types of users can be a reality.

Thus, the main goal of Universal Design is to achieve universal performance of designed products, buildings and environments, providing flexibility in use, especially at an urban level. It promotes a shift towards user-centered design by following a holistic approach and aims to accommodate the needs and wishes of people, regardless

of any changes they might experience in the course of their lives. Consequently, Universal Design is a concept that extends beyond the issues of mere accessibility to buildings for people with disabilities. Universal Design should be an integrated part of the policies and planning in all aspects of society [14] and does not only focus on the users' physical abilities but also on their cognitive and communicative abilities. Thus, there is more to functionality and task performance than bodily access alone.

3.4. Welfare Technology

During the last three years, the Nordic region has seen rapid development in welfare technology. It has moved away from being little more than a relatively undefined vision of innovative vision, and has grown into a tangible tool in a toolbox for the Nordic public authorities [15].

In Norway, the term 'welfare technology' is most commonly used for technologies in the domain of elderly care. The definition of welfare technology given in the Digital Agenda for Norway [16] is*; technology that can help promote safety, security, social participation, mobility, and physical and cultural activities*. Welfare technology enhances peoples' ability to manage everyday life despite illness or impaired social, mental, or physical capacity [17]. Welfare technology can also help family members and others contribute towards improving accessibility, use of resources, and the quality of services offered. Welfare technology can be a tool to promote user-driven innovations, or, in contrast, can be another way to hold older users hostage. Healthcare technologies are increasingly important for the society, in order to be able to offer health and care services in a quantity and quality that mirrors the expectations of the population.

4. Method

4.1. Research Design

This study was designed as a case study, in which the process has been focused on analysis and reflections more than on the actual outcome of the projects. Case studies provide stories that can be used as teaching tools to demonstrate the application of a theory or concept in real situations. Good cases generally have the following features: they tell a good story, are recent, include dialogue, create empathy with the main characters, are relevant to the reader, serve a teaching function, require a dilemma to be solved, and have generality [18]. Case studies are often complex and the nature of the case depends on the situation. They can also be influenced by a variety of events.

The student groups met their supervisors at weekly meetings for guidance, evaluation and reflections on their work. The four supervisors met once per week to discuss and reflect on the progress of the student groups. After four weeks, an interview was held with two students from each group. The focus was on students' experience and opinions concerning the cross-professional cooperation, responsibility, trust, learning in group processes, and their experiences gained from working with Universal Design and welfare technology in practical settings. After eight weeks, the groups reported their findings in a written report and in an oral presentation in a plenary session.

4.2. Experiential Learning

The students' educational learning method was Experiential Learning [19]. This means that they learn by working together to solve concrete, practical problems. Experiential Learning is inspired by several different teachers (e.g., [19] and [20]). Learning is simplified for the performance of practical activities and, at the same time, reflects on what is happening. Schön [7] underlines the particular importance of reflection in connection to the positive in the development of competence in carrying out actions.

Dynamic Product Development - DPD [8] was used as the method for guiding the groups in the creative development of new solutions.

The benefits of collaborative learning was described by [21], arguing that besides the development of critical thinking and problem-solving skills, collaborative projects allow students to become intrinsic learners and genuine communicators. Further, collaborative learning fosters more interactions and social support, compared to traditional learning [22].

Participant observation was done in the environments where the use of the products was intended to take place. Interviews of intended users were carried out using the two data collection methods so that the students could gain an understanding of the problems they had to solve [23]. By using these data collection methods, both expressed and unexpressed needs became clear and the contextual factors that affect the usability of the products and services could be identified [24].These are the actual problems focused on by the project teams.

- Design a “storing system” for wheelchair users to promote autonomy and independence.
- Develop a more universally designed electric cable plug in compliance with Norwegian standards.
- Make improvements to “the skilator” (a type of ski rollator for kids) so it can contribute to increased participation for most children.
- Create a universal mobile holder that will improve the use of a phone for people with spasms, decreased muscle power /and or reduced grip.
- Develop a product that can counter act dehydration for most people with cognitive impairment.
- Design a product that helps people with impaired grip-capability to become more independent in the use of cosmetic products.
- Develop a universal output options cart.
- Develop a universal solution to prevent falls in outdoor staircases.

5. Result

5.1. Question 1

How can a knowledge base for increased cross-professional cooperation among students in higher education be created with the aim of better preparing them for their future professional roles?

Initiatives were taken to implement cross-professional projects in an existing course in the curriculum of the third year of the two bachelor programs. The course selected for the occupational therapy program was “Universal Design and welfare

technology", a public health issue (15 ECTS). For the students at the Technology Design and Management Program, the course, Universal Design (10 ECTS), was chosen. The courses were chosen because, from an administrative point-of-view, it was practical to engage both programs for this type of implemented project.

Important success factors for the creation of a knowledge base for increased cross-professional cooperation were:

- an entrepreneur, in this case, a teacher with former experience of starting up new development projects in university settings;
- department management at the university that accepted the pilot project idea and showed supportive interest;
- interested and motivated teachers/supervisors in both departments.

5.2. Question 2

What challenges did the students experience in the different phases of the projects and how did they share knowledge and experiences with each other in the project teams?

After four weeks, the students indicated that they were experiencing great uncertainty. This was internally discussed by the supervisors and led to closer contact and more support for each group.

The supervisors did not appoint project leaders for the groups, which is in line with the concept of Idélab 24. The project groups, themselves, appointed project leaders one or two weeks after the start (in the orientation and conflict phases). The absence of a person in the role as project leader was seen by the groups in later reflections as something that negatively affected the projects. Several groups also expressed their opinions that there was a disadvantage in not knowing one another before the project started, being forced together and being given a task to solve. This indicates that kick-off meetings beforehand would have helped.

Some groups indicated that they were unsure of how to write the documentation of the projects. This caused conflicting situations and the students discovered relatively large differences in the academic approach between the health care and the technology departments. Different approaches to user participation and an understanding of the concepts and definitions can lead to misunderstandings. One view from the interview of students was:

"we need a common understanding of words and definitions, who the user is and why the environment is crucial. For us occupational therapists, the user and the environment is so close… it is difficult (Group 3).

After about four weeks, the groups reached the collaboration phase, in which they began to share information and organize and design the meetings in a proper way. Their ideas about solutions were discussed more and they started to plan for different areas of responsibility. The supervisors also noted that the projects were more efficient in the four last weeks.

"In the starting phase of the project, the solution soon became focused on one product idea. We think that it would have been an advantage if we had also looked at a service solution to add to it, but the timeframe did not allow for that" (Group 4).

The last week of the project was chaotic for several groups as they were unable to agree on how to design the report, and what to focus on: the process or the outcome. Time limits and disagreements on how the project should be presented caused frustration. In the final evaluation of the student projects, all groups, except for one, expressed the opinion that the various backgrounds of the students had been a strength.

They mentioned that they had learned a lot about project work and the process of interaction with the other project members from the sharing of the others' expertise and competence.

All groups mentioned that they thought that the time for the project was too short. All of them started the design and the subsequent evaluation of its solution based on the principles of Universal Design [25]. They found it useful to have the UD-principles as a guide for their work.

The students' perceptions of the problems largest problems they experienced were:

- a lack of previous experience of cross-professional collaboration (planning the activities within a project, time calculation, etc.);
- a lack of understanding of each other's professional knowledge (no trust, misunderstandings, etc.);
- various academic approaches (ways of writing reports, use of references, etc.).

5.3. Question 3

How can the concept of Universal Design be used in a practical project within the area of welfare technology?

In their final, written reports, the students indicated that their knowledge about Universal Design had increased because they were forced to do something practical with the theoretical concept. It was a good pedagogic strategy, which they experienced as beneficial.

"It's not given that everyone can use products, even though they are universally designed - there will always be cases in which there is a need for individual adjustments" (Group 1).

One group reported that "we have chosen to describe and analyse the electric plug based on the seven principles of Universal Design because those principles are so extensive" (Group 2).

All of the project groups used four of the seven UD-principles in their work.

6. Analysis and Discussion

Initiating cross-professional cooperation between different educational programs in higher education is a complex task. Universities are hierarchically structured and there is often a relatively long distance between "a question and an answer". Teachers at universities are often occupied with their own research and with writing applications for the funding of their next research projects. Furthermore there are time schedules, space regulations and other practical limitations that make "simple and easy" things become very troublesome.

To add a cross-professional project as part of a course in an education program means less administration than to provide it as a new, open course as some other topic must be removed for such a new course. A possible option can be to provide a new course as an elective. What makes this initiative unique and different from other courses with project work included is that students from different institutions work together towards new solutions in the field of welfare technology, for which both health professionals and technology competences are needed. A further challenge is to

reinforce their capabilities and competences regarding how they use the concept of Universal Design in a practical project within the area of welfare technology.

At the completion of the projects, the students were expected to have acquired knowledge and understanding concerning how to work independently on issues related to the knowledge and skills previously acquired in their educational courses. Universal Design, as a theoretical concept, was known by all the students, but to practice the UD-principles [25] in a real project was demanding, and the discussions in the groups indicate that theory and practice was sometimes difficult to unite.

Trust is a vital ingredient in collaborative projects. Gravis [6] argues for a strong professional identity as a prerequisite for trust in project groups. A lack of this among the students was perhaps one reason why they lacked trust in each other's competences. According to Atkins et al [3], successful collaboration demands that team members share the same objectives and have the same value systems. Members of the project groups shared the same objective within their groups but value systems are more complex to deal with, and the eight weeks was a too short a time to really look for strategic ways to become fully united.

The project groups experienced a lack of time, especially in the final phase of the project. The startup phase became long for most of the groups, and they spent much time getting to know each other and to trust other team members' competence. Differences in education can be a weakness, but it can also be a strength. In the evaluation of the student projects, most of the students expressed the value of cross-professional cooperation, because they had often experienced their own lack of knowledge and this could be complemented by someone else in the team. It was a question of trust and for the team members to possess an understanding of one's own role as well as the role of others [4].

Our study points out some barriers for cross-professional cooperation in university settings, but it also presents a number of opportunities and incitements that can be developed further in order to stimulate cross-professional project work.

The lack of experience in assessing how long different activities would take in a project was commented on by several students. Also, the preparation of the oral presentation became a time-consuming activity. These issues prompt reflections on the teachers' ability/experience to assess the initial period required in student projects and there is potential for improvement. Student views on the issues that they felt to be the most common were:

- a lack of previous experience of multidisciplinary collaboration;
- ignorance of each other's terminology and phage display;
- various academic approaches.

This result suggests that students should be prepared before a cross-functional project is started. Companies and organizations often start development projects with a "kick-off" meeting of two or three days at another place, with activities that contribute to getting to know each other. The reason for this is to weld the team together and to explain the objectives, resources and time requirements: Performance, Cost, and Time [26]. The student project probably would have benefited from such a start. Having clear guidelines for the writing of the report, including its form and scope would have made it easier for project teams to write the reports, e.g., if the time-consuming discussions had been eliminated. However, the process is important for learning/maturation in higher education, and it is through the dialogue and the argumentation that new knowledge is created.

The terminology used in different fields can be exclusionary for those not familiar with the particular environment. In cross-profession projects, it is especially important not to assume that all participants are familiar with specific profession expressions. Instead, talks and discussions should be carried out using universally understood language and terminology.

7. Conclusions

For universities, there are opportunities to tie training and working life closer together, and to cooperate with the surrounding society in solving actual welfare demands according to the demographic development of the society. This is also a necessity for the environment of innovation and entrepreneurship in the sector of care technology, which has a significant need for new ways of thinking, from the point-of-view of both the new technological/digitally-based products and the care services.

This interdisciplinary project was found by the students to be a good pedagogic strategy, which they experienced as beneficial. Their knowledge about Universal Design increased because they had the opportunity to do something practical with the theoretical concept, which they found resulted in providing them with handling competence. The experience gained in working with real problems in the care sector led to increased awareness of the importance of innovative thinking.

Acknowledgement

We would like to thank Universell.no for the financial support for this study.

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