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Design Thinking in Teaching: Product Concept Creation in the Devlab Program

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Abstract: This paper summarizes a case study within which the concept of design thinking (Brown 2009) has been used to construct a practical user-centered process to support rapid product concept creation in an entrepreneurship education program. This process has been established within the DevLAB program at the Oulu University of Applied Sciences in Finland which acts as a permanent pre-incubator program for university level students and professionals accessing re-training. Design thinking was chosen as the basis of the program to support interdisciplinary teams that need to work together effectively. Design thinking is useful in this scenario since it is a suitable methodology for projects in any field. It is especially well suited to ill-defined problems. This paper will summarize the context, curriculum and preliminary outcomes associated with this design thinking process. It will also outline how design thinking has become an integral aspect of the development phases that interdisciplinary teams of students go through to build prototypes and create start-ups as part of their studies. While this program is still relatively new, preliminary feedback from participants suggests that the design thinking is an effective model for supporting the development of project work within entrepreneurship education at the higher education level. Ultimately, this case aims to educate people who can apply the tools of design thinking into their careers.

Keywords: design thinking, project based learning, LAB studio model, concept creation

1. Introduction

The need for interdisciplinary teams for solving complex problems is well recognized. The world and the problems in it are becoming more and more complex and change seems to be a constant. Experts are required to adapt to changing contexts and challenges that often cannot be addressed by routine solutions. Solutions and future development demands that the professionals are able to work together across disciplinary boundaries and in different contexts. (Engeström, Engeström & Kärkkäinen 1995.) Higher education is challenged to teach skills and competences for the future, which are often referred to as 21st Century Skills, to match the needs of the emerging models of economic and social development (Ananiadou & Claro 2009.).

Solving complex problems requires a wealth of knowledge that a single person cannot possess and interdisciplinary team work is needed. How to train students for interdisciplinary work already during their education? Oamk LABs at the Oulu University of Applied Sciences in Finland is an educational setting based on studio pedagogy and project based learning. It brings together an international group of students from different fields to work on problems that are connected to real-world problems and phenomena.

Working in an interdisciplinary and international team puts high demands to communication and collaboration. Cultural differences and language issues on top of the various professional viewpoints and frames of reference can create a very difficult work environment at first. In addition, creating anything new, innovative and worthwhile is very demanding. Given that we have a group of interdisciplinary students and a bunch of ill-defined problems to solve, how do we instruct an interdisciplinary team in co-creation of a solution concept? What can we offer as an intermediary frame of reference for opening the communication and enabling collaboration?

Design thinking has gained increasing popularity in the last decades both in management studies and as a tool for transforming education. We believe it is well suited to serve as the common ground in interdisciplinary concept creation projects as it also calls for radical collaboration across various fields. This paper highlights a case study on the use of design thinking as the concept creation methodology in a full-time project-based higher education program called DevLAB at Oamk LABs. The objective of this paper is to summarize the innovative uses of design thinking in DevLAB which is a permanent program at the Oulu University of Applied Sciences in Finland. This paper will first cover the basic definition of design thinking and make connections with related concepts. The second section will introduce the DevLAB program and the final section will outline some learnings and points relating to future development.

2. Design thinking

2.1 Background on design thinking

Using design thinking as a management tool to build strategy and solve complex problems started to gain traction roughly ten years ago and became more widespread in 2009 when IDEO a long running design company started to market itself as an innovation company rather than a design company. Designers have always been regarded as innovative. Design thinking has become popular because the way that designers work and the modes of thinking were used became packaged in a way that was accessible to others outside of the community of design professionals, coupled with the cachet that a successful firm like IDEO brings to it (Johansson-Sköldberg 2013). Tim Brown defines design thinking as,

> *"a human-centered approach to innovation that draws from the designer's toolkit to integrate the needs of people, the possibilities of technology, and the requirements for business success."*
> *(www.ideo.com/about)*

Tim Brown (2009) and the Stanford d.school online resources offer a set of tools for design thinking which have been used as a grounding for concept creation employed in DevLAB. Design thinking can further be seen as a collection of mindsets, five modes of thinking and a large set of tools. The mindsets highlight the need for a diverse team of collaborators with varied backgrounds and fields to bring various viewpoints and skillsets to the problem. Behaviours and culture should favour using visual communication and stories to create a clear vision and experimentation to learn quickly. The fundamental mindset is to focus on the human values through understanding the life of the user. These mindsets need to be connected to a process of thinking modes (Figure 1) where the current phase and its goals are clear for all participants (Bootcamp Bootleg 2013).
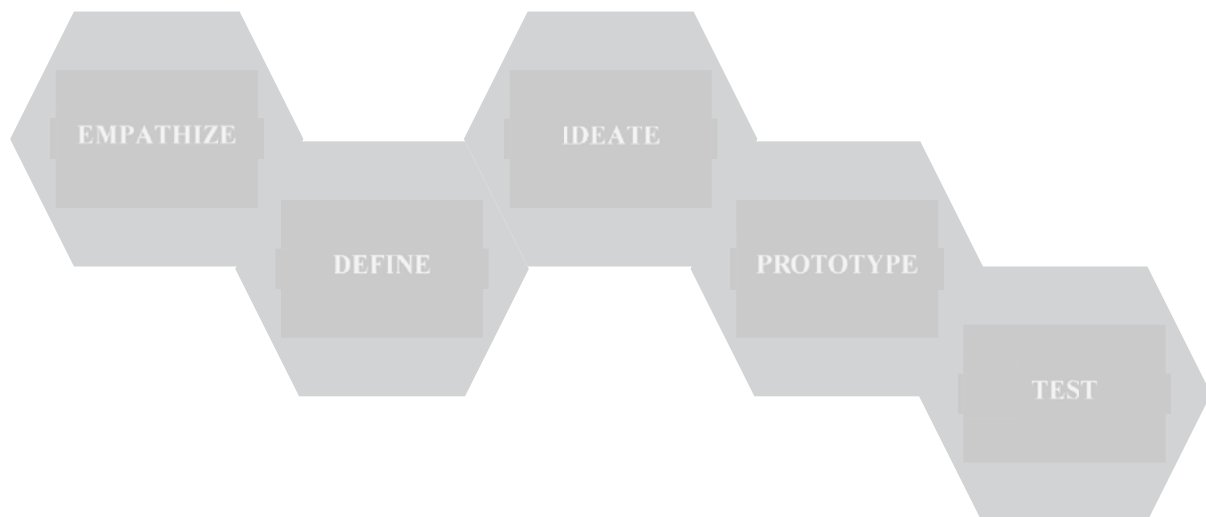

Figure 1: Design thinking modes (based on Bootcamp Bootleg 2013)

2.2 Design thinking modes and process

The design thinking process begins with building empathy with the one you are designing for and work to answer the following questions: What are their experiences, what do they value, what drives their behaviour in their lives? Empathy can be built for example by observing the users, interviewing them and immersing yourself in their situation. Based on the discovered information and collected stories about the needs and insights, the next step is the distill it down to an actionable problem statement: a point of view (PoV). The PoV statement frames the problem in a way that focuses and inspires the team, provides a reference to evaluate against. It can also be an effective way to easily communicate to people you meet. This is the result of the define phase.

Based on the PoV statement which in effect it a self-defined design challenge it is time for ideation, generating a large volume of diverse solution ideas. Based on evaluation of the ideas the most promising one or ones are taken forward to the prototyping phase. Prototyping should be understood here very broadly as anything that takes a physical form. Prototypes can be used learn more about the problem and users, develop the solution ideas further or test different options. Most importantly they can help to better communicate your vision to

team members or other parties. Testing provides you with learning which may lead you to refine the prototype or even reorient your point of view. It would be a mistake to think that Figure 1 represents a linear process that is conducted only once. Results from building a prototype or testing with users may loop back to any of the earlier modes.

2.3 Designerly thinking and design thinking

Design thinking is increasingly being used and is applied to various different aspects of creating new objects, services and managing companies. It is also not simply used to define design or the act of design as is discussed in later sections. By conducting a literature review, Johansson-Sköldberg (2013) maps out two main discussions associated with design thinking. The first and more recent discussion, one which includes the definition used above, takes place within management studies and is less academic in nature. Discussion is typified with success stories and a view that anyone can think the way designers think. Within this discussion there are firstly people who frame design thinking as way to create innovative products (Brown 2009). Secondly, there are people who argue that design thinking is a way for businesses to explore new avenues and transform the corporate culture (Martin 2009). Thirdly, there is an aspect to this discussion that suggests that managers already think like designers, because management is inherently messy and ill-defined.

The second discussion, which is more academic in nature, has a longer history focusing on designerly thinking, which centers around how designers think and create new concepts in design practice. It is also related to one's definition of design. Here designers are understood as mostly graphical or industrial designers and architects or design professionals. Within designerly thinking there are five distinct viewpoints (Johansson-Sköldberg 2013) related to the main activity of creating new concepts.

- Design as the creation of artifacts or 'the transformation of existing conditions into preferred ones' (Simon 1996). Creating anything can be considered designing.

- Design as reflexive practice sees focuses the practice of design on reflection of the creation and re-creating it based on the reflection (Schön 1983).

- Design as a problem solving activity, which is a step-by-step process, an analytical step for problem creation and synthetic sequence of problem solution (Buchanan 1992).

- Design as a way of making sense of things in the research of Nigel Cross (2006) and Bryan Lawson (†yu2005)

- Design as creation of meaning in the research of Klaus Krippendorff (2006)

For the purposes of this paper, design is defined very broadly as the creation of something new in line with Simon (1996). Simon talks about a "science of design" and writes,

> *"Few engineers and composers, whether deaf, ignorant, or not, can carry on a mutually rewarding conversation about the content of each other's professional work. What I am suggesting is that they can carry on such a conversation about design, can begin to perceive the common creative activity in which they are both engaged, can begin to share their experiences of the creative, professional design process." (p.137)*

Simon suggests that design should be an interdisciplinary subject of study, because the fundamental process is the same in any field. On the other hand, project work and studies are a practice that requires reflection as Schön's arguments remind us. Thirdly, design is a process and in design thinking the problem creation step is part of a design thinking mode. Coming up with new solutions requires us to make sense of the needs and usage situations in new ways which can be argued as a cognitive process. Lastly, humans attach their own meaning to artifacts. For example, Ebay can represent a way to make money for some users or a convenient shopping site for other users. Ultimately, design is the creation of affordances that give raise to desired meanings.

3. DevLAB

3.1 Defining the DevLAB experience

DevLAB is part of the university series of programs at the Oulu University of Applied Sciences (Oamk) called Oamk LABs which offer semester-long, full-time project studies within which projects are completed in interdisciplinary and international teams. Oamk LABs studies are based on the LAB studio model (Heikkinen and Stevenson, 2016). DevLAB is one of three LABs currently running at Oamk. DevLAB focuses on creating digital solutions and service concepts. During the academic year 2015-2016, projects were from the fields of health and

social care, tourism, energy and environment. The concept development process begins with a problem statement and it is the task of the team to come up with a solution. Teams are encouraged to challenge the problem statement, look for the business opportunities and research the issue thoroughly. The LAB studio model has two main phases which are the Lead phase, where the concept is created and the Lab phase, where the demo is built. During the Lead phase, there are two gates where a portion of the projects are cut and bigger teams are created for the more promising projects that continue. Teams are supported by professional coaches either from the university staff or from the industry. The goal of DevLAB is to create self-aware professionals that are able to develop new solutions and recognize their own skills as well as the skills needed from professionals from other fields. Additionally, DevLAB can be seen as a business pre-incubator, created to produce promising teams with solid and proven potential for creating their own new business (Heikkinen, Seppänen and Isokangas 2015).

3.2 Concept development and design thinking

The concept development process generally starts from the needs of the users and is undertaken to identify the correct target users and then to generally understand the problem and possible business opportunities solving it may unlock. Oamk LABs concept creation process was not well defined, when the LAB studio model was initially formed in the original LAB focusing on the games industry, where intuition and a developer's own sense of a fun game guided the game concept development. In DevLAB, students are creating solutions for various different user groups and to needs well outside of their own experience. Therefore, a more general purpose model and structure was needed.

Design thinking was deemed as an effective way to map what the staff in the Oamk LAB program were already doing and provided them with a well-defined process and a set of tools. Furthermore, the radical collaboration across various fields that design thinking calls for is also one of the cornerstones of the LAB Studio Model. By bringing in a new concept creation process that is not based on any of the fields of the students, an equalizing force was initiated that allows for everyone to participate. The promise of design thinking is that anyone can do it if they follow the mindsets.

Design thinking, service design and related tools had been offered to students already earlier, but in the fall semester 2015 they were made a part of the development process. For the spring semester 2016, the design thinking process (Figure 1) was fully implemented and realized as two subsequent cycles though the modes during the Lead phase to create a solution concept. In the Lab phase, participants kept iterating on the solution with prototypes and user testing.

4. Our findings with design thinking in DevLAB

The LAB Studio model is based on values of trust and care (Heikkinen and Stevenson, 2016). This means that students are trusted to be responsible individuals and are given considerable freedom to run their project. They have 24/7 access to their work space, which they can organize to suit the needs of the project. Student teams largely self-organize and divide tasks. Importantly the team is ultimately in control of what the concept or solution will be. Coaching will give them feedback, but the team chooses their own path. The second part of the values, care means that we support them with information, tools, coaching and tutoring. We support the concept creation process, team dynamics and both professional and personal growth. However, as the design thinking methodology is mostly unknown to the students we need to initially run the process for them and teach the mindsets and provide the tools. This is cause for some internal debate on how much we provide structure and intermediate checkpoints. Design thinking literature does not offer much in the form of schedules or timeframes when it would be good to move from one mode to another or how to allocate the available time. I suspect that practical business matters often dictate how long each mode can take. The same is true with our school.

One key purpose for the use of design thinking is to create creative and innovative solutions. Connected to this is the concept of creative confidence introduced by Kelley (2013) which is the ability to come up with a novel idea and the courage to act on that idea. We know that all children are creative until someone, most likely an elementary school teacher tells them that they are not creative. People also often equate creativity with artistic qualities or the ability to draw. Furthermore, we have seen how difficult it is for students to think of new ways for solving a problem. With this in mind, it is suggested that educators must further encourage and foster a

creative culture. As a result, there should be no fear of failure and judgment, because these kill creativity and lead to self-censorship.

This creates a dilemma for coaches and potential for misunderstanding between feedback about the work result of the project and feedback about the team actions in project work. To characterize this, there is no right or wrong answer for the project result, but there is a preferred way, as instructed through team work, which teachers will evaluate. In other words, the team can be doing the right thing, but in a wrong way. Here the balance we need to strike is between project results and learning of the chosen concept development methodology.

In DevLAB, teams are working on wicked problems which are characterized with confusing data, multiple users with differing values and not having a right or wrong answer. The possible explanation of the problem actually is dependent on the world view of the designer (Buchanan 1992). Although we might initially have trouble getting the students to generate alternative solutions, later we may end up in deep discussions on which solution the team should create. This forces the students to examine their own values and find arguments to make their view heard.

Collaboration and showing unfinished work is key in building something new together. Ideas build on top of other's ideas. Regular classes only call for delivering the finished work. Visual communication is necessary because it centers the conversation to something tangible and lowers the possibility for misunderstanding. By externalizing their thinking students will have to crystallize their ideas so that is can be shared, this is key in the SECI-model of knowledge creation (Nonaka & Takeuchi 1995). Drawing by hand rather than with a computer is better for communication of work in progress because it invites commenting by clearly not being finished work whereas a slick computer drawn image may feel ready and final and there is a risk that innovation is deterred. It is important that the team has a common understanding of the phase of the process they are currently in. In studio model learning the visual communication is important for creating awareness about the process phase, where the is and how they got here (Bull, Whittle and Cruickshank 2013).

Designing requires the designer move between different logical level of the concept being created. The FBS-model (Gero 1990) represents different aspects of the design object as function, behaviour and structure which describe what the object is for, what it does and what is is. This model connects with Simon Sinek's who notes the "why, how, what" idea of a communicating style (Sinek 2009). When we are building prototypes we are moving between the logical levels, building a structure to see if it enables or provides the right behaviour for example. Prototype is anything that represents a design idea. Anything can be prototyped, but it is important to be clear about what is the design idea you are testing and what is it that you want to learn. (Houde and Hill 1997)

The result of the Define-mode allows the team to bring together user research insights collected from all team members and combine the information to a simple actionable statement. This forces the team to pick an aspect of a challenge they feel is worth solving and they feel energized by. This phase can be very difficult for students who are not used to setting a task for themselves, but would rather expect the teacher to define what needs to be done. During DevLAB, the team make up changes in the gate-process. A well defined design challenge in the form of a point of view statement can be very useful in bringing the new people into the team.

There has been a critique to design thinking that just listing tools is not enough. Some tools like ethnographic observation sounds simple but is in fact demanding to do well. We have noticed ourselves for example that students struggle to create good interview questions, ones that would not include their own assumptions or be leading. Even for students whose training should prepare them to evaluate people in discussions, we have been using the problem interview method (Maurya 2012) with some success.

The DevLAB environment and working modes are very different from traditional university courses. It would seem that students get so overwhelmed with the new environment and operating mode that they lose some of their own professional capacity. By learning to use new tools that come with design thinking, students acquire the mastery of confidence in the tool gradually. For example using the interview techniques first with other students in DevLAB and getting feedback before venturing out to interview others outside of the program. This is true for all the design thinking modes as well. We have been adding more granular checkpoints to provide moments of reflection and feedback for teams. Here our challenge is that teams in DevLAB can be working very different types of concepts with one team creating a festival experience while another building a smartphone

application to help parents deal with children with behavioural issues. How do we plan the checkpoints so that they are generic enough to help suit of these example teams, but specific enough to help them move forward?

5. Conclusion

Creating something new is a demanding task. Doing it in an interdisciplinary and international team makes it even harder. Through the creation of the DevLAB program, it has been found that bringing the concepts of design thinking into university programs, although they are not easy to grasp let alone implement, provides value to creating product concepts. Design thinking creates a common frame of reference for the team members with its mindsets, modes of thinking and tools. This is valuable because it creates a vocabulary for the team that is outside of anyone's profession. There are a lot of development needed to gradually raise the level of confidence in the students to express new and perhaps wild ideas. Similarly, the bar should gradually rise for all checkpoints for students' work established in the program. Our goal at DevLAB is to produce self-aware future professionals who are capable of developing new solutions in their future professions and recognize the other needed professionals and their skills to solve complex problems. It is believed that the design thinking mindsets will be a key factor in supporting this process.

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