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Cover Page Footnote

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Abstract. Teaching and learning design theory are challenging tasks. To solely teach design theory through rules or codes of conduct, could be seen as a static way of approaching a complex phenomenon. In this paper, we argue for the importance of engagement in sensitive design situations, an approach that entails a process of de-emphasizing objectivity and promoting subjectivity through real-life sensitive cases to learn from, to foster reflectiveness for the future designers. This study aims to explore how sensitive design situations can be used when teaching and learning design theory. The research approach consists of a case study in a Nordic university, and a course in interaction design in a software engineering program. The sensitive design situation involves designing a digital artifact that can help children that have been diagnosed with cancer, cope with their cancer treatment. The main contribution is a teaching method for cultivating ethical design, which includes the application of sensitive design situations when teaching ethics to students. We illustrate that by forwarding three characteristics that can be used when teaching and learning ethical design through sensitive design situations.

Keywords: Design theory, Design thinking, Sensitive design situation, Higher education, Teaching, Learning.

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1 Introduction

“Humans did not discover fire—they designed it” (Nelson & Stolterman 2012, p.11.). The above quote introduces the book “The Design Way”, a book that can be considered a modern classic for those looking towards learning about design culture, design thinking, and the way design perspectives influence the world. The authors discuss design as its own culture and argue that when we create new things or engage in changes processes, whether it is with technologies, organizations, processes, or other types of systems, we are engaged in *design* (Nelson & Stolterman, 2012). Through that type of expansive view, design constitutes a broad concept. In general terms, design concerns the creation of the artificial, by humans (Simon, 1969) as opposed to natural phenomena occurring independently from human influence (Stolterman, 2008). Design is constructive (Gregory, 1966) and deals with new structures (Alexander, 1964); that is, the creation of things that do not yet exist, or radical changes of things that exist but are altered through a design process (Islind, 2018; Islind & Norström, 2020). The designerly way of knowing and embracing the world differs from the scientific way of knowing and approaching the world (Cross, 2001). A design situation is typically unique, complex, ill-structured, and has no obvious method or solution that will have the intended effect or desired change (Islind & Lundh Snis, 2018; Pareto & Willermark, 2019; Willermark et al., 2020). Design situations have been characterized as “wicked problems” (Rittel & Webber, 1973). The attributes of a wicked problem include that a wicked problem does neither allow for a simple procedure nor an easy characterization. Instead, wicked problems have incomplete, contradictory, and changing requirements which cannot be solved linearly. Engaging in design is thus a complex and multi-layered task. Being a designer entails leveraging different perspectives and interests while engaging with wicked problems which also touch upon issues of responsibility and ethical design. Teaching and learning these trades are not straight-forward, linear processes.

In this paper, we explore the role of sensitive design situations for teaching and learning ethical design and design theory. More specifically, we explore how university teachers can use sensitive design situations in their teaching to promote students’ reflections concerning design theory. Furthermore, we explore students’ experiences and reflections, when facing a delicate and sensitive design situation. We explore how students take on, and reflect upon, a design process where the objective is to design a digital artifact that will provide support for children during their cancer treatment. This approach deliberately differs from problem-solving oriented tasks and includes several important aspects: i) the frail, sensitive situation of being involved in the design of digital service that is supposed to aid children that are sick, during an extreme life-stage; ii) different stakeholders that are heterogeneous including the children, their parents and

caregivers and; iii) the need for making an already existing analogue process digital. By offering a complex and sensitive design situation, the aim was to trigger reflection on the complexity, heterogeneity, and difficulty of the design situation.

End-user involvement in design has a withstanding history and has been linked to benefits such as increased user satisfaction (McKeen et al., 1994), accuracy in requirement specification, and increased acceptance, while it has also been forwarded as an important aspect from an ethical perspective (Kujala, 2003). However, designing for and with frail users has been addressed as a major challenge, which intensifies when it involves children (cf. Lindberg et al., 2017; Ruland et al., 2008). The literature often reports on participation and collaboration through the design process from the perspective of how to engage the users in participatory design, or co-design in complex situations (Islind, 2018). However, there is limited literature addressing the perspective of the designers and more specifically, concerning the cultivation of ethical design and ethical decision-making in relation to becoming a designer and how to practice design theory. The question therefore remains, how do designers *become* responsible and ethical designers? This study aims to explore how sensitive design situations can be used in teaching and learning design theory in order to cultivate ethical design. We pose the following two research questions:

How can sensitive design situations be used to teach design theory and to cultivate ethical design?

How do students experience and reflect upon their future role through engagement with sensitive design situations?

The main contribution of this paper is a teaching method for cultivating ethical design through sensitive design situations. We illustrate it by forwarding three characteristics that can be used when teaching and learning ethical design through sensitive design situations.

2 Design theory

In this section, we discuss design theory and related work. More specifically we elaborate on ethical design followed by the aspect of teaching and learning design thinking. The design thinking relates to aspects of participation in design and sensitive design situations which are central perspectives for analysing the role of sensitive design situations for teaching and learning design theory.

2.1 Ethical design through Design Thinking

Ethical design outlines an emerging area of interest. The definition of what ethics entail is however widely debated (Mingers & Walsham, 2010; Mulvenna, Boger, et al., 2017; Mulvenna, Hutton, et al., 2017). Our view on ethics in general draws from an understanding of moral principles that govern decision making processes for a person. Mulvenna, Boger et al (2017) defines the concept of *ethical by design* as a design philosophy. Although we see the value of applying an overarching design philosophy, we in this paper instead draw on ethical design as a practical concept, which is derived from the abovementioned design philosophy but entails two practical aspects of an ethical design process: i) an ethical compass of the designer, and; ii) ethical services as output. In addition to that, teaching ethical design for those enrolled in a natural science program, such as engineering, is an even more hot topic (Hess & Fore, 2018). Even so, most researchers agree that ethics: i) entail morality, goodness, care, and virtue; ii) can be understood as a field of philosophy and; iii) hold discipline-specific standards in particular that are an addition to morality in general (Fore & Hess, 2020). The position of this paper is that all these aspects of ethics are relevant for design. However, ethics can only partly be learned by increased knowledge of philosophy and standards. To address these issues of transfer, it becomes important to contextualize ethical dilemmas concerning aspects of morality, goodness, and virtue in practice, through lived experience. Thus, teaching ethics through rules and codes of conduct outlines a static way as rules are set in a reactive manner instead of in a proactive manner (Fore & Hess, 2020). Rules are in place, to follow, but they do not outline creative teaching cases, due to their static and reactive nature. Engaging in ethical design, understanding ethical dilemmas, and developing an ethical compass guided by morality, goodness and virtue entail a process of de-emphasizing objectivity and increased subjectivity through lived activity (Riley & Lambrinidou, 2015).

In regards to teaching ethics to engineers, or engineering students, there are four main instructional strategies outlined by Hess and Fore (2018) including: i) there is a gap between what the learning goals outlined, and the space for learning ethical disposition; ii) there is a gap between the philosophical discussion about ethics and learning skills such as morality, goodness, virtue, and care; iii) there is a gap between classroom interactions and lecture strategies, and in-depth understandings through experiential learning and; iv) there is a gap between theory and practice, meaning that there is a consensus concerning the importance of teaching ethics, but few papers explain documented cases. In this paper, we contribute to these gaps.

As we see it, involving ethical design, in already existing frames of teaching, like through teaching ethical design as a part of designing thinking, could be one way of

embedding the topics that allow for the subjectivity needed to learn ethical disposition. Let us elaborate on design thinking then. Design thinking has become a central aspect of contemporary design discourse and rhetoric and for a good reason. It has been gaining popularity and is now considered a stimulating and useful approach to understanding features of problem-solving when tackling wicked problems within different fields (Paracha et al., 2019). Design thinking constitutes an approach that designers often use to address wicked problems. Design thinking as a concept encompasses a process that includes several steps that allow participants to analyze, synthesize, diverge and generate insights from different domains through drawing, prototyping, and storytelling (Brown & Katz, 2019). Additionally, it is considered an approach to learning that focuses on expanding peoples' creative confidence (Carroll et al., 2010; Paracha et al., 2019). In the design thinking process, the ideation phase is seen as a central ingredient. The ideation process begins with stimulation through brainstorming, which is facilitated through an understanding of the people that the designers are designing for, and ends in a new solution that is tailor-made to suit their needs (Read et al., Forthcoming). It is therefore not about finding generic and universal solutions but adapted solutions for a specific problem (Nelson & Stolterman, 2012; Paracha et al., 2019). Despite the known importance of ideation as an important pillar in design thinking, the research on how ideation can be taught to those that are unused to design engagement is scarce.

Design thinking urges the design community to broaden the horizon beyond both the omnipotent designer view and the fascination with products and objects that solves universal problems. Instead, it is suggested that: i) that designers should be more involved in the big picture of socially innovative design, reaching beyond economic aspects; ii) that design is a collaborative effort where the design process is spread among diverse participating stakeholders and competencies, and; iii) that ideas have to be prototyped i.e., envisioned and explored in a hands-on way and tried out early in the design process in ways characterized by human-centeredness, empathy, and optimism (Björgvinsson et al., 2012; Lunch & Koningstein, 2017; Paracha et al., 2019). Design thinking suggests creative alternatives to the assumptions made in developed societies and markets. Thus, design thinking is a tool for imagining these experiences, but also for giving them a desirable form; a design (Behrendorff et al., 2011). However, a designer must consider the meaning behind what a potential design solution may be for the end-user and understand the impact of their work. This is the essence of design-driven innovation (Behrendorff et al., 2011; Verganti, 2008). It is with a design thinking perspective that the study was formed.

2.2 Users and participation in design

A central aspect of design thinking is the notion of being closely intertwined with, and heavily influenced by, the end-user. Within the Scandinavian school of design, there has been an enduring focus on the participation of end-user and their engagement in the design process (Bødker et al., 2000). The collaborative creativity where the end-users are engaged as a co-designer i.e., seen as a collaborative agent or actor in the design process is central within that stream of literature. However, this perspective is not new, within the Scandinavian school, it has been the guiding philosophy for 50 years. An important building block in the move towards participatory design was written by Cross (1972) in the preface to *Design Participation*, where the theme was “user participation in design”:

Professional designers in every field have failed in their assumed responsibility to predict and to design out the adverse effects of their projects. These harmful side effects can no longer be tolerated and regarded as inevitable if we are to survive the future. [...] There is certainly a need for new approaches to design if we are to arrest the escalating problems of the man-made world and citizen participation in decision making could provide a necessary reorientation (p. 11).

When participatory design, and later collaborative design (which was ultimately termed co-design) emerged in the literature, the design approach was often targeted towards designing a specific service. However, more recent work addresses the notion that we are not only designing products for, or with, end-users. Instead, we are designing complete future experiences and digital artifacts that construct cultures, new practices and have the potential of triggering the empowerment of the participants involved in the design activity (Islind, 2018). Designing in a way that seeks inspiration from participatory design, or co-design, is thereby specifically about creating arenas that facilitate collaborative creative activity where people, who are not trained in design work, alongside trained designers engage with each other to further the design process (Bødker & Pekkola, 2010; Kanstrup, 2003). An activity which can be seen as a specific instance of co-creation (Bratteteig & Wagner, 2016; Islind & Lundh Snis, 2018; Joshi & Bratteteig, 2016; Sanders & Stappers, 2008; Vallo Hult et al., 2020). However, when creative individuals are training to become designers, the approach of participatory design or co-design can be challenging. Also, when the end-users are frail, and cannot for some reason participate fully in the design process, a notion that adds additional layers of complexity that are less explored in the literature. These less explored aspects of training

for engagement in participatory design, and involving frail users outline a gap in the literature, a gap which this paper targets.

Moreover, the literature has forwarded user-centered design. User-centered design (UCD) is a design approach that does not necessarily include users but can include users to a large extent. One of the main building blocks of UCD is that the users are kept in mind throughout every step of the design process, by exploring how to design for different users in different contexts and with diverse challenges (Marti & Bannon, 2009; Svanæs & Gulliksen, 2008). UCD can be both user-focused and user-centred and can in some cases be materialized in a similar way as participatory design or co-design. Our paper draws on the values of UCD, participatory design and co-design since our paper focus on designing for and with an in-depth understanding of the users. In UCD, the designers use a mixture of investigative methods and tools (e.g., surveys and interviews) and generative ones (e.g., brainstorming) to develop an understanding of user needs (Norman, 1986).

As a part of the literature on participatory design, there is a strand of research on participatory design or co-design that includes children. For instance, Malinverni et al. (2014) explore the creativity sparked by the participation of children with special needs. Similarly, Van Mechelen et al. (2018) discuss the facilitation of empathy and collaboration for the children involved in the design process, while others explore empowerment of children through critical reflections (cf. Harrington et al., 2019; Iivari & Kinnula, 2018). These studies are all from the perspective of the children, and through the inclusion of children and their view on empowerment. Looking towards a historical perspective on participation and how the concept has evolved, the concept of participation has matured in the literature. The focus now is to a larger extent on the process and genuine user involvement, instead of the product or reporting on the end-user insights from their involvement in the design process of that product. However, less focus has been put on the perspective of the designer. In line with that new wave of participatory design, our focus in this paper is on inspiration through understanding the involvement in the design. It includes preparing for end-user involvement and on how these skillsets can be trained to do just that, *prepare for engagement* with the end-users. We thereby take a designers' perspective and look towards the context of sensitive design situations, a context which we elaborate on next.

2.3 Sensitive design situations

Within healthcare, digital services have been used both to support healthcare professionals as well as to improve the lives of care recipients. For example, digital peer-sup-

port that connects people with shared experiences (Johansson et al., 2021; Klang et al., 2013; Lindberg et al., 2017), smart homes that offer the opportunity to remote monitoring and self-monitoring the health status of the elderly in their own homes (Liu et al., 2016), and digital services enable access to video consultations anywhere (Islind, Snis, et al., 2019). The unit of analysis in these research efforts is the end-users and not the designers. Additionally, there is a growing body of literature within the field of human-computer interaction that takes place in so-called sensitive settings with participants who can be considered as vulnerable, due to for example chronic illness or living with mental health issues. We want to move that line of thinking into information systems and enrichen the views of the growing interest on how to conduct research where vulnerable participants play a central role (Waycott, Wadley, et al., 2015). On a similar note, there are several examples of research that engage in designing with and for disadvantaged or marginalized communities or people such as; children (Lindberg, 2018; Yip et al., 2013) people with functionality variations (Bothe, 2008; Munteanu et al., 2014) as well as adults with low literacy (Kodagoda et al., 2012). When engaging in highly complex settings that involve frail users, researchers, and designers, the situations pose inherent sensitivities that can be characterized by the essence of the ‘goodness’ that needs to be portrayed through design (Waycott, Wadley, et al., 2015) and in such situations, the ethical compass becomes vital.

Waycott, Wadley et al. (2015) argue that many projects that are conducted in an insensitive manner, or emerging areas, raise new and complex ethical design concerns that can neither be predicted nor planned for. They highlight different key challenges to relate to in sensitive settings. They use the terminology “situational ethics” to describe the emergent and anticipated issues that arise in the situation and suggest training to ensure better preparedness to handle a sensitive situation (Waycott, Davis et al., 2015). It involves becoming aware that the research process or the digital service design may need to be adopted over time, in response to unexpected ethical design challenges. However, although Waycott, Wadley et al (2015) provide insights, there is a gap in the literature regarding how to foster this in practice. Furthermore, there is the issue of “exposing vulnerability”, which calls for the need to reflect upon how the digital service design as well as the design process could expose vulnerabilities and that these can in worst case scenario mean putting users at risk of negative effects (Durrant & Kirk, 2018; Waycott, Davis, et al., 2015). As many design situations carry a social stigma, designers must try to ensure that the design as such is empowering in the way it is conducted (Liang et al., 2021; Rooksby et al., 2016; Shilton, 2018). Still, there is a danger that by aiming to address vulnerabilities, the technological design risk is disempowering or that the process becomes disempowering (Hodge et al., 2020; Islind & Lundh Snis, 2017). Thus, there

is a need to acknowledge that sometimes the best way to act is simply to not design technology-based solutions (Waycott, Wadley, et al., 2015) and that to encompass these aspects of design, that these skills need to be trained. Additionally, Waycott et al (2015) highlight the social context as a critical aspect when using technology to build social connections by bringing people together to share experiences. This could be challenging in managing group dynamics and ensuring the anticipated social benefits to be realized in practice (D’Olivo et al., 2020). Thus, bringing people together entails the risk of conflicts as well as unexpected disclosures (Sin et al., 2021). Lastly, the aspect of “managing diverse needs and expectations” is important (Waycott et al., 2015). It involves navigating among diverse stakeholders with different needs and expectations regarding how technology might benefit them. Waycott et al (2015) highlight a children’s hospital case as a situation when this becomes particularly clear. In that case parents, siblings, teachers, and staff at the hospital brought entirely different perspectives into the design situation, while all sharing the intention of wanting the very best for the children. These aspects of a design show how tensions are likely to arise when technology is being designed and developed in complex sensitive settings (Sand et al., 2021). The issues listed above are incorporated and represented to a large extent in our empirical case which we will describe in more detail next.

3 Research approach

The overall research approach is based on a case study. The choice of conducting a case study can be described as a choice that rests on what object is to be studied, rather than merely a choice of techniques or methods (Stake, 1995). The approach in this particular case study is interpretive (Walsham, 1993, 2006) where we explore the role of sensitive design situations for teaching and learning design theory. As we see it, teaching design, constitutes an ill-structured practice, requiring teachers to apply complex knowledge structures across different cases and contexts (Koehler & Mishra, 2009; Mishra et al., 1996; Pareto & Willermark, 2019; Spiro & Jehng, 1990; Willermark, 2018, 2020). As such, teaching design can be understood as a wicked problem full of complexity. The desired outcome of teaching is learning. As for other design activities, the teacher can only organize a learning situation that hopefully will result in the planned learning, in this case, ethical design and design theory. Here, such organization includes the following main steps: i) preparation; teaching the basics of design theory b) engaging in a design task: students’ involvement with a sensitive design situation and design a digital application prototype c) reflection; individual and shared reflection upon students’ digital design and their engagement with the case.

3.1 Empirical case

The empirical setting is a Nordic university, and the students are enrolled in a three-year software engineering program, which leads to a bachelor's degree. During the first term of their studies, the students enter a mandatory 12-week course in interaction design, which is then a recurrent theme that they apply in other courses throughout the program. The interaction design course encompasses all core aspects of design through the foundations of design theory and design methods, prototyping techniques, and user testing. This case study was executed as a part of that course. The objective of the integration of this course in the program was two-fold, on the one hand, to teach students of interaction design, and on the other hand to integrate an ethical design and societal impact into the program, from the very beginning. The idea for the course is sprung from a perceived need by one of the authors of this paper, to teach the students about ethical design and societal issues. The teacher had previous experience that design theory, as it used to be integrated into the program, was perceived as abstract and many students had difficulty relating design theory to their future professions as designers. Such a theory-practice gap is not new neither specific for software engineering students (cf. Billett, 2009; Billett & Choy, 2013; Costley & Armsby, 2007). Using cases is a wide-spread and natural part of informatics educations. Fictional or authentic cases are often used, and students are engaged in designing for business value whereas the focus herein is on larger questions, on a societal level, which is rooted in the will to become a responsible designer and learning design theory in practice. The overall idea behind the instructional design was to enhance students' engagement in difficult design situations and by doing so, face wicked problems early on in their program and trigger the opportunity to practice design thinking.

3.2 Data Collection and data analysis

The empirical data is based on two different student groups, taking the course in interaction design at a software engineering program in autumn 2019 respective 2020, totaling 82 students. A total of 47 students, 1 lecturer, and 2 teacher assistants participated in the course in the year 2019. A total of 35 students, 1 lecturer, and 2 teacher assistants participated when it was taught in the year 2020 (see Table 1). The students needed to engage with the project to pass the course, yet their inclusion in the study was optional. Informed consent was ensured by informing the students about the ongoing study and its purpose and offering the students an opportunity to engage in the course and still refrain from being included in the research.

<i>Participants</i>	<i>Year 2019</i>	<i>Year 2020</i>	<i>Total</i>
<i>Number of students</i>	47	35	82
<i>Age range</i>	19-31	19-28	19-31
<i>Proportion of female participants</i>	14 (30%)	8 (23%)	22 (27%)

Table 1. Details about the participating students.

The empirical data is derived from teaching and learning activities during the course including; observations and observation notes from interactions with the students during their engagement with the sensitive design situation; analysis from students written design reflections (open-ended questionnaire based on their experience, $n=82$ documents), and analysing students digital application prototype ($n=82$). The written empirical data was translated into English. The edits to the transcripts were limited but, in some quotes, the words were shifted for ease of reading. The names of the participants in the following chapters are pseudonyms, used for ease of reading.

The analytical approach in this paper is based on analysing the empirical data using an abductive approach. The specific aim was to look for and distinguish various themes that outline changes in the students' view on design, triggered by the intervention of the sensitive design situation. Here, the abductive nature refers to the interplay between the empirical data, realized through real-world problems (inductively obtained) in combination with influences from theory (deductively inferred) (Gregory & Muntermann, 2011) by viewing "reality from the theoretical viewpoint or perspective" (Van de Ven, 2007, p. 104). The abductive nature has thereby involved shifting between inductive and deductive reasoning as a way to continuously revise, sharpen and re-formulate the research design (Gregory & Muntermann, 2011; Van de Ven, 2007) through engagement with the coding of the empirical data. All instances related to changes in students' views were coded and categorized as dimensions of 'becoming a designer'. The focus thereby included exploring the connections to design theory in a broad sense, with an emerging focus on concepts of problem framing (tame or wicked problem), ethical design, and responsibility. Both authors analysed the whole empirical data together and differences in interpretations were discussed. The analysis process included iterations of coding and clustered themes. No comparison was made between students from different year groups, as no changes were made in the instructional design.

4 Results

The result is structured based on the research questions, which means that we first describe how sensitive design situations can be used to teach design theory followed by students' experiences and reflections.

4.1 Teaching design theory through sensitive design situation

The course was initiated by introducing the students to design theory by a series of lectures, such as “ethics in design” and “design judgment” as a basis for knowledge and reflection. Second, the students received the assignment with a sensitive design situation and the design of a prototype. Third, the students reflected upon their engagement with the case, and their design both individually and together with other students and teachers. The students received and gave peer-feedback on their assignments as well as received feedback from the teachers involved in the course. The students' task was to develop a proposal for the mobile app and reflected on the process of engaging with the sensitive design situation (See Figure 2).

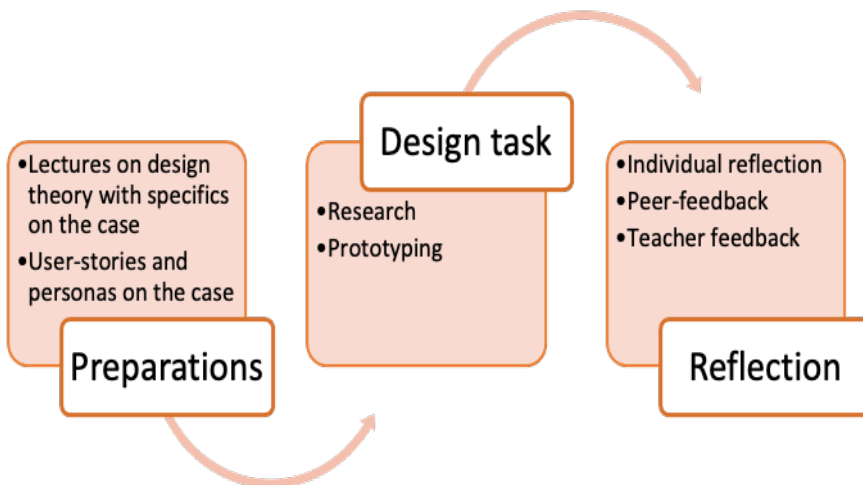


Figure 1. Overview of the instructional design

Selecting a sensitive case

The sensitive design situation used in this study is about designing a digital artifact for children that are undergoing cancer treatment. As one can imagine, it is shaping

children to be diagnosed and treated for cancer. It puts strains on the whole family and is painful for the relatives, the parents, and siblings. “Beads of courage” is a concept that has been developed to help children during their cancer treatment by providing emotional support in their cancer journey. It is a global phenomenon, adapted to local contexts. An important part of the concept through which the support materialized is a physical bracelet, called beads of courage (see Figure 2 for an authentic example). In every stage of the cancer treatment, the children receive a new bead. The bracelet represents their journey and the stage they are at. The bracelet is carried with the child and used to keep a record of the hospital trips, each treatment, side-effects (e.g., hair-loss), and so on. The beads are in different colours and represent different types of treatment-related steps. For instance, a white bead represents chemotherapy, whereas a glow in the dark-coloured bead represents a course of radiation treatment. Blue represents a visit to a medical centre and yellows an overnight stay at a hospital. Purple heart bead represents a finished treatment. There are some local variations to the beads of courage concept where beads can be used for special purposes and the colours can differ.



Figure 2. An example of beads of courage, printed with permission (<https://dontforgetthebubbles.com/beads-of-courage/> generously gave permission to use this photo, which illustrates one way of using the beads.)

This sensitive design situation was chosen as a basis for the student design task. The students were given the task of making a digital artifact where the beads of courage concept, was moved from an analogue process with physical beads, to a virtual process with digital beads. The digital beads of courage are not meant to be a replacement for the analogue ones but should be considered as a complement for those who still want their bracelet on their wrist. Thus, the original design problem is the same, yet, with the reservation to create a digital design which opens numerous ways to take the concept in different directions.

Creating a design task

The assignment was deliberately broad, to favour a designerly approach to the task and to not anticipate specific technical or design-based solutions. The assignment, therefore, included eliciting design proposals, design reflections, and design principles from the students that are becoming designers. The sensitive design situation as such enabled the students to face dilemmas as reported in Waycott et al. (2015) including; *“exposing vulnerability”*, as the case promote critical reflections upon how the design could expose vulnerabilities among sick children and stimulate reflections on designing or opt-out technology-based solutions; *“the social context”* as it easy to imagine approaches using technology to build social connections to share experiences and possible risks; *“managing diverse needs and expectations”* is reflected in the assignment, as although the primary end-user is the children, it involves diverse stakeholders such as parents, siblings, teachers, and staff at the hospital, bringing diverse perspectives. These aspects do not guarantee that students reflect upon these problems. However, it provides an opportunity to reason about the complexity of the design problem, reflect on ethical design considerations, and adopt a designerly approach. In this sensitive design situation, the students were instructed to come up with ideas for a mobile application that could help the children in their journey (see Figure 3).

From an ethical design perspective, students must get to know and reflect on difficult situations. Using sensitive design situations was considered an opportunity to do just that, through engagement with the sensitive design situation. Questions about responsibility and ethics must be raised concerning these issues, and for ethical considerations to become an integrated part of the role of the designer. There is an importance in showing how these aspects manifest in less crystallized, more sensitive design situations. However, also based on ethical design considerations, the decision was made not to involve the end-users. Instead, students were encouraged to create knowledge about their end-user group through other types of research through a user-centred design ap-

About the case:

- At every stage of cancer treatment, children receive a new Bead of Courage
- The beads join together to form (often long) physical representations of their recovery, keeping a record of every hospital trip and treatment on their courageous journey
- The Beads of Courage help to decrease illness-related distress and increase positive coping strategies to support children and their families.

A few examples of these beads include:

- Yellow bead: an overnight stay in hospital
- White bead: a course of chemotherapy
- Blue bead: visits to the clinic
- Glow-in-the-dark bead: a course of radiation treatment
- Glass bead: an act of courage
- Special star bead: a special accomplishment
- Purple heart bead: completion of treatment!

As we discussed in lecture, there are different elements that can be built into your idea, you can make a game out of it, and you can enable kids to share their process with others.

Figure 3. Illustration of the project description

proach. The students were presented with personas, and user stories (which are classic approaches used in an interaction design process) and an elaborate description of the sensitive design situation through a lecture. One such user story was:

As a child, I want to collect my beads on a digital bracelet so that I can show my family when I accomplish new things in my cancer journey.

They used these details as a guide in their design process. The personas and the user stories were derived through experience from years of engagement with other cancer-related research cases by the instructor. Additionally, they were given a website to use and reading material online to read and to familiarize themselves with the end-user and their process. The main reason for not involving end-users was because we saw risks in engaging relatively new design students with a vulnerable, frail end-user group. Thus, the objective was to train the students in design, to become more equipped before engaging with frail users in the future. This relates to the notion that although real engagement with users entails unique challenges for the designer, it must be considered against the risk of harming and stigmatizing participants (Waycott et al., 2015). Moreover, due to the complexities and heterogeneity of stakeholders in some sensitive design situations, it may be impossible to carry out a participatory design or co-design

process, despite the potentials. Healthcare constitutes one such area where some argue that participatory design or co-design may be incompatible with the in-situ design challenges (Mønsted & Onarheim, 2010). Also, the timeline of carrying out a co-design, or participatory design process with heterogeneous stakeholders in healthcare settings often counts years to design something that could be considered as successful and fully integrated into healthcare infrastructure (Islind, Lindroth, et al., 2019). Lastly, true engagement with the end-users would have required ethical approval, which would have added a time-consuming layer of complexity. Based on these arguments, end-users were not involved in the task. Instead, a user-centred design approach was adopted to prepare students for end-user engagement.

4.2 Learning design theory through sensitive design situation

Students' experiences and reflections from facing a sensitive design situation include four themes: i) experiencing the meaning of design; ii) realizing the responsibility; iii) identifying the wicked problem, and; iv) facing the complexity of heterogeneity. Hereinafter the students will be referred to as designers, as they are assuming the role of a designer during the instructional task.

The focus of this study is not on the designers' solutions, but on their reflections in relation to the design process. However, to give a sense of the situation, we can report that the designers took on the task in quite different ways. In a very broad attempt for categorization, the digital artifacts could be divided into three main categories; i) games, where the mobile applications as a whole were built up as a game for the children and the beads only outlined a fraction of the game; ii) collection-oriented applications, where elements of gamification were used to make the collection of beads more fun for the children and the beads were the primary element, and; iii) social-interaction applications, where the social aspect was the main target and interactions with other stakeholder groups outlined the primary element (sharing beads and messages with other children, parents or healthcare professionals).

Experiencing the meaning of design

A recurring theme in the designer's reflection relates to the overall meaning of design and that the meaning becomes particularly clear through practically engaging in a design process. The designers reflected on the importance of the interaction design, how it can make an important difference in people's life and 'make things better' in line with what is stressed by Nelson and Stolterman (2012). Several designers describe it as a new

experience and others express how the assignment felt significant and therefore difficult. Through the designers' reflections, it seems like many designers have gone from intellectually understanding that design plays an important role in bringing something new to the world (e.g., Cross, 2001) to feeling that it makes a difference and gaining a lived experience:

I thought it was hard. I started reflecting on ways to make their stay [in the hospital] more pleasant. The whole experience, the whole interaction design, and user experience became more important than ever (Stefan, 2019)

Most importantly I learned how difficult situations can be made better through design" (Sara, 2020)

I must admit that I got sad when I read the assignment and even sadder when I read about the 'Beads of courage project'. On the positive side, I had fun thinking about ways I might be able to make a small difference in someone else's journey and difficult times. I do think it is important for designers to work on a case like this, and in fact, everyone can gain something by trying to think about other people's needs and struggles and how they might be able to make a difference (Anna, 2020).

From the reflections, it becomes obvious that the designers experienced an important difference when working with the sensitive design situations in comparison to other design situations such as working on designing a digital artifact for customer relationship management:

I found this a very fun, challenging and a very different design challenge. It was different to work with this example than the project we have been working on. It's a totally different challenge" (Lars, 2020)

When the case involves so much sadness, it's really important to be gentle and to listen. When the case is more of a business character, it's easier to have stronger opinions about what type of design would fit the users (Maria, 2019).

The latter quote illustrates the way the designer is growing into their role and realizing that their role in the design process and their way of viewing the world, truly impacts the design outcome.

The complexity both extended to the journey of the designer, and to the way specific issues should be solved technically and organizationally:

I found this a remarkable project especially because children with cancer were the target users. How can you make their stay a little more enjoyable? It was a bit more complicated than I thought because I don't quite know what they want all the time and don't know exactly what kids like to do while they are in such a difficult process. Getting insights into that helped me. Still, I found it very hard to hear their story and I found it hard to put them in their shoes [...]. My idea for this app was that it would require some numbers to sign into the app, to show that the user has cancer, a number that can be provided by a nurse or something" (Alex, 2019).

They started to envision how the digital artifact would eventually become a part of a care process and that someone eventually will have to administrate the sign-on process. The impact of one digital artifact can have ramifications on many different levels and illustrating that through experience with those that are becoming designers, is an important element of gradually understanding the potential effect of their design. Throughout the empirical data, the empathy was tangible:

I tried as hard as I could to think of the children and tried to consider the playful aspect and did something playful, graphic, and simple. I tried to put myself in their shoes, but it is incredibly difficult as I have not gone through what they are going through. I still tried my best to do so but it was more difficult than when working with other cases. This case was heavier. You then must consider parents and guardians too. It is a heart-breaking situation they are all in" (Helena, 2019).

Realizing the Responsibility

The designers gradually reflected on the value of making the previously analogue process digital. They recognized how they could use pre-existing features like notifications, and including others in the community building through those pre-existing features and how could add value to the process:

The children can get notifications when they have gotten a new bead and the primary physician can get a notification when the child has gotten a new bead, but of course the physicians have to be able to turn off the notifications, to be able to really go home from work (Sebastian, 2019).

Reflecting on the difficulty of the work situation of the physician and discussing that as a part of the design situation, also showed that the designers knew the potential impact of the digital artifact they were designing. This, not only on the children, but also on their families and could have additional ripple effects on the extended care team involved, it involves realizing that the design process is spread among diverse participating stakeholders and competencies (Björgvinsson, Ehn, & Hillgren, 2012; Lunch & Koningstein, 2017; Paracha et al., 2019). The ideas gradually grew:

First, I just drew simple ideas for a login so that you could only participate if you were a child that had been diagnosed with cancer or their family, I drew a selection window where you could choose to decorate your pearls and also included a musical screen and a pearl mount screen where you could choose to put your pearls on a bracelet (Will, 2019).

During the next phase of the project that same designer continued iterating and improving their design, and adding value through letting the digital artifact speak, and thereby removing the responsibility of being the bearer of bad news from the child to the digital artifact:

I wanted the kids to be able to share their pearls, to other kids that were undergoing the same process. Some of them are in isolation because of their immune system and they should be able to know how their friends are doing and share their hard times. They should not have to say it out loud if they don't want to. Because when it's going bad, maybe you don't want to say it out loud (Will, 2019).

Building a community for those that share a common pathway, became an element that was represented in most of the designs and reflections by the designers. It became more tangible through the process as the designers discussed it more and got to know the case better. The strong need for building something bigger than merely a digital artifact became more apparent, and they focused on building a community where the children can feel a part of something:

The children can view individual pearls. There they can swipe between the beads, view them, and read the meaning behind them. To the side is a menu that allows the user to go to ‘home’, ‘friends’, ‘search’, and ‘settings’. At the top of the screen is the name of the person wearing the bracelet. The description of the pearl also shows which friends own a particular pearl when they acquired it and other information. They can be together in the process. Be bracelet friends (Livia, 2019).

The strong alliance between the children was yet again forwarded:

The app will include a chat room for children with cancer. There they can chat with each other and show each other their bracelet. They can give each other glitter to use for the pearls (Christian, 2019).

Identifying the Wicked Problem

The literature often describes how wicked problems are mistaken for, and thus treated as, tame problems (Rittel & Webber, 1973). In the designers’ reflections, however, there are indicators that they identify the wickedness in the particular case. In the designers’ reflections, there are signs that they realize that there is no ultimate solution but rather solutions that are better or worse. Furthermore, they discuss wickedness related to differences among children, and different needs from different stakeholders. The designers gradually started to reflect on the prescribed meaning, and that there was a difference therein. For example, one child could see a bead as a happy occasion, while another child could see it as the opposite. Being reflective and understanding that the role of the designer also entails the understanding of the uniqueness of each user, while still designing for a larger crowd. It constitutes an important insight and facilitating that through design is a critical element while working with delicate design problems:

Every bead is unique. Even though the colours and shapes are associated with a specific meaning you still can make the bead yourself and decorate it. Drawing the bead and decorating it and writing what it represents in general, and then also writing what it represents for you. Because for some kids a stay at the hospital is a win because this time it was only one night and for others, it’s the worst. It depends on how your cancer is progressing. It would also be great if they could use a template that they could colour in themselves, like a coloring book thing but that you could not copy other beads, then each bead becomes super-special,

and they are special, for that kid. You can then place your bead in your own galaxy and from there see far, far away that your friends have beads that shine, some have the same kind of beads and other friends have different types. The new ones can shine, and then you can click on them to see what has happened in your friends' cancer (Johann, 2020).

Many reflections illustrate the dilemma and how the solution to a problem can create a new one (Nelson & Stolterman, 2012; Norström et al., 2017; Rittel & Webber, 1973). The difficulty of overseeing the consequences of different design situations was considered particularly difficult because the designer differed from the target group:

It was much harder than I expected because working with children was so challenging. It was hard for me to put myself in their shoes (Ville, 2020).

Facing the Complexity of Heterogeneity

There were many reflections related to heterogeneity. Thus, although the designers are primary designing for children it is a very ambiguous group, as illustrated by:

They are not all the same, we have to think about that as well. They are not all just children. They are so different, and have so different needs (Karen, 2020).

The designers reflected upon the fact that the children differed in terms of age and that due to their illness, some of them have missed extensive periods of school. Furthermore, some of them are not able to read due to fatigue, due to their illness, due to their age or because they have missed that school period which places demands on the design and the designer. It illustrates the need to learn from and collaborate with the end-users of the product or service (Brown & Katz, 2019).

Even though the primary users are children, they are heterogeneous within that stakeholder group as well, and an additional layer of complexity relates to the fact that their parents or caregivers are also in some cases helping them operate the digital artifact, meaning that the group of end-users becomes even more diverse (Bjögvinsson et al., 2012; Lunch & Koningstein, 2017; Paracha et al., 2019). When reflecting on the children specifically, the designers understood that they needed to both respect the attention span and that their design could not put a strain on the children through a heavy reading curve, as illustrated by:

[...] children have a limited attention span and that is why I have used the most visual and friendly environments I could use within the app for the child (Thomas, 2020).

In the above citation, short attention span is linked to age category, whereas some designers also show more nuanced reflections:

Some of them are also not able to read. Some are also just too tired (Ulrika, 2019).

Some examples indicate both a simplified and complex understanding of the difference among the users. This is for example exposed in the designer's reflection related to easy access, and simple ways of interacting and re-claiming their user profile if lost:

Children are also always losing their stuff and because of that, it is important to have the ability to get help with the app and make it easy to download the app again and again and have the login simple. This project taught you to think much more as the user than as yourself. And I understood that these children are so different, even though they have being a child in common, they are so different and have different needs and know different things (David, 2020).

The realization that the cancer treatment is a process that can take a turn to the worse and respecting the need for looking back to see how much is already accomplished was also forwarded:

You can see what beads the person collected each year and you can press each bead individually to read information about it. Because some kids get relapses. Then it's good to be able to look back, and see what has already been done, and how brave they have already been (Martin, 2020).

5 Discussion

The recent debate surrounding the exploitation and data mining of users' experiences for finical gain through surveillance capitalism, the nurture of addiction through social media, the design and use of information systems to systematically polarize views in relation to elections (Zuboff, 2019) all outline reasons for why ethical design is needed

now more than ever. As information systems become an increasingly powerful part of our being, and as we streamline educational programs, we cannot forget the importance of teaching and learning ethical design. We need to teach humans to act humanly in the design process, and to teach students to understand their role as humans, concerning the design of information systems. We need to teach future designers to reflect on morality, goodness, care, and virtue, to teach them philosophical stands (Fore & Hess, 2020) and practical ways of embedding these important aspects of humanity, into the design. We cannot ignore the power of designers as important players in the future of information systems, and we need to take the role of teaching them how to become responsible designers, seriously. We need to discuss ethical design openly, and we need to engage all students in ethical design. Having an ethical compass and applying it to design is not something that just happens. As we see it, teaching ethical design through rules and codes of conduct can be seen as trying to apply a static way of thinking to a complex phenomenon of acting. This is in line with what Hess and Fore (2018) forward, regarding the need of proactively engaging ethics for engineering students instead of reactively teaching it through lecturing about codes of conduct. Instead, the development of an ethical design compass calls for a proactive and reflective way of understanding, through lived experience. Regarding the lived experience, a central aspect of design thinking is through prototyping i.e., envisioning and exploring in a hands-on way early in the design process in a compassionate way, characterized by human-centeredness, empathy, and optimism (Bjögvinsson et al., 2012; Lunch & Koningstein, 2017; Paracha et al., 2019). However, some sensitive design situations do not allow for end-user engagement. Instead, it calls for other ways of practicing human-centeredness, for example by user centred design approaches to foster end-user substitute. This is what we would like to coin as ethical design, practicing; design through sensitive design situations, human-centeredness, and becoming a designer.

5.1 Cultivating ethical design

We argue that ethics can only partly be learned by increased knowledge of philosophy and standards and show that the ethical design compass can neither be considered as a static embedded capability nor a stable disposition of actors. Instead, it constitutes a situated ongoing accomplishment that is constituted and reconstituted as one engages in practice (Orlikowski, 2002). To address these issues of transfer, it becomes important to contextualize ethical design dilemmas concerning aspects of morality, goodness, and virtue in practice, through ethical design and sensitive design situations. Ethical design needs to become an integrated part of higher education to help students become re-

sponsible designers. In this paper, we therefore, apply the approach of de-emphasizing objectivity and created a lived activity that takes the point of departure in a sensitive design situation. Still, the lived activity forwarded in this paper is through design objects, personas and user stories, and not through meeting the end-user. We would like to argue that the impact of the sensitive design situation alone, is illustrated through our findings, and that end-user engagement with the children with cancer, was not needed. The lived experience enabled the designers to embed what they had learned theoretically, into practical handlings through a sensitive design situation. As argued earlier, rules are in place, and they are expected to be followed (cf. Riley & Lambrinidou, 2015). However, they do not outline creative teaching cases, due to their static and reactive nature but we show that instead of focusing on working with a sensitive design situation, where there are emotionally embedded factors involved, creates deeper footprints on the students. Additionally, being a student, and handing in an assignment has a certain effect. The bias of it being an assignment, which is a part of a mandatory course is at play here. However, through our engagement with the students we saw that the sensitive design situation affected them more deeply in comparison to business-related cases worked with as well, which we show through our findings. None of the students reported the sensitive design situation as meaningless, but they did report the heaviness of it. More specifically the sensitive design situation triggered reflections where the students showed that they were: i) experiencing the meaning of design; ii) realizing the responsibility that their role as a designer entailed; iii) identifying the wicked problem through the complexity in the design situation, and; iv) facing the complexity of heterogeneity.

Through this type of approach, the designers are engaged with hands-on situations that build empathy, promoting a bias toward action, encouraging ideation, and fostering active problem-solving skills. As we see it, students need to become equipped designers, before engaging with end-users and to learn how to become ethically responsible designers, sensitive design situations are important for learning those aspects. Stimulating the designers through brainstorming as an integrated part of the ideation process is central in design theory and design practice; it begins with the people that one is designing for and ends with new solutions that are tailor-made to suit their needs. Understanding the meaning of design, consists of starting with building a deep understanding and empathy based on those who will ultimately be the users of any new digital service, digital artifact or product that is developed (Lunch & Koningstein, 2017). Moreover, if the sensitive design situation is illustrated through certain characteristics, the ethical design and design theory, can be projected through it. Our argument herein is not that there is a silver-bullet to teach and learn ethical design or design theory that will make every design ethical and every designer ethically informed.

Instead, we argue it outlines an important factor when educating future designers. A first step in such a process is to address the important role, impact and responsibility that it means to be a designer. Through the application of sensitive design situations in teaching, that role becomes particularly clear. It enables an increased understanding of the complex design expertise that is required to tackle future design ethical dilemmas.

5.2 Characteristics of sensitive design situations for teaching ethical design

From the empirical findings, and through engagement with the literature, we suggest a teaching method for cultivating *ethical design*, which can be applied through sensitive design situations. We illustrate the importance of the way the *ethical design* is forwarded via a set of characteristics that the sensitive design situation should hold, to teach and learn ethical design through sensitive design situations in an effective way. More specifically we present a strategy for learning ethical design via the application of sensitive design situations. This particular strategy aims for creating conditions for fostering creativity in the teaching situation. We do this to prepare students for authentic design situations with wicked problems, full of dilemmas. The composition of the sensitive design situation is of importance and could advantageously include the following characteristics; i) *exposing vulnerability*: to promote critical reflections upon how the design could expose vulnerabilities; ii) *managing diverse needs and expectations*: to promote reflections about the needs and interests of different groups and how it should be addressed in the design situation, and; iii) *leveraging open-endedness*: to provide an open-ended design situation, in which the students can both explore different technological solutions, like through the different type of digital artifacts and explore focus on different stakeholder groups primarily. However, sensitive design situations as such are not enough to promote in-depth reflections. Dilemmas must be faced in action to challenge current views, principles, and design practices in-depth. Thus, the instructional design must include that the students prototype their design, to force the students to make active choices and be able to motivate these.

6 Conclusion

In this paper, we have explored the value of sensitive design situations for teaching and learning design theory and illustrate the importance of ethical design. More specifically we have examined how the application of complex and ethically difficult, sensitive situations promotes core reflections about the meaning of design, and the responsibility

that being a designer entail. The instructional design, of de-emphasizing objectivity and increased promotion of subjectivity through lived experiences, and real-life, sensitive cases to learn from proved favourable to stimulate ethical design considerations and dilemmas; to learn to understand ethical design.

The main contribution includes proposing a teaching method for cultivating *ethical design*, by the application of sensitive design situations. More specifically, we suggest three characteristics that the sensitive design situation should hold, to teach and learn ethical design through sensitive design situations including: i) *exposing vulnerability*; ii) *managing diverse needs and expectations*, and; iii) *leveraging open-endedness*. These characteristics are to be used by others when embarking on a similar quest of teaching students to become designers. A future area of research will be to validate the results in other contexts, or through other sensitive design situations.

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