INITIAL FINDINGS FROM A NETWORK FOR SUSTAINABLE EXPERIENCE DESIGN EDUCATION

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ABSTRACT

Toward the common goal of sustainable consumption experiences, effective and efficient education methods and expertise can vary a lot in Finland and in Asia reflecting relevant characteristics. The goal of the Finland-Asia Network for Sustainable Experience Design Education (SEDE-FAN) project is to build the network of higher education institutes in Finland and in Asia so that successful efforts in Sustainable Experience Design Education in Finland and in Asia can be shared. Also, learnings acquired in not-so-successful trials in such educational endeavours can also be communicated. In this way, the knowledge and principles underpinning such educational methods and expertise can be collected, stored, exchanged, retrieved, reused and enhanced through the project. This paper reports the findings of the first-year efforts in the project where two institutions in Finland and one in Korea have conducted sustainable experience design education efforts. Particular focus is placed on how different education contexts are related with respective sustainable experience design education efforts. In that sense, it will be useful to design educators who would like to introduce sustainability issues in their design education.

Keywords: Sustainable experiences, experience design, design education, international network

1 INTRODUCTION

As experiences are created by all individual consumers and users under various contexts, the nature how sustainable consumption experiences are made reflects the characteristics of the actors and their cultures and living contexts. While the goals of sustainable experiences design education can be common, effective and efficient education methods and expertise can vary in many different regions and contexts. With the goal to build the network of higher education institutes in Finland and in various countries in Asia in order to share successful efforts in sustainable experience design education in Finland and in various countries in Asia, the Finland-Asia Network for Sustainable Experience Design Education (SEDE-FAN) project has been launched. In this way, the knowledge and principles underpinning such educational methods and expertise can be collected, stored, exchanged, retrieved, reused and enhanced through the network. The critical aspect of this project is the diversity of Asian partners and Finnish collaborators. The Asia network is to be composed of institutions in Korea, Singapore, China, and some South Asia countries. Kyung Hee University, Korea, and Nanyang Technological University, Singapore, have participated in this project since 2022.

Participating higher institutions offer diverse courses at undergraduate and graduate levels where the sustainable consumption and experience issues are educated in the form of design projects. Such design project-based learning efforts typically employ problem-based learning approaches through team-based projects. While the specific courses may have diverse detailed contexts of education, these courses share the underlying method of design thinking in that human-centred problem-solving method and mindset are transferred to students in possibility-focused and hypothesis-driven manner. For Finnish partners, not only regional characteristic and disciplinary diversities will be considered while all these institutions share the core "experience design" theme. University of Turku is the leading institution of SEDE-FAN project. University of Oulu has joined the network in 2022.

The issue of sustainability has been actively integrated into design and design education. Some efforts address sustainability as a part in design education, while others use design as a way for sustainability education [1]. The evolution of design for sustainability methods shows gradual transitions from a product innovation level to a product-service system [2] innovation level, and to a socio-technical system innovation level [3]. A higher emphasis has been placed on consumer activities and behavior

first, then this has evolved to encompass new services, educating and facilitating desirable consumption behaviours [4].

In the following sections, three sustainable experience design courses taught at University of Turku, University of Oulu and Kyung Hee University are briefly described with the overview, the course structure, special educational characteristics and their respective findings. Then comparisons of those characteristics are made for the three courses. Discussions on findings with those three courses in comparative and in collective manners are addressed together with some plan to support the courses in collective and in respective manners. Note that the goal of this paper is to understand how different some efforts for sustainable experience design education are and how these different efforts in the network can learn mutually from one another.

2 DESIGN THINKING COURSE

2.1 Overview

Learning of design thinking, as a problem-solving method and a mindset, which are applicable not only in design problems but also in business innovation is the primary goal of the introductory Design Thinking course of University of Turku. A conceptual design project on new services for a product has been conducted as the first team-based project in the design thinking course. The intent of this course is to equip students with design thinking problem solving method and mindset through various design projects. Particularly, service design thinking, which is design thinking in the context of service-dominant logic and experience economy, is primarily addressed. Whether service design is viewed as designing services or design for service, human activities and experiences are at the core of designing in this course.

2.2 Course structure

The design thinking course is an introductory course for master degree students. The core course activity includes several team-based or individual projects addressing design thinking and human understanding topics. The project spanned over 5 weeks where two-hour session on lecture and discussion is followed by two-hour session of design projects and critiquing on the same day. Students were grouped into three teams so that diversities of all three teams are supported [5]. The teams were asked to choose a product for which new service concepts are to be designed. The students were exposed to design thinking methodologies and after going through design thinking phases of *empathize*, *define*, and *ideate*, the teams brought about new service concepts for their respective products. Each team's presentation was followed up by instructor's critiquing. Note that the students became familiar with the underlying design thinking competency learning through individual exercises. The students conducted their second design thinking project with broader design issues for another 6 weeks before the course is closed.

2.3 Education characteristics

The course was designed in a way to enable the students to carry out their design activities in a structured way. The teams went through the empathize phase of their service design thinking process. For the define phase, the teams were introduced about user journey map, and they constructed journey maps with pain points and delight points identified. The student teams iterate a little with more empathy activities as well as define and some initial ideate activities. Then they were asked to build as-is service blueprints as key define phase design activities. After discussions with teams about their as-is service blueprints, the instructor introduced a case of product-service system design which contains some sustainability issue and explained the key *imagining* method for new services using the Context-Based Activity Modeling (CBAM) method [6]. Then student teams conducted their design activities of the ideate phase with some iterations including define and empathize phases. With their presentations of initial service design concepts, critiquing has been done with instructions to reflect on their services further so that improvements on their service design solutions can be made. The student teams conducted their ideate activities further with some iterations involving the empathize and the define phase activities. The final presentations of the teams' final service design proposals were done with critiquing comments by the instructor.

All three teams properly conducted design thinking projects with reasonable new service concepts proposed while their treatments of sustainability issues are widely varied. The E3 value modeling method [6] provided a structured mechanism to address ecological values in a balance manner with economic and experience values. Thus, all three teams smoothly addressed ecological values. As the

example case addressed reuse service issue, sustainability issue was gently introduced. The ways the teams reflected this issue in their respective project varied a lot among the three teams. This is at the level where sustainability is addressed in a minor manner as the primary learning goal is to learn design thinking.

2.4 Findings

Using the CBAM representation scheme of activities, detailed activity information can be systematically represented for *experience*, *design* and *education* activities. It is expected that those higher education institutions participating in the SEDE-FAN project have now a guide in how to report and represent their sustainable experience design education efforts using the framework [6]. While project-based design is a desirable way for learning design, some additional concerns can be combined so that specific learning activities are intertwined with design activities. By embedding certain learning activities together with project-based design tasks, smoother learning of certain design methods could be enabled. It would be desirable if the framework would include some reflection tools so that design learning stakeholders like students and instructors can represent and reflect their respective design and education activities. Design student experiences should also be evaluated as in Önal and Sener-Pedgley [7].

3   DIGITAL FABRICATION COURSE

3.1 Overview

Digital fabrication environment has the ability to influence the way design is taught and practiced. Thus, digital fabrication in the context of design education impacts both the processes and outcomes. Digital fabrication laboratory has a collaborative platform for students where they can meet and share innovative ideas. The main objective of the Digital Fabrication course at University of Oulu is to develop design skills and knowledge using digital manufacturing process while promoting sustainability, in a digital fabrication environment [8]. The earlier framework [9] for sustainable design and prototyping using digital fabrication has been refined and some sub-sustainability indicators as well as educational intervention to enhance sustainability practices has been identified in the course as conducted as a part of the network [8].

3.2 Course structure

In the beginning of the course, the instructors taught design and prototype development methodologies over the span of six weeks. During this period, significant components of the framework such as design awareness and environmental responsibility were discussed. The objective was to provide and enhance theoretical and practical knowledge of digital manufacturing process. In the second phase, student brought about their theoretical knowledge into practice through design prototyping. The instructors provided feedback on the design prototypes as well as substitute solutions while deriving students' attention towards sustainability. For example, utilization and reusing of electrical and mechanical components were handled. Students were assigned the task to design a 3D interactive prototype and design mechanical components for the prototype following by group discussion among the team members. The project duration was seven weeks long.

3.3 Education characteristics

Each team was required to document the design process in form of a journal [7]. The aim of this journal was to allow the students to self-report and keep track of all the difficulties they encountered and the solutions they came up with. To serve the purpose, the students were asked to use a blog-based website where they could document their ideation phase description, design process, and results supported by pictures and videos. This blog-based website allowed both the students and instructors to post, see and comment on the weekly submissions. Another requirement of the course was to reflect on prototype generation process.

3.4 Findings

By using the prototypes or outputs, journal documentation, and self-report, sustainability considerations are examined. This examination resulted in refined indicators and requirements. The sub-indicators during the prototyping phase concerns recycling, reusability, transportation, energy consumption, waste reduction, and emissions [8]. The three stages of design thinking process composed of *ideate*, *prototype*,

and *test* have significant sustainability impact. Software and 3D simulations can be used during iterative improvement of design solution during ideation phase prior to physical prototyping. Early prototypes can be made using leftover or recycled materials.

4 HOUSING DESIGN COURSE

4.1 Overview
The Housing Design courses at Kyung Hee University are for two-course sequence over two semesters. These courses are used for the bachelor degree exhibition for the students in the Department of Housing and Interior Design [10]. Thus, the first course is taken by junior students and the second course, by senior students. As a part of the workshop of the SEDE-FAN project, the resulting states of the first course for student design teams were presented. At the time of this paper, the second course is being conducted.

4.2 Course structure
The teams are composed of 2 – 4 students each and 10 teams have been formed. The teams focus on the design problem understanding and design requirements identification. As Kyung Hee University joined the SEDE-FAN project, they introduced the focus on sustainability and all teams were required to identify their UN Sustainable Development Goals (SDG). Some of external lecturers were invited to give special lectures on green design and recycling service systems. The instructor also asked each student to declare their personal statement on sustainable life. The student teams designed building concept with considerations of the major activities of the residents of their choices. During the second course, student teams will address prototyping design and building in preparation of their graduation exhibition.

4.3 Education characteristics
Summary of 10 design teams is now provided. Team 1 aims at achieving SDG of 3-good health and well-being, 8-decent work and economic growth, and 15-life on land. They plan on designing eco-friendly co-housing using the slope of existing land to reduce the damage to the land without any underground development. The objective is to enhance ecological value of the landscape by creating linked green spaces. Their target residents are those with forest-related occupations and artist of nature. They plan to build eco-friendly co-housing. Team 2 focuses on SDG of 3-good health and well-being, 4-quality education, 10-mitigating inequality, 11-sustainable cities and communities. They plan to use slop roof form and rooftop garden to develop a specialized self-reliance preparation co-housing for 15 young people. Team 3 intents to achieve SDG of 3-good health and well-being and 12-responsible consumption and production. In order to create maximum green space, they plan to link surplus space with existing green areas, and community gardens for residents. They also plan to control the amount of sunshine with the awning and block sunlight in summer while making the best use of sunlight in winter. The main intent is community housing for the coexistence between young people and senior citizens.

Team 4 addresses SDG of 13-climate action and 14-life below water and life on land. They propose to use the roof as a rain gutter to clean the plastic and use it as living water, and to connect green areas inside and outside the land. The target residents are young beginners in society, and they plan to improve the environment and revitalize the region with the recycling of plastics by building community housing. Team 5 has selected SDG of 10-eliminating inequality and 11-sustainable cities and communities. They plan to generate electricity using solar power to use eco-friendly materials for their co-housing design for disabled residents. Team 6 focuses on SDG of 8-quality job and 10-reducing inequality. They plan to maximize ecological environment by creating continuous green areas within the site and induces a connection with external green areas to protect nature. They aim to create a healthy indoor air environment by allowing fresh outside air to flow well to the elderly through openable windows in a community housing building. Team 7 aims to address SDG 1-no poverty, 3-good health and well-being, and 4-quality education. They intend to design the building while saving the slope of the existing land to avoid excessive underground development. The building type is a group home for children, accommodating 12 children and 5 childcare teachers.

Team 8 focuses on SDG 3-good health and well-being and 11-sustainable cities and communities. They plan to manage water circulation, store and use rainwater through the central sunken garden. To protect the ecological environment, they aim to actively utilize green areas in the land and connect with animal

and plant habitats in the surrounding mountains, focus on natural light and ventilation, and design for the consideration of socially underprivileged people in the house unit. The building type is multi-family housing for the elderly, accommodating senior citizens in single and two-person households living in existing old residential areas. Team 9 intents to achieve SDG 5-gender equality and 8-decent work and economic growth. They plan to design the building to induce user behavior and contribute to resource circulation and prevent problems caused by the absence of family members through shared spaces with neighbours. The building will be community housing suitable for single-parent households, accommodating 8 households with pre-schoolers/lower grades and parents, 16-20 people. Team 10 focuses SDG 3-health and well-being, 8-decent work for all ages, and ensuring sustainable consumption and production patterns. They plan to build welfare housing for the elderly engaged in farming activities where they can use natural light to save energy, use solar panels, collect rainwater, and reduce food waste by sharing among residents.

4.4 Findings
As the teams are still working toward prototype models in their efforts, it is still not yet mature to list up their findings. The instructor asked, at the early stage, each student to declare their personal statement on sustainable life. They plan to require more reflections from individual members of the teams by using various forms of surveys and open-ended notes.

5 COMPARISONS
The key features of the courses offered by the three universities are summarized in Table 1. University of Turku's course is a master level course. The primary goal of the course was to teach students design thinking methodologies with a minor emphasis on sustainability in comparison with the other two universities. The duration of the specific project addressed was five weeks and the main education characteristic was structured design methodologies. The main finding of the course for SEDE-FAN project is that there are three layers of activities, consumer's experience activities, student's design activities, and instructor's education activities and the specific activities of each layer. Also, confirmation of the proposed framework for representing and analysing these activities.

Table 1. 2022 Comparison of Three Sustainable Experience Design Courses in SEDE-FAN project

	University of Turku	University of Oulu	Kyung Hee University
Student level	Master	Bachelor	Bachelor
Primary Goal	Design Thinking	Prototype Fabrication	Housing Design
SDG Goal	Minor	Medium	Medium
Project Duration	5 Weeks	7 Weeks	2 Semesters
Special Characteristics	Structured Design Method	Blog-based Self-report (General)	Self-reflection (Personal Sustainability)
Main Findings	Three Layers of Activities & Framework for Activities	Sub-sustainability Indicators	Housing Design Requirements and Design Prototypes

University of Oulu's course aimed at providing bachelor level students with primary focus on developing design skills and knowledge for digital manufacturing process while promoting sustainability, in a digital fabrication environment. The sustainability design goal was of medium importance compared to other two universities. Students were required to complete their project by the end of seventh week of the phase two and the course had a blog-based self-report activity as its significant education characteristic while it addressed many general topics. The main finding from the course was sub-sustainability indicators for fabrication for prototype phase of design thinking.

Lastly, Kyung Hee University offered a bachelor level project-based two-course sequence with a primary learning goal of housing design education and its impact on the environment. The sustainability design goal was of medium importance compared to the other two universities. The project spanned over two semesters, and the education characteristic of the course was self-reflection with sustainable life. The main finding from the project so far was identification of housing design requirements. Note that the focus will be made in making prototype models for their exhibition in the second course.

6 DISCUSSIONS AND CONCLUSION

Based on the comparisons in Section 5 which demonstrated how different in what contexts these courses are, some mutual learning possibilities will be discussed in this section. University of Turku's course can learn from University of Oulu and Kyung Hee University about self-reflection so that it is applied in improving its learning goal of design thinking education as well as the minor goal of sustainability related understanding. University of Turku can learn about development and use of sustainability indicators from the course of University of Oulu. University of Oulu can learn from University of Turku about structured descriptions of student and educator activities and their relations. University of Oulu's course can learn from Kyung Hee University's course about using specific student reflection, for example, more specific sustainability related reflection surveys. University K's course will learn from University of Turku about structured design process issues and from University of Oulu on developing specific sustainability indicators as needed in housing design education. Specific immediate future work for the network is to devise a structured student reflection tool which can support specific design process steps so that both students and instructors can review their respective design and education activities from the perspectives of specific design process requirements or sustainability indicators. Improvements due to such a reflection tool can be compared with mutual efforts in using the tools in respective education contexts so that these findings can be transformed to broader education efforts.

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