

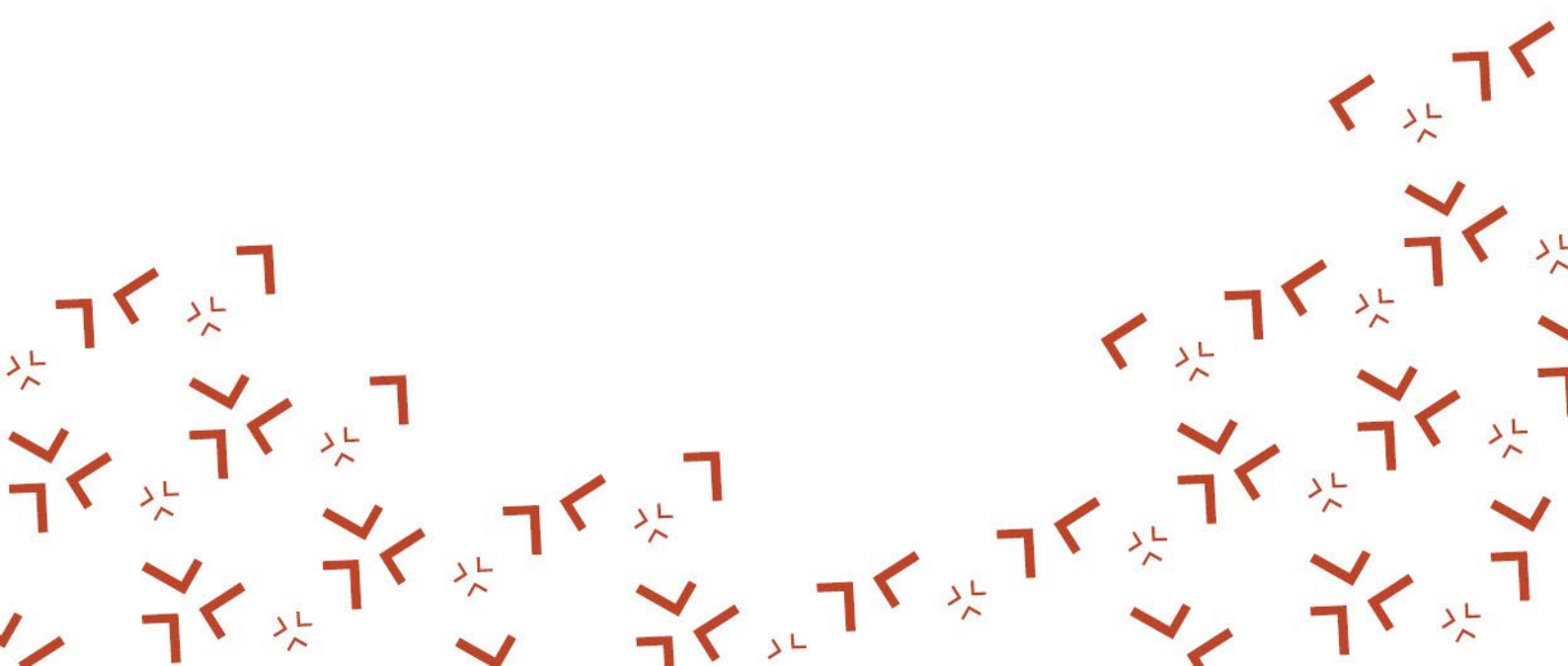
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DEVELOPING FUTURE WORKING LIFE COMPETENCIES WITH EARTH-CENTERED DESIGN

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ABSTRACT

Integration of sustainability in the curriculum of higher education creates a demand for bringing the theme into concrete development projects. Sustainable and proactive development have been identified in Finland as key generic competences in higher education. Capability to innovate and create sustainable solutions and services for future are key skills in producing novel sustainable solutions. We experimented with master's level students the use of a novel design method, Planet Centric Design (PCD), to create sustainable system and service concepts for the future. The trialed method combines systems thinking with service design to solve sustainability related challenges. It has been developed by a software company to support practical sustainable solution development jointly with their customers. Companies have

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recently been active in developing their own approaches to support design related activities. Trialing, benchmarking, and learning the use of the topical industry-lead methods during their studies, provides students practical hands-on experiences of using the methods and confidence to use the methods. The participating students found using an industry-developed design method valuable. Learning about sustainability was perceived to be applicable both for working and personal life and have impact in both areas. In the student's self-reflection reports on their learning and experiences, the collaborative teamwork in multidisciplinary teams and the creative confidence gained through the learning to use a novel design approach, were the most most often described positive themes.

1 INTRODUCTION

1.1 The need for new sustainable future related working life skills

Sustainable development related working life skills are increasingly part of competencies of software engineering curricula. This development is driven by, e.g., the UN 2030 Agenda for Sustainable Development [1].

In Finnish universities of applied sciences generic sustainable development competence related skills on bachelor's level include familiarity with the principles of sustainable development, ability to promote their implementation and acting responsibly as a professional [2]. For graduating bachelors, ability to find sustainability related information and solutions, and apply them in practice, as well as understand sustainability related challenges and issues are described as possessed skills. On master's level sustainable development competences call for ability to develop and manage sustainable and responsible operating methods in work, and support sustainable change in work community and society [2]. Furthermore, the abilities of graduating master's level students include creation of sustainable solutions and analysing and assessing systemic dependencies of complex challenges.

Future competencies include also proactive development. On bachelor's level a graduating student seeks and implements solutions that anticipate the future and can apply existing knowledge and methods [2]. On master's level student can manage the development of new solutions that anticipate future by using various research and development methods to create new knowledge [2]. In addition, creative problem solving collaboratively in multidisciplinary teams, design thinking related customer centricity, sustainable and viable solution seeking and development, as well as future anticipation are needed skills for proactive development [2].

This pair of competencies calls for novel approaches to integrate the skill acquisition into the curricula and course implementations. Concrete development projects, where development methods used in industry are applied in practice to solve real-life problems have proven fruitful in learning the status quo industry practices [3]. Software companies are increasingly digital agencies providing not only software development, but also consultation and collaboration based on design thinking and service design. They provide as services not only solution identification, design and

development, but also strategic planning, e.g., including business model innovation. Therefore, companies are active in developing approaches that support their wider spectrum of provided services.

1.2 Design approaches to solve sustainable future related challenges

As sustainable development goals increasingly drive innovation activities in organisations, new practice-oriented design approaches have emerged. As Papanek [4] in 1972 called for design that is revolutionary and radical to be ecologically responsible and socially responsive, Design for Sustainability as an approach emerged to address the sustainability and responsible design activities [5;6].

Designers themselves have recently globally joined to create an initiative and community around so called Earth-Centered Design [7]. The idea is to move from starting the design process from individual level to planetary ecosystem level. Earth-centered design has sparked practical design approaches, some of which are called planet-centric design. They are offered as consultative services for organizations to create sustainable solutions and business models. As the approaches are novel and industry-developed for practical purposes, the research on earth-centered and planet-centric design is still practically non-existent at the time of writing this article.

Design Council has also been active in creating a new framework for designing for the planet. Design Council's well-known Double Diamond model [8] for innovation is originally based on practitioners' design thinking approaches and has been widely applied in software engineering projects in industry as well as by academia. Recently Design Council has published for sustainable design a Systemic Design Framework [9] that combines the Double Diamond model with systemic thinking and puts planet and people in the center of design activities.

The Systemic Design Framework has six principles that guide the design activities [9]. These include the following: 1) People and planet centred to focus on shared benefits of all living things, 2) Zooming perspectives in and out - from a human to the wider system, from present to future, from root cause to vision, 3) Testing and growing ideas, 4) Inclusive and welcoming difference by creating safe and shared spaces to include various perspectives, 5) Collaborating and connecting as a project is one element in a wider system, and 6) Circular and regenerative by re-use, nurturing and growing existing physical and social assets. Systemic design includes the following activities: 1) Exploring throughout the design process, 2) Reframing the problem in different ways to support the creation of new ideas, 3) Creating bold, radical or provocative ideas as well as interventions at different levels of the system, adopting a circular mindset and prioritising most valuable actions, and 4) Catalysing by testing prototypes and consequences, by measuring by created metrics the environmental and social impact, by using sustainable business models to avoid negative consequences, and identifying similar ideas to create a bigger movement for change. The methods used in the Systemic Design process can be applied, e.g., from service design or from organisation's own or other suitable toolkits.

As an example of a planet centric design (PCD) toolkit developed by a company, a Finnish technology company Vincit openly shares their PCD toolkit to be used in sustainable design activities [10]. The approach combines systems thinking with design thinking to support creation of sustainable service or product concepts as well as business models. Design is done collaboratively and using a creative mindset. Toolkit consists of 19 canvases and a handbook to support the design process. The canvases are used to analyze, design, and evaluate different aspects of the sustainable solution development and the outcomes of the design process. The approach consists of five phases, with each phase having 2-6 canvases to support the design activities. The five phases of the PCD process are prepare, understand, envision, create, and release. We chose this method to be used in our course implementation, as it was at the time of planning the course implementation one of the few openly available toolkits and provided both the handbook as well as the canvases to be used in a concrete design project.

2 TRIALING PLANET CENTRIC DESIGN APPROACH

2.1 Learning goals

Problem-based learning (PBL) as a pedagogical approach emphasizes working on open-ended real-life problems to enable acquisition of desired skills and transferring learning to real-life [11]. We found it fitting as an approach to acquisition of competencies in sustainable and proactive development. To enable the development of the two competencies, we searched for novel approaches and practical methods that supported developing and trialing new pedagogical implementations. To address the goal of our master's level course "Creation of Future – Out of the Box" where sustainable development goals (SDG) were set as the driver for design and innovation activities, we decided to utilize an openly available industry-developed approach and toolkit for sustainable design, that is, the previously described Planet Centric Design (PCD) approach by Vincit.

As problem-based learning was chosen as the pedagogical approach in our course, we chose seven business fields in which the students as teams explored the sustainability challenges in their business field and chose the challenges to address in their team work. The learning goals of the course included understanding sustainability and sustainable development goals, mastering skills needed in creative collaboration and working as multidisciplinary teams, as well as applying design and systemic thinking related principles and development skills in practice.

2.2 Preparation and used learning technology

At the time of starting the planning of the course implementation and using PCD as the design approach, we contacted the technology company who had developed and openly shared their PCD approach and the related toolkit. The company experts, who had been designing and developing the PCD approach, gave the teachers support in planning the use of the toolkit and choosing suitable canvases (i.e.,

templates supporting design activities) from the toolkit to be used in the course implementation.

Materials of the course for self-study prior to and during the course were selected, created, and shared on a learning platform (Moodle) on the PCD toolkit, SDGs, creativity, systems thinking, as well as on business model design. These were chosen to support the students' self-paced learning. Miro boards containing the chosen canvases from the toolkit were created for each of the student teams to work on. Miro (miro.com) is an online collaboration tool that provides support for distributed cooperation synchronously and asynchronously by providing a whiteboard as a workspace. A group was created in MS Teams for the course and channels for each of the student teams were created to support their team work in terms of joint meetings and workshops, communication, and creating the team assignment outputs. The teachers of the course followed up and gave mentoring support in the design process by following up the activity of the teams in Miro, and on MS Teams channels, by the chat function of the channels.

2.3 Course implementation

35 master's level students enrolled to the course. Students were simultaneously actively working in their own organizations and primarily worked on the team assignment after work in the evenings or during weekends. The learning activity consisted of following parts. First, in a pre-assignment they chose on first come, first serve basis one of the seven business fields to work on as five (5) member teams: 1) Buildings and homes, 2) Green energy, 3) Tourism, 4) Transport and mobility, 5) Health and wellbeing, 6) Food, and 7) Online shopping. After choosing the theme, the students were asked to explore digital services or products in their chosen business field individually. Each of the students reported online in their joint discussion forum in Moodle their findings on the exploration of solutions and identified gaps related to sustainability. This pre-assignment was aimed at supporting further working as a team during the first joint contact session online as well as during the later phases of the design process.

Three experts from a technology company facilitated an ideation workshop in Zoom for the student teams in the first contact session. This activity was based on the findings of the pre-assignment and self-study materials on SDGs. Student teams ideated solutions using a Planet Centric Ideation canvas in Miro to a question "*How might we deliver [value] responsibly, systemically and transparently by 2030?*" related to their business field. "*How might we*" questions are typical questions used in service design processes as the question to which solutions are ideated for.

First, the student teams needed to identify for the question the "value" to be delivered. Then the value to be delivered was asked to be brainstormed taking into account each of the three viewpoints. The students were encouraged to ideate in this phase freely, without criticism, to generate as many ideas as possible. The three viewpoints – responsible, systemic and transparent - were defined as follows. Responsible covers causing harm to the planet, systemic refers to collaboration

between different partners, organizations, and other collaborators, and transparent stands for opening up the processes to end users and providing sustainable choices when using the service or solution. After ideation all the teams came together to discuss the ideas. The company experts discussed with the students the identified problems and value propositions, and the ideas for the three sustainability related areas. Experts also raised questions and helped the students in formulating and refining the value propositions and ideas.

After this session, each student team continued their PCD process online at their own pace during a one-month period. Miro board was used as the ideation and development platform, and MS Teams as the communication and collaboration channel synchronously and asynchronously. The process required the students to work as a collaborative team synchronously when brainstorming and developing solutions on the Miro board. This differed from many of the earlier course implementations during their master's degree studies where they could do group work asynchronously and divide the work between the group members for independent working. The details on the used eleven canvases from the total of nineteen PCD canvases in the design process are reported elsewhere [12].

In the end of the course, the students were asked to report their design process with its phases and outcomes with a short 10 min video and write a blog post on the learnings on the creative process, the use of the method as well as reflect on the ideas and thoughts on applying the learnings and methods in their worklife. In the second, final joint 4-hour learning session in Teams at the end of the course, each student team was asked to moderate a 15-minute discussion based on the 10-minute video presentation by one of the other teams. Instructions for how to prepare and run moderated discussions were given to the students to help them prepare their moderation. The moderation included introductions to the theme and the presenting team members and their video, preparing questions to the presenting team, and leading the discussion based on the video using the prepared questions.

2.4 Questionnaire for students on learning process and learning experience

In the end of the course, students were asked in a self-assessment questionnaire to reflect their own learning process focusing on skill development related to creative thinking, sustainability development, and future readiness. They also were asked to describe their learning experience – what was easy, what was hard for them, as well as what skills they would like to develop further, and how they could apply what they learned during the course and while applying the PCD process. The collected data was qualitative, and it was analysed by thematic analysis.

3 RESULTS

3.1 Design outcomes from the PCD approach

As outcome of the PCD process in its fourth phase, i.e., the Create phase, each of the seven student teams created one digital service or an IoT solution concept taking into account the sustainability aspects and using the results from the earlier phases

of the process, including the third phase, i.e., ideation of solutions. The Planet Centric Concept canvas was used to transform ideas into concepts and identify what makes the concept sustainable. Idea was analysed with the following questions: What does it do? What is the planet positive impact? How can you measure success? What are the risks? How can it be improved?

For the created concept teams also analysed the systemic touchpoints by considering the positive and negative impact from the point of view of economy, society, and environment. For economy the question to answer was: How does the concept change the value of key resources? From the point of view of society, the questions to consider were: How do lifestyles change? Do new behaviors emerge? Who are the winners and losers? Finally, for the environment, the impacts on environment were collected with the question: How does value of resources and new behaviors impact nature?

To enable concrete business to emerge, a business model canvas was used to address what the business model would be like with sustainable goals. Specific questions related to sustainability related issues guided the creation of the business model. As in traditional business model canvas, customer segments and value proposition were the starting points of filling in this canvas. Furthermore, the key strategic partners were identified that would enable the concept to develop into a real service. These were identified in terms of amount of influence, and on the other hand, who is in favour and who is resisting and holding back the initiative. These could be both internal and external partners.

Finally, in the fifth phase, i.e. Release, teams were asked to address how they could get their message across about the sustainability of the created solution to their target audience using the Sustainability Storytelling template. Teams considered first, what would be the metrics, i.e., the facts, related to sustainability that are communicated to the target audience. Teams then picked the tone of their message, that would represent the brand personality, and created the message to share the facts. Teams reflected on the possible perceptions of the target audience on the message, and impact of the message on their behaviour. Also risks related to the created message were analysed. If risks emerged, message could be iterated.

The concepts created by the teams included the following. A mobile application concept for mobile phones was created to support saving energy in buildings. Another team created a concept platform for green energy market for those selling energy and for consumers. Team focusing on food, identified sustainability related gaps in the current model of food delivery service Wolt, and created new features to the service based on their findings, thereby renewing the concept and business model. Online shopping platform Wish was analysed by one team, and they found a number of sustainability related issues in the operation model to address, including the returning of products. The new concept addressed several SDG's to create a more sustainable online shopping experience. The team focusing on tourism created a novel mobile application concept to support sustainable travel and related choices. New requirements were also identified for developing smart watches, including

materials and batteries, and related digital services. One of the teams created a novel digital service concept for sustainable citybikes.

To address the quality of the outcomes of the process, the following can be concluded from the perspective of the teachers. Firstly, quality of the outcome was affected by how the team committed to working as a team synchronously in joint workshops, and how well organized the planning of the joint team workshops were. If someone took charge of planning and facilitating each of the team workshops, this affected positively the quality of the ideas, the created concept, the business model, and the message to be delivered to the audience. Secondly, the more focused the problem to address was by the teams, how many SDGs were chosen, and how clearly the value could be identified, the more desirable and viable the concept and business model appeared, and the more clearly the message could be conveyed.

3.2 Fun and inspiring – Student experiences from the trial

The most often mentioned positive theme in the students' reflection of the course and using the PCD approach in the questionnaire was collaborative teamwork to solve the problems together as a multidisciplinary team. Furthermore, students described the creative nature of the PCD process, and many described that their creative confidence was boosted while learning and using the PCD approach collaboratively. Focusing on sustainability was considered challenging, but the canvases were mentioned to help in taking it into account in the process. Most of the students mentioned spontaneously that they took after the course more into account the different aspects of sustainability in their own working and personal life, although they noted that making the choices was not always easy. In addition, the systemic approach of the method that revealed the complexity and interconnectedness of issues, was described as valuable. Learning to use the industry-developed PCD approach and gained knowledge of sustainability issues was described as an asset and giving practical skills to be applied not only in the worklife, but personal life as well. The challenges of using the method raised by the students were primarily related to understanding the use of the canvases or the process itself, but as the process advanced, this was described to become easier. Overall, the students reflection revealed that the learning and experiences were positive.

4 CONCLUSIONS

We described the use of a novel Planet Centric Design method in higher education while using problem-based learning approach in a course implementation. The collaboration with the software company that had developed the method and applying the method was perceived fruitful and valuable by the students. In order to ensure both work-orientation and value of acquired competencies in studies for working life, experiments with new methods should be carried out as well as trialing the use of industry-standard methods in higher education. This would also allow a further comparison of the methods and the results obtained in these experiments in terms of competence and skill development as well as their applicability in working and personal life.

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