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Engaged Scholarship for Designing Product Service System Innovation Opportunities in an Industrial Design Course

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***Abstract*—This paper explores a design case study in an industrial design classroom in which actors with diverse expertise were involved for the creation of Product Service System (PSS) innovation opportunities in societal contexts. By engaging diverse experts from different fields, the classroom was turned into a learning landscape through which the students learned how to create PSS proposals and the stakeholders received various opportunities to create for PSS innovation.**

Keywords- product service system; engaged scholarship; design-driven innovation; competency-centered learning

I. INTRODUCTION

Our society is faced with a number of major challenges. Among others, increasing ageing society and the related healthcare challenge are one of the most important ones. These societal challenges, also known as wicked problems, are complex and difficult to address. For example, there are incomplete or contradictory knowledge about ageing due to the really diverse ageing population; different actors have different opinions about how to deal with ageing; ageing is also very much dependent on elderly's physical, social, environmental, and economic conditions. Consequently, to cope with these wicked problems, creating Product Service System (PSS) solutions is more and more desired since societal challenges require a dynamic and continuous collaboration of various actors with complementary knowledge and skills [1, 2, 3]; i.e. a form of open innovation [4, 5]. To reach successful collaborations, the initiation of the multi-stakeholder collaboration is of high importance. This is very challenging due to the openness and complexity of the process involved. Chesbrough [6] for example, called for a practical guidance to open innovation initiation. Therefore, how to initiate PSS innovation opportunities is worth of further exploration.

Although the concept of PSS started from the field of sustainable innovation [7, 8, 9], the relation between design, designers, and PSS creation has recently received significant attention in design research. Manzini and Vezzoli [10] (2002) have highlighted the fact that design can have a strategic influence on creating PSS innovation. Since then the idea that design researchers can contribute to the PSS design, such as network partnership initiation and development and/or PSS design methodology [11, 12] has been receiving more and more recognition. In this paper we are interested in how designers can contribute to initiate PSS innovation opportunities.

In the Department of Industrial Design (ID) at Eindhoven University of Technology (TU/e), we aims to teach industrial design students to design and create intelligent systems, products, and related services in a societal context. Intelligent systems and products refer to those that have adaptive behavior based on the situation, context of use and users' needs and desires. In particular, we focus on societal problems and opportunities that are beneficial to individuals, societies and different cultures worldwide [13]. The mission of the department consequently requires close collaboration of the department with governmental, profit and non-profit organizations as well as end-users when dealing with societal challenges in both education and research. In this paper, we will discuss a teaching case, a master module (5 day compressed course) "Activating Your Innovation Radar", in which we, together with our master students and governmental, profit, and non-profit organizations through engaging scholarship [14] created PSS innovation opportunities for and with(in) a societal context. Engaged scholarship refers to those people with specific and complementary expertise who can support the creation of PSS innovation opportunities. Engaging them in the creation of PSS innovation opportunities in an education setup implies that their expertise will contribute to the co-creation of (1) the education program through which the students can get trained towards meeting the learning objectives, (2) the formulation of the PSS design challenges, (3) the design of the PSS innovation opportunities, and (4) the creation of design methodology for PSS initiation with the network of experts.

This course is also part of activities within a project called Grey but Mobile, which is one of the 8 design research projects under a national Creative Industry Scientific Program (CRISP). The Grey but Mobile project aims to develop care and mobility PSS solutions for elderly citizens in the Netherlands. Crisp was funded by Dutch Government FES funding and a consortium of scientific and industrial partners. From 2011, this program has been focusing on the design of PSS, generating and disseminating the necessary knowledge, tools, and methods (www.crispplatform.nl).

The paper is structured as following. We first explain how the education course was set up using engaged

scholarship. Then we describe the results that were achieved from different scholarship perspectives. We also discuss and reflect on the obtained results, not only from the PSS creation perspective and its relation with design and designers, but also from teaching, learning, and collaboration perspective using engaged scholarship.

II. EDUCATION COURSE SETUP

A. Course Program Design

The education model used at the Department of ID is competency-centered. It combines learning and working together and emphasizes on experiential learning, on self-directed learning, and on reflection [15]. Students learn to learn (why, how, and what) and we facilitate their learning. A competency in our department is defined as an individual's ability to select, acquire and use the knowledge, skills and attitudes to support the students to act effectively in a specific professional, social, or learning context. Our students therefore need to develop the corresponding attitude towards this way of learning, develop the ability to reflect, to self-regulate their learning, to take responsibility, and to learn from experience. All these need to also be assessed. Staff-members need to make an education attitude and methodology shift from teacher-focused to learning-focused. This means a change from being an authoritative source of knowledge to a facilitator of student learning.

Consequently, a few important decisions had to be made during the definition of the learning program. First, the theory behind the PSS creation had to be conveyed to the students in an experiential learning format. Lecturing in classroom was not considered as the correct format to provide room for students to learn and work together through experiential learning, self-directed learning, and reflection given the disadvantage of the large lecture in conveying tacit knowledge. A teasing workshop about PSS innovation was therefore given followed by a sensing workshop to enable the students to get awareness of theoretical background, really experience the design context, motivate self-directed learning, and support reflection. A realistic working context was set up to enable students to design in relevant societal contexts. The students were encouraged to sense from first person perspective (be the end-user), second person perspective (interact with the end-user) and third person perspective (observe the end-user) for both end-users and the organizations. Eventually more insight about why the end-user needs different care and mobility PSS and why the stakeholder needs to participate and contribute in the related PSS innovation. Second, the PSS innovation challenges that we were dealing with relates to care and mobility of elderly people, are typical wicked problems. More reflective practice type of design process is desired in this case [16, 17]. The reflective transformative design process [17] was therefore chosen as an inspiration to organize the flow of the module week. Two design iterations and reflection moments were planned to allow the students to boil down to the actual design challenge, make progress in design for PSS, and improve their insight on end-users. The module program can be seen in Figure 1.

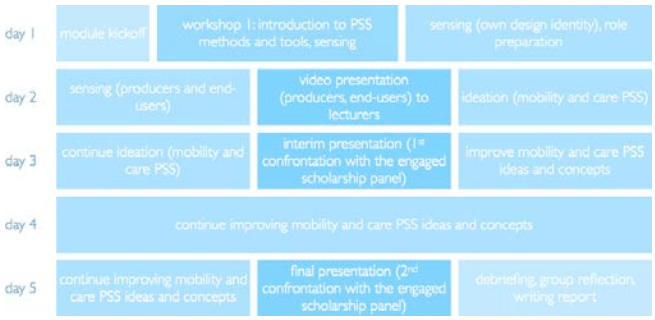

Figure 1. Activating your innovation radar master module program

B. The Engaged Scholarship Panel

In the course program design, we discussed how we take the competency-centered learning into account in this module. In addition, we also employed engaged scholarship in defining the learning facilitation. The teaching facilitation consists of the teaching team at ID and an expert panel from industries.

The teaching team consists of two people. One is an experienced senior teaching staff in the competency-centered learning model with research interest in initiating PSS innovation through design and the other is an (innovation) design strategist and researcher with research interest in meaning in PSS and adoption of PSS from a holistic multiple actant system perspective. In order to set up the learning process properly, the teaching team has consulted the competency-centered learning expert at the department and tried to get her input on how to set up the course.

As mentioned in the course program setup, we need to define an education-work context close to real-life in which the students can learn how to create PSS innovation opportunities through experiential learning, self directed learning, and through reflection. To create such an context, the teaching team has contacted five participating organizations from the public, private, and non-profit sectors. Each of the organizations was asked to provide a design challenge within the main theme: design of care and mobility PSS for elderly. The participating organizations in random order were: Toyota Motor Inc., Zuidzorg (a care organization in the Noord Brabant province/Eindhoven region of The Netherlands), Connexxion (the largest a mobility service provider in The Netherlands), De Witte Raaf (a non-profit volunteer organization by elderly for elderly to fulfill their transportation need), and the mobility and care department at the City of Eindhoven. The reason that more than one partner company was invited to participate in this master module is to create a set of potential care and mobility PSS proposals to inspire Grey but Mobile project to develop pilot projects in the future. The teaching team worked with the partners extensively and individually to define the initial design challenges and design briefs. The basic idea is that the design challenge would be formulated from each partner's perspective. However, the students would be encouraged to initiate PSS innovation from each individual partner's perspective and propose their PSS solution to a network of stakeholders who potentially could join forces to work

towards the realization of the PSS solution. Students would therefore work in groups and in the realistic contexts that these organizations would provide.

Next to their contributions in defining the design challenges, these experts from the 5 different organizations also acted as the engaged scholarship panel during the interim and final presentation of the student groups. Together with one end-user representatives from Association for Healthcare and Wellbeing Deurne who also participated in the engaged scholarship panel, the engaged scholarship experts provided the students with feedback. The feedback was on the learning process of the students but also about expressing opinion towards the PSS innovation proposals from different perspectives and concluding on the effectiveness of the design deliverables, produced by the students, on initiating PSS innovation.

III. THE MODULE RESULTS

In total 22 students participated this module with duration of one-week time from November 12-16, 2012. In this section, we explain the module results from the following perspectives: (1) the learning process and deliverables of the students from their own perspective based on their reflections, (2) the contribution of the engaged scholarship panel in co-constructing the education program, in providing feedback to students on their learning processes and deliverables.

A. The Learning Process and Deliverables from the Student Perspective

The student reflections indicate that the students have experienced the module as a high pressure cooker project in real-life contexts.

The students started this module with different expectations. Some of them aimed to learn more about business process design related competencies while others wanted to understand how they as designers with their design skills could contribute to PSS innovation.

During the first iteration (first half of the module), the students made videos in which they showed their personal view on care and mobility challenges in the given contexts. Moreover, the students created a set of 3 videos each from a different perspective: (1) designer (the students themselves), (2) the elderly (target end-users), and the stakeholder (the organization that provided the design brief and in some cases their employees). By analyzing and reflecting on the video material, the students identified PSS design opportunities for specific contexts and a design vision for the given design challenge. The visions supported further developed of PSS ideas with initiation potential. The solutions addressed both the design challenge organization and a network of potential innovation actors for the PSS solution. Students presented the first ideation results to the engaged scholarship panel during the interim presentation (half way the module). The students perceived the feedback as useful and they were able to make follow up design decision based on the feedback received. For example, the feedback from the user representative really helped the students to understand that who the elderly were and what student idea would possibly

Figure 2. Engaged scholarship in the learning process

be appealing for them. The feedback received from the private and public organizations made students aware of what is feasible and possible within the real world.

During the second iteration (second half of the module), some student groups were able to evaluate the concepts with their stakeholders and/or end-users. The student groups then further refined the design direction. Eventually each group presented their final concept using a scenario video that clearly described how the proposed PSS solution can be meaningful to all the actors involved. Figure 2 shows some of the moments during the master course such as sensing stakeholders, working in groups, reflect together and etc..

The students especially appreciated the open setup of the module through which the academic experts and industrial experts participated in this module and co-shaped their learning processes. The students got introduced to PSS design theory by means of a PSS workshop organized by the teaching team. Although given the time limitation, they did not fully get the complete picture of what PSS design is and what they can do with it initially, it did already support them to take initial action to go beyond traditional product design and start exploring PSS innovation opportunities. The feedback from the panel members was very useful to reach this step. Moreover, it supported students to reflect on their earlier design directions and to obtain more insights about care and mobility PSS opportunities in the given context. Due to this, students developed their competencies related to PSS innovation initiation. The module setup close to real-life setting motivated them to act professionally and root their design solutions in real societal contexts. What students found difficult though, was that web meetings needed to be organized to get the feedback from partners who could not be present in the classroom. The quality of the web connection and web meeting facilities at the university were not ideal to support this remote interactive group learning yet.

In total 6 PSS concepts with a scenarios video were created through which students explained the PSS concepts from the user experience perspective as well as from the stakeholder and associated stakeholder network perspective. The teaching team encouraged the students to use video as the primary communication tool to present and communicate

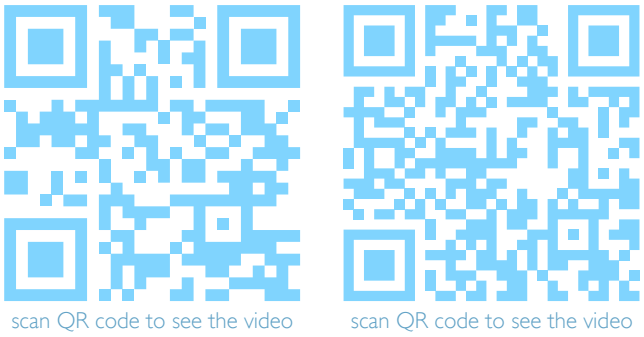

Figure 3. PSS solution videos: (left QR code) video of IRIS PSS, (right QR code) video of MOCA PSS

their ideas with the engaged scholarship panel. Students used the combination of low-fi (simple animation) and high-fi video making (real video making and acting out) in the interim presentation and final presentation respectively. Scan QR codes in Figure 3 to see some example videos.

B. The Engaged Scholarship Expeirence and Contribution

The scholarship panel has actively participated in this module in co-framing the module design, in providing useful feedback to the students on their growth as well as assessing the relevance of the student deliverables from their perspective.

Process wise, the engaged scholarship panel was very impressed with the amount of progress and growth that the students made during such a short period of time. They noticed that on Wednesday the students were still uncertain about their decisions and their video made was not yet completely self-explanatory, however, it struck them that the students were asking the right questions and managed to get a better understanding of the wicked problem and found a direction to move on. On Friday, the scholarship panel members were pleasantly surprised by the improvement that the students had made during the last day. However, they did find it too complex for a module to host 6 different design cases. Even web meetings needed to be organized when partners could only participate from distant and it seems that the current web meeting technology used at the university failed to support the interactive group feedback session.

Content wise, the engaged scholarship panel was impressed by the creativity of the students applied into such complex societal contexts. They were also surprised how well the students understood their position in the design challenge, and how they proposed the PSS innovation perspective from their brand identity perspectives. The new ideas created by the students were beyond the organizations' current solution spaces, i.e. they were out fo the box but yet quite reachable. Among the 6 final concepts, three companies and one organization expressed their ambitions to pilot field studies to further explore the PSS innovation opportunity in real life.

During the final feedback session, the engaged scholarship panel commented that they very much liked the diverse industrial and personal background of the panel members in relation with the design challenge (care and mobility PSS innovation for elderly citizens). The cross presentation structure during the interim and final presentation offered the engaged scholarship panel members the opportunity to look into each other's kitchen and learned that the challenge they are facing now is not unique and there are plenty of opportunities to work with each other. For example, Connexxion was happy to learn that some of the ideas initiated from other partners' perspective were already taken at Connexxion and they were very much willing to share their experiences with others.

IV. Discussion and Reflection

A. Lessons Learned from the Learning Facilitation Perspective

When looking back at the module from the teaching team perspective, we have learned the following two main points:

1) Open Education Format: The open education format consisting of interactive workshops, reflective design iterations, and confrontation with engaged scholarship panel was considered as a very useful format to support the competency-based learning model of ID and in encouraging self-regulated learning and reflection for students. From the reflection and feedback from the students we learned that they really appreciated the open format in which they were allowed to try out, make mistakes, ask questions when ever possible, and of course getting rewarded with their growth eventually. The amount of facilitation from the teaching team and the scholarship panel during this module was considerable compared to more traditional class room learning in which only academic experts are present and act as the main source of knowledge.

2) Reflective Practice: The reflective nature of this module program has encouraged the students to take necessary room to review their progress, reflect on their actions, and plan next steps. They became increasingly aware of the academic as well as the industrial motivation and background of this module. The initial workshop, the design exploration, the cross group presentations and confrontations with the engaged scholarship panel, and frequent reflection moments with the teaching team have supported them to transform the tacit knowledge from the teaching team and scholarship panel to tacit knowledge of PSS design and innovation at group level and to transform explicit group knowledge back into tacit group and individual knowledge through design iterations and personal reflection.

B. Lessons Learned from the PSS Innovation Initation Perspective

The module results indicate that apparently the open education format and the employment of the engaged scholarship panel have created a platform through which students were able to create PSS innovation opportunities from perspectives of stakeholders. Despite the fact that the students were new to the organizations that they worked with and for, the close participation and co-creation of the engaged scholarship in this module have made it possible

that the students quickly learned how to design from the stakeholder perspectives towards the target end-user groups.

Furthermore, this education platform was able to provide the participating stakeholders the access to a different source of innovative ideas than what they are usually used to. Through cross presentations and confrontations of the student teams, the stakeholders were able to co-evaluate the ideas proposed and have the possibility to combine different aspects and create collaboration opportunities with each other. For example, Connexxion and the City of Eindhoven found it interesting to combine the two ideas proposed by their team and work out a pilot plan together in the near future. In return to their efforts, this platform provided opportunities for the stakeholders to learn from each other and learn about PSS innovation and collaboration opportunities.

V. CONCLUSION

From the reported master course in the field of initiating PSS innovation, we have learned that by engaging scholarship in a competency-based learning education, we were able to transform the learning environment at universities into an open learning landscape and an inspirational incubator for PSS innovations in societal contexts.

Dunphy and Herbig [18] and Verganti [19] stated that when customers adopt a product, a service or a PSS, they are adopting the meanings created and the meaningfulness is the key factor that determines the customer adoption. Normann and Verganti [20] suggested that design-driven research could lead to radical innovation of meanings. These are in line with our observation that the future designers, our design students, have successfully demonstrated the strategic value of design as the source of creating new meanings and innovation together with engaged scholarship. We are not yet able to propose a set of new design methodology to create PSS innovation, but the effect of such an education exploration with engaged scholarship panels deserves further research on how these panels can contribute to PSS design methodology development.

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