A SERVICE-DOMINANT LOGIC BASED FRAMEWORK FOR TEACHING INNOVATION IN HCI

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ABSTRACT

While Human-Computer Interaction (HCI) has successfully contributed to innovation, HCI education has made only moderate efforts to include innovation as part of the curriculum. In this paper, therefore, we propose a service-dominant logic-informed framework for teaching innovation in the context of HCI education. Our approach combines service-dominant logic from the field of marketing with experiential and constructivist learning, leveraging value co-creation as the primary method of connecting diverse actors within the service ecology. This aligns with the current conceptualization of central university activities as a triad of research, education, and entrepreneurship. The paper illustrates our framework with experiences from a project-based, bachelor’s-level HCI course in the computer science department and shows how value co-creation brings a new dimension to HCI education. The proposed framework and our experience described herein can be useful for teachers designing and improving project-based HCI courses.

KEYWORDS

HCI Education, Innovation, Service-Dominant Logic, Value Co-creation

1. INTRODUCTION

The HCI community has long recognized the need for continuously updated HCI curricula focused on what is a ‘must’ for the curriculum, choosing among diverse theories, frameworks, and exemplars. For example, the ACM SIGCHI Executive Committee sponsored a project (see Churchill et al., 2014, 2016) to investigate the present and future of HCI education. The project ran from 2011 to 2014, and the findings pointed to the desire among HCI scholars and educators to share and collaborate on the development of course outlines, curricula, and teaching materials, calling this the HCI living curricula. With fast-changing technologies and continued rapid expansion of the field, HCI education is particularly sensitive to issues of relevance and balance between theoretical and practical professional knowledge and skills. Thus, what should be taught and how to do it best (Churchill et al., 2013; Culén et al., 2014; St-Cyr et al., 2019) has been difficult to establish.

HCI researchers have also increasingly recognized that framing design activity, which is at the core of innovation, no longer relies on the traditional pairing of users with designers in today’s mainstream participatory and co-design activities. Instead, approaches that value the full complexity of stakeholders in each design situation are recommended (Gray et al., 2019; Irwin, 2018; Rosenberg, 2016). Furthermore, recent awareness related to sustainability has highlighted the need to consider how the course design might help reach the university’s aim to contribute more directly to the positive social changes that are needed today.

Since we consider deeper involvement with value creation for the public good (both at the institutional level and the level of instructional practice), we wanted to explore if and how Service-Dominant Logic (S-DL; Vargo and Lusch, 2008) might help teach innovation in HCI. S-DL proposes service as central to any exchange, whether for business purposes or otherwise (Vargo and Lusch, 2008). In (Hollebeek et al. (2019), the authors proposed an S-DL-informed model for customer engagement that views resource integration as a required antecedent of customer engagement and co-creation as its key outcome. In addition, work such as (Lusch and Nambisan (2015) and Ordanini and Parasuraman (2011) explicitly used S-DL to frame service innovation and highlight the importance of exploring the integrative interfaces between customer engagement and service innovation (Hollebeek and Andreassen, 2018). According to these views, innovation is a result of
resource-integrating activities that create new resource configurations, thus paving the way for innovation. In line with S-DL, the main components of this perspective include the following:

- **Service platforms**: Structures of tangible and intangible resources that facilitate the undertaking of interactions between the involved actors (Breidbach et al., 2014).
- **Value co-creation**: The extraction of actor-perceived value from focal service innovation-related interactions (e.g., customer–firm, employee–firm).
- **Service ecosystems**: Networked actors connected through service exchanges that serve as the environment within which service innovation takes place. While some ecosystem actors may make direct innovation-related contributions, others may make indirect ones (e.g., by virtue of their connections to other actors).

S-DL has previously been applied to understand higher education as a customer experience (Ng and Forbes, 2009). A study by Ng and Forbes (2009) showed that the core service in a university experience is a learning experience that is cocreated, and that the value is emergent, unstructured, interactive, uncertain, and possessing a hedonic dimension. Additionally, Jarvis et al. (2014) applied S-DL to conceptualize engagement in large flipped classes. They provided an S-DL-based framework that was implemented in undergraduate marketing courses and showed that the approach fostered co-creation and enhanced the learning experience as well as the learning outcomes, even in very large classes. This framework was used for the evaluation and iterative improvements of an HCI course that we taught until 2017.

This paper contributes to HCI education by proposing a framework based on S-DL that fits the needs for active collaboration with industrial partners and experiential learning when teaching technology-based innovation, including social innovation. The paper is organized as follows. Section 2 describes the course and the key elements that we used for shaping and improving the course. Section 3 proposes an S-DL-based framework for teaching innovation in HCI and describes its main components. Section 4 describes how this framework was used to move our teaching in a more socially responsible direction, respond promptly to changes in the world around us, and bring a new dimension to teaching and learning HCI through value co-creation. Section 5 provides concluding remarks.

## 2. TEACHING CONTEXT

We taught a project-based HCI course jointly from 2011 until the present. In 2018, the course was fundamentally redesigned and split into two courses, one of which we have continued to teach under the same premises discussed in this paper but with more explicit involvement with the sustainability, social responsibility, and political aspects of innovation in HCI. The second course is taught by others and offers a deeper theoretical grounding in research methods in HCI. From 2011–2017, the course was the third class on interaction design in our bachelor’s program in the interaction, use, and design of technology (the prerequisites for taking the course were the introductory course in interaction design based on Sharp et al. (2007) and use-oriented design), and now, it is the fourth course (with a research methods course using Lazar et al. (2010) as an additional prerequisite), offered during the last semester of students’ bachelor’s education. Until 2017, the course had about 80 students. At present, the course has an upper limit of 40 students. Due to the outbreak of COVID-19 at the start of the 2020 spring semester, the course had to be updated on-the-fly and adjusted to the new situation, while in 2021, it was offered as an online course.

Our original motivation was to provide our students with real-life and meaningful project experiences. Thus, before the start of the course each year, we discussed and identified a set of relevant problems. Once we decided on the potential topics, we recruited organizations, startups, or research organizations participating in large EU or Norwegian Research Council-financed research projects with related and relevant themes. Due to the large number of students in the class until 2017, we needed to recruit at least 10 outside collaborators each year, who were encouraged to provide two distinct project opportunities each. Each year offered both old and new collaborators, engaging over 30 organizations of different sizes and natures (from both the public and private sectors). The students typically worked in teams of four people, in line with the established optimum for experiential team-based learning (Kayes et al., 2005). In what follows, we focus on the opportunities that S-DL thinking and value co-creation in particular allowed us to incrementally transform the course with a deeper awareness of values and their visibility in the course outcomes in the context of the collaborative project.
3. S-DL-BASED FRAMEWORK FOR TEACHING INNOVATION IN HCI

After several years of working with this course, we needed an analytical tool to help us continuously improve the course and adapt it to social and educational changes in a structural way. We thus developed a conceptual framework for teaching innovation in HCI based on Service-Dominant Logic.

Table 1. SLE-based framework for teaching innovation in HCI

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<th>Component</th>
<th>Definition</th>
<th>Main issues</th>
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| **Service Ecosystem**| A relatively self-adjusting system of industrial and educational actors and beneficiaries of services connected by shared interest in innovation and mutual value co-creation through the development of new technologies and exchange of services. | (1) The service ecosystem needs to consider diverse actors, such as the university, instructors, individual students, student teams, companies/organizations that own the problem, regulatory bodies (NSD), and end-users of proposed solutions as well as the broader society and the environment as parts of the system.  
(2) The actors need to understand the service ecology.  
(3) The actors need to understand the situated context of each project.  
(4) The need to develop a shared system of value expectations and understandings among actors. |
| **Service Platforms**| Structures facilitating actors' interactions with resources and/or other factors. | (1) The need to provide structured and efficient approaches for interactions (shared work platforms, blogs, emails, calendars, etc.).  
(2) The ability to adapt interaction to online-only communication.  
(3) The need to define clear rules for exchanges (confidentiality and intellectual property agreements among universities, companies, and students), the frequency and content of the supervision provided by companies, and ethics/privacy in contact with end-users and deliveries in the project (the platform for uploading the deliveries and informing the students).  
(4) Learn to communicate effectively.  
(5) Learn to relate concrete experiences to more abstract levels of knowledge and the converse.  
(6) Inclusion, trust, and safety need to be addressed.  
(7) The need to learn and develop professional conduct. |
| **Value Co-creation**| Jointly creating value through interactivity (within a student team, between the team and project stakeholders, and other actors in the ecology). | (1) Define key roles in the project (including roles within the team) and the nature of value co-creation.  
(2) The need to clearly communicate values and expectations among the involved actors.  
(3) Use diverse learning pedagogies, including peer-to-peer learning.  
(4) Assign tasks to different team members according to their skills or learning needs.  
(5) Discuss the purpose (identify benefits) of the project.  
(6) Utilize differences and diversity of perspectives and knowledge among design team members.  
(7) Engage with instructional staff to support design and new knowledge creation.  
(8) Teams take charge of the process. |

Our concern was not about a specific curriculum, but how to use the above key elements of S-DL to design a course that reflected the values that we wanted to impart. Inspired by (Hollebeek and Andreassen (2018), Lusch and Nambisan, (2015), and Vargo and Lusch (2008), using teaching goals for the course and experiences gained from previous courses, we elucidated the following three components of the framework:
service ecosystem (including a broader network of participants than stakeholders e.g., the university strategy makers and social groups), service platforms (representing the set of technologies and platforms used), and value co-creation (covering a broader set of values than just the learning benefits for the students and the potential value of the project outcomes for partner organizations). This is summarized in Table 1. While the framework can be used for other courses, such as project-based engineering courses, we believe that it fits the complexity of the ecosystem needed for teaching innovation to HCI students particularly well.

4. EVALUATING AND IMPROVING THE COURSE

The S-DL-based framework was used as a tool to systematically evaluate and improve the course. It was used to get a bird’s-eye perspective of the whole ecosystem and to assess the strengths and weaknesses of our course design for each version of the course. Each year, after the semester and exams were over, we collected feedback from the students, partners, and others contributing to the teaching (teaching assistants and supervisors) on the processes that unfolded in the work on the projects. We also served as supervisors for some of the projects, the ones that were directly related to our own research, which gave us the opportunity to observe students directly in action and make note of any challenging points that might need improvement. Some years, we also felt that we needed to make deeper inquiries to better understand how teams worked with value co-creation and how different actors collaborated and used service platforms. In 2015, we interviewed eight of our industrial and research partners and conducted a survey among all 18 student teams. In 2021, we conducted interviews with partners and students (four groups and three individual interviews: 13 students and three partners in total).

The interviews were conducted in Norwegian or English (depending on the students’ preference). The collected qualitative data, including notes, observations, and interviews, were analyzed by the authors of the papers using a simple coding schema matching the framework elements. It should be noted that this evaluation was done in addition to the regular course evaluation completed by an independent student body at the end of each semester. This standard evaluation targets students and cannot reveal the views of other stakeholders, such as industrial and research partners, which are central to the success of such a project-based course. In what follows, we relate the three components of the framework to our course. We then explain how the framework helped us identify strengths and points of improvement in the course design.

4.1 The Service Ecosystem

Our course and the projects included actors such as the university with its teachers and other helpers, administrators, and students (individuals and teams) as well as other actors, such as participating research and industry partners, the Norwegian Data Protection Service (NSD), those people who might benefit from the outcomes of these projects, and, for some projects, others with governance knowledge, law, or expertise. The project beneficiaries represented diverse social groups. Some projects involved children, while others included people with special needs (e.g., patients and such users needed to be met with special care and perhaps additional consents or permits). There were also those who were difficult to recruit for participation for project work due to their busy schedules, such as air traffic controllers, police, oil-engineers, or firemen. This posed additional challenges for design teams and often departed from students’ expectations of having situations prearranged for them. Additionally, student teams often had to master new and rather complex domain knowledge, both to support their design processes and to be able to communicate efficiently with field experts. This often presented additional workloads for instructors, internal supervisors, and contact persons in participating organizations. However, we did not find any evidence that students preferred projects in domains that were easier to understand or where the users were more accessible.

Almost always (with a couple of exceptions among 125 projects), the actors in service ecology gained a good understanding of the context for collaboration. Still, for some actors, it was more difficult to respond to the needs of some projects. For example, the regulatory body (NSD) could not change its routines to accommodate student projects, even understanding the project needs. Normally, it takes about four weeks from the submission of the notification form (for projects that require the processing of personal data) to its approval, which is too long for projects where students had only five weeks to deliver the first prototypes or solution sketches. This is an example of a challenge that we could not solve. It was addressed by workarounds—by either avoiding the collection of personal data altogether (for example, taking notes instead of audio recording interviews) or by postponing data collection that involved sensitive data.
4.2 Service Platforms

Apart from the possibilities for face-to-face meetings with instructional staff, students could share their project-related processes with the instructional staff as well as the industrial partners, using blog posts to share their progress regularly. Finding an adequate platform was left up to the students. Many teams preferred simple blogging platforms, such as Tumblr for external communications and Google Docs for internal work. Various scheduling tools, such as Doodle, were frequently used. E-mail was still one of the primary communication channels with partner organizations.

During the pandemic, the communication moved to Zoom and Teams. Figma (the collaborative interface design tool) and Miro (online whiteboard tool) were used for prototyping and sharing ideas. As the first lockdown in Norway began in the middle of the spring semester (March 2020), the students as well as the teachers, partners, and user groups had one week to completely change their project plans. The workshops and focus groups that had already been prepared were replaced with online studies.

Students often thought of partner organizations as clients and themselves as design consultants. Many students remarked that it was motivational to think that way and that it helped them to develop a professional attitude as well as to take the extra mile to learn. For example, they were willing to learn how to use sophisticated platforms that their clients carried out their work on, even if they required extra time and effort, and even if they were not likely to use these programs after the project is over. This was often the case for large organizations with proprietary platforms and specialized work tools.

4.3 Value Co-Creation

Value creation, and later value co-creation, was the most central focus of our efforts when shaping the course. At the start, our goal was to design a course that would benefit students (to create value for students primarily) by providing real-life experiential learning that granted self-efficacy and self-management while providing a good safety network should one be needed. However, through iterative improvements in the course design and formulation of the framework, we started to note more clearly the potential benefits of collaboration for diverse organizations. This enabled us to be clearer and more convincing in getting organizations to partner with us and to actively build and expand networks of potential project contributors, for example, by sharing success stories from previous projects and pointing out their impact. The main motivational factor for the organizations to engage in this collaboration was the possibility of exploring students’ novel ideas or the ideas that they had but could not explore due to time or resource constraints.

However, when asked about the benefits of working with students after experiencing the collaboration, the organizations frequently highlighted the importance of students’ creativity and the value of their activities for the organization. Many organizations became repeat participants, emphasizing that the projects generated significant value to the organization. The importance of the outcomes of collaborations for organizations could be classified as (1) significant experimental and conceptual explorations, (2) directly or indirectly generated larger research collaborations, and (3) outcomes that were interesting in their own right, either as usable products or experiences. With time, it became clear that beyond creating value for the students and learning only, we could actually talk about the co-creation of values for actors within the ecology, including the public and the university at large. Addressing the latter, every one of the participating organizations said that they would recommend such collaboration with the university to others.

To illustrate how the values were cocreated for diverse actors within the service ecology and how they intended to provide values for social groups or the society at large. Figure 1 gives an example of a project. It addressed the needs of people living in rural, scarcely populated areas for sustainable, convenient, and low-cost transport. It was a part of the research consortium consisting of two universities: a municipality and a hospital.
Mobility-as-a-Service (MaaS) is a type of service enabling users to plan, book and pay for different mobility services through a single digital platform. The MaaS app tailored to the transport needs specific to rural areas was developed (see Figure 1). The app uses an optimization tool that calculates possible journeys from point A to point B and the impact of the journey on the environment. Users of transport services can then select their journeys based on different criteria, such as waiting time, travel time, or CO₂ emissions. In their design, the student team considered both the impact on the environment and the impact on the local community.

To make the impact of the projects and co-created value more visible, for the benefit of all involved, we turned the final course presentations into a competition, where, as mentioned, a jury of experts evaluated the projects by novelty, impact, user engagement, and the ability to clearly communicate the central challenges and outcomes of the projects. The competition was followed by a social event, enabling students to meet diverse industrial partners, experts, faculty, and other guests. In this context, we would like to point out that this was also a way to network and identify potential openings for employment (something that happened on several occasions). Trying out a different opportunity regarding the same goal, we organized an open seminar featuring student innovators. Alongside their talks, the seminar included talks by organizations that participated in student projects, startups (some launched by our former students), and the Norwegian Business Association. For the cohorts with smaller numbers of groups (2020 and 2021), instead of having a competition, we invited all the external partners as well as guests from another European university teaching transition design to the presentations of the students’ projects at the end of the semester.

4.4 Use of the Framework to Identify Strengths of the Course Design

The framework clearly leveraged value as a tool to evaluate and identify possible pathways to the co-creation of values through different partnerships with external actors. It also helped to compare the expected and actual outcomes of the co-creation. Students, the instructional team, and the industrial partners shared positive feedback on the significance of the projects and, specifically, on the opportunity to co-create values. For example, in a survey conducted in 2015, we asked each student team if it was valuable to collaborate with an industrial partner. The majority of teams found it to be valuable (MED 1; AVG 2.3 on the scale of 1 [totally agree] to 7 [totally disagree]; N = 18 groups). A corresponding question posed to eight partner organizations was answered affirmatively by all. In the interviews conducted in 2021, the students emphasized that a main value from the course, both for them and for the partners, was a gained understanding of how designers can make a real change toward a sustainable future and take the first steps toward such a
change. The project results (different prototypes and tools developed in the projects) were of great value to both the students and the partners.

On a smaller scale, the framework allowed us to re-evaluate the course requirements and platforms (e.g., time investments for various actors) and outline how changes that we made affected the course (e.g., one year, we specified that the blog was an obligatory communication platform but found out that while this worked well for some teams, it did not work for others, resulting in just a recommendation to blog the year after). Paying attention to interactions among different actors within the ecology helped us gain insight into the amount of work and time needed by different actors to support the projects effectively (e.g., how many hours for teaching assistants, internal supervisors, etc.). It also enabled us to make clear agreements on working conditions and to attempt to make the conditions equal for all projects.

Among individual elements, the purpose of the project, learning from teammates, and the openness of many on the project, allowing for creative solutions, were most appreciated. In their post-course surveys, post-exam surveys, and the conducted interviews, the students stated that the diversity of skills, knowledge, and experiences within the team created additional value for them and increased both creativity and learning. They found teamwork in real-life settings to be both motivating and fun. One team described their teamwork experiences as follows: “We have a group of different people with different ways of thinking, stirred together in a creative pot, it's awesome!” Another said, “Working in a group has been a good learning experience and really helped us to explore the different ways to design.” Still another team found that “It [teamwork] really helps. Quite often you have some ideas, but you need help to be able to explain them. So, in our group we really understood how each other was thinking, and we could really help each other describe and realize our ideas and creativity.” The students also emphasized the importance of safe teamwork guidelines and “not killing each other’s ideas.”

4.5 Use of the Framework to Identify Points of Improvement

The framework helped to elucidate that while diversity (of knowledge, skills, thinking styles) in teams was appreciated and important for value co-creation, diversity in projects had a positive impact but at a sizable time cost. The ecosystems included many actors, leading to an increased workload for the instructional team related to project management. Due to the diversity of the projects, methodologies, eagerness, and skills of the teams, among other factors, the workload grew for students and partners, which we tried to compensate for by providing extra supervision. This added further hours for the instructional team, students, and sometimes the partner organizations as well. In terms of the workload among student teams, those who had the highest motivation and the best results often ended up using a lot more time than expected. The expected workload in the course was 13.5 hours per week, including lectures, work on assignments, readings, and projects. The actual self-reported average workload was as expected (MED: 40 hours per week for all group members [3-4]; MIN: 6; MAX: 70), but for those highly motivated students, the average of 70 hours was too high. The workload became a clear point of improvement, and this is one of the reasons for splitting the course in 2018 and scaling it down. The second reason for the split also emerged clearly from working with our S-DL-based framework—we felt that the situation in the world and in the field of HCI is changing—calling for responsible innovation and responsible teaching of innovation (Bates et al., 2019), and the new course design needed to have a substantially strengthened focus on social values and how to enact positive changes at scale (how to think about enacting changes at scale) toward more sustainable development.

We also decided that the new course would have all the projects dedicated to the same overall topic. For example, the topic in 2020 was ‘Artificial Intelligence for Sustainability,’ and our partners were invited to come with project proposals addressing this topic in different ways, ranging from healthcare chatbots to AI agents, enabling smart transport in rural areas or waste management. With these more complex projects, the issues of how to teach and learn about responsible innovation come to the forefront. Another point of improvement that emerged was related to first-time partners. It was difficult for us to know exactly how they would work, even when we communicated well about the course and saw great potential for value co-creation. The student feedback on some first-time partners was often somewhat lower, with the main complaint that they sometimes did not dedicate enough time to projects.

On the other hand, some partners also had suggestions for improvement. They expressed a desire to be better informed (by us) about students’ abilities regarding their programming experience, design experience,
HCI methods, and other skills. While we recognized the importance and potential challenges that the lack of such information might cause, we could not provide this information in a timely fashion at the start of the course. Massification and mobility in education certainly had an impact on this, as we often had students from other institutions as well as international students. Although we asked all students to describe relevant experiences, skills, and knowledge when selecting a project to work on, their self-assessments did not always match the reality. Also, they often did not always have the skills that we expected (e.g., even though everyone had to have a programming course, not everyone was actually able to program). One of the partners, for example, told us that their team had no programming skills whatsoever, though they expected informatics students to be able to do well with programming. The students, however, were quite creative and delivered a range of ideas and explorations that were highly appreciated. If the partner had possessed this insight, they informed us that they would have written a very different brief to start with. Our master’s students had especially varied educational backgrounds (e.g., bachelor’s in education, music, art, design, and/or psychology), sometimes to the great benefit of teamwork. However, this made it difficult in terms of course planning in two ways: how to best connect the experiential learning path with a more theoretical and methodological one and how to determine how much work the extra supervision would take.

5. CONCLUDING REMARKS

We believe that the proposed framework fits well with HCI education in times of global change. Our work bears similarities to the research mentioned above on S-DL in higher education, as it focuses on the co-creation of value and the desire to create an engaging and positive learning environment. However, our framework considers multiple factors, where, in addition to the university and students, industrial partners and possibly their customers contribute to the co-creation of value through joint innovation efforts and experiential learning in design teams. It also provides more specific details, enabling its direct application in course design and evaluation. Collaboration with industrial partners brings a current and relevant industry focus to HCI education in a way that is concrete, experiential, and centered on what is of growing importance: co-creating values for all—the students, the partners, the university, and the public—through education. The students also become better prepared for professional practice. With the flipped classroom elements of the course and focus on critical thinking, students felt empowered and more confident in the skills they gained through the course and, most importantly, through the project work. The survey, the course evaluations completed by an independent student body, and interviews with participating organizations all showed that it is precisely the co-creating value that was the most productive aspect of this form of learning. When the projects were successful, students felt a sense of pride and that they were actually contributing to society. In some instances, the student projects have been recognized as innovations and have motivated companies to research, seek grants, or develop products in collaborations across the service ecology. Notably, at the moment, the framework and the iterative approach to making a course allowed us to align with our institute’s and university’s strategies to scaffold active collaborations between academia and the industry to provide timely, relevant, and responsible contributions to mounting social challenges. As an analytical tool, the framework helped us iteratively to improve the course and adapt it to different challenges in a structured way. For example, it helped us to identify and address the need to shift the focus toward sustainable innovation and the need to quickly adapt work and communication platforms due to the pandemic. In terms of the limitations of the work, the main one is that we can only report on our own experiences with the proposed framework. This limitation also frames opportunities for future work. We hope to be able to observe others using the same framework in their courses to gain a more objective assessment of its usefulness.

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