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Shared Interests In Live Case-Based Learning – Students' Dynamic Role In An Innovation Ecosystem

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SHARED INTERESTS IN LIVE CASE-BASED LEARNING – STUDENTS' DYNAMIC ROLE IN AN INNOVATION ECOSYSTEM

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ABSTRACT

Teaching engineering students to navigate complex innovation ecosystems and deal with wicked problems is vital for contributing to sustainable development. Research shows that case-based learning with real-life challenges boosts motivation and learning outcomes. This paper presents a course that is in the core of an ecosystem where engineering students engage with hospitals, and work on the hospitals' documented innovation needs. By design, the course setup has a double purpose: in a learning context, the course strengthens intrapreneurship education, with students acting in an empowered role like professional consultants. In an organizational context, the course enhances knowledge sharing, filling in the gap of innovation competences and resources needed to create value and stimulate intrapreneurial initiatives. The ecosystem has evolved as result of an iterated development of the course including the tools and frameworks that empower the students to act as autonomous innovation consultants in constant interaction with the process of mobilizing the case partners. Thus, this paper presents a study based on current experiences and learnings, focusing on the relationship between the facilitation of student empowerment in live case-based learning and the impact on both 1) engineering students' motivation and learning outcomes; 2) value creation for the participating ecosystem. The paper builds on qualitative data from two sources: yearly follow-up interviews with case partners since 2018, and student reflection reports from 2022.

1. INTRODUCTION

After hosting a group of engineering students from an innovation course in the department, a senior consultant physician in a palliative care unit at a Danish hospital said that:

"[The students] have been super observant. It is wonderful to have eyes from the outside on such a messy shop as ours. They see some of the same things that I see, but they can say it impartially. It has been extremely useful."

Students wrote in a reflection report after another project at the same course:

"The doctor confirmed the skills we had learnt and were now using on the ward. It left us with a great feeling. We already felt we had made a difference by proposing concrete places to look to solve some significant problems. It was a much better feeling than getting an A grade."

These initial quotes remind us that the education of engineering students has become more than just teaching the technicalities of the engineering profession. Engineers nowadays are often placed in interdisciplinary contexts, where they work with complex problems, or so-called 'wicked problems' (Buchanan 1992). Moreover, it is often the case that the complexity increases when involving multiple stakeholders in intricate organizational webs. To prepare engineering students to their future professional reality, higher education institutions create and modify courses to expose students to real-case scenarios, interdisciplinary group work, and collaboration with organizational partners.

One example of an engineering program that aims to empower students to work in highly complex organizational environments is the bachelor study program of Process & Innovation, at Technical University of Denmark. The Process & Innovation

study program educates design engineers. The students become generalists, and as it is written in the introduction at the university's website: "As an innovation engineer, you can help translate new ideas into concrete and usable solutions" ("Bachelor of Engineering (BEng) in Process & Innovation" 2023). The students "learn to work professionally with innovation and the implementation of new concepts, products, and processes from an engineering perspective" (ibid).

Early in the Process & Innovation study program, students are exposed to wicked problems, but the 4th semester course, entitled 'Innovation in an Organizational Context' (IOC), is their debut with live case-based learning in a professional context. Specifically, students in the IOC course work with hospital wards for 20 weeks.

The IOC course objectives aim:

"To enable the students to clarify, problematize and constructive relate to the relationship between organizational culture, knowledge dynamics, organizational changes and value creation, and the underlying socio-technological innovation ecosystem, and on that basis in praxis facilitate innovation in an innovation ecosystem" ("Innovation in an Organizational Context. Course Description" 2023).

In this practice paper, we frame the IOC as a case on how to facilitate student being part of an innovation complex organizational ecosystem. As outset, we consider that there are two main actors interplaying: the students and the professionals at the partner organization. Students act with an empowered role as professional consultants in the organizational ecosystem, whereas professionals act as contact points, i.e., sources of knowledge for students to explore the system and receivers of the finalized student project and derived value creation. These two actors have shared but also distinct expectations to be aligned.

Based on that, we investigate and discuss the following:

How does the expected value creation that meet the students in the organizational context in the ecosystem influence their motivation, learning outcome and self-efficacy?

We outline the course structure, the applied learning elements, and the process of mobilizing the ecosystem with support of empirical data.

2. METHODOLOGY

The paper builds on qualitative data from two sources:

- Follow-up interviews with case partners (hospital wards).
- Submitted student reflection reports.

Since 2018, 24 hospital wards have participated as case partners. In the same period 35 semi-structured follow-up interviews have been conducted. Typically, the respondents were the head of department and/ or the case contact person and, eventually, other staff members. The interviews have, with minor modification, followed an interview-guide, where questions were asked in four categories:

- The cooperation between students and the ward in general.
- The delivered outcome in the specific case.
- The perceived value creation.
- The effect of the students' presence in the department's work life.

The interviews have been recorded and transcribed. In the reflection reports, students ought to reflect on key events, on collaboration with the department, and on the group process applying Gibb's reflective cycle (Graham Gibbs 1988).

Both categories of data have been coded following a code list, including the terms 'value creation', 'trust', 'relations', 'process', 'expectations', 'optimism', 'motivation', 'feedback', 'engagement', 'ownership', 'efficacy' and more. In total, the analysis builds on 10 reflection reports and 35 follow up interviews from the period 2018 to 2022. Additionally, the paper also refers to course description and internal materials.

3. THEORETICAL BACKGROUND

3.1 Self-efficacy in live case-based learning

Case-based learning is an instructional approach broadly implemented in university education of nursing, medicine, law and business education, but that is still at its infancy in engineering education (Maslen and Hayes 2020). Case-based learning exposes students to cases, i.e., specific situations, scenarios, or problems that resemble real-world challenges they will encounter in their professional practice (Tripathy 2008). On way of implementing case-based learning is through live cases, where students are placed within an organizational context interacting with other key actors (Blomkvist and Uppvall 2012).

The practice of live case-based learning encompasses the idea of students perceiving themselves as being responsible for an outcome, while still having the support of their group mates and the facilitation of the supervisor. Tinto (2017) positions 'self-efficacy' as one of the key elements in the model of students' motivation and persistence in their education, together with 'sense of belonging' and 'perception of curriculum'. *"Self-efficacy is learned, not inherited"* (Tinto 2017), meaning students build their sense of self-efficacy from the experience with others and the situations in which they interact.

In this paper, we depart from the assumption that live case-based learning can potentially increase or decrease students' sense of self-efficacy, as they move along to work on their cases. Whilst a real case seems very challenging, students might increase self-efficacy if they find ways to navigate complexity, so that even difficulties on the way do not stop them to persist. We understand self-efficacy as a core element needed to be strengthened through practice of engineering education.

3.2 Value Creation in live case-based learning

In the last 20 years, universities have grown more entrepreneurial and have undertaken different forms of innovation collaboration with companies, comprising, for instance, students' live case-based learning (Perkmann and Walsh 2007). Live case-based learning has developed particularly important to partners who are new to innovation processes or that do not have enough dynamic capabilities to cope with innovation, such small enterprises, non-governmental organizations, and institutions like hospitals (de Silva and Wright 2019). Societal actors engaging with students can benefit from a multitude of advantages, such as access to skilled workforce, corporate societal responsibility efforts, ecosystem orchestration etc., while having a first evaluation of the efforts and outcomes of interacting with universities (Rafaela Hillerbrand and Werker 2019). Then, live case-based learning courses work as a platform that connect various actors to students and create reciprocal and shared value (Osorno-Hinojosa, Koria, and Ramírez-Vázquez 2022).

Nevertheless, as each collaboration is different and it involves actors with peculiar necessities, universities often struggle to balance out value creation for both the students and the interested stakeholder(s), but also value capture for itself (McAdam, Miller, and McAdam 2018).The difficulty comes from the nature of such shared value creation because value creation is both individually perceived and experienced (Lusch and Vargo 2006), and it is influenced by the different ecosystem in which each actor is contextually embedded (Jennifer D Chandler and Lusch 2015).

The case presented in this paper involves hospital wards, who revolve around their complex own ecosystem, multiple customers, and value creation strategy ("Budgetaftale 'Tid Til Patienten'" 2020), and students with separate logics. Therefore, while value creation is the objective of students' collaborations as a strategic capability that might drive actors' engagement and further the university ecosystem development (Orazbayeva et al. 2019), it also evolves along the interaction's deployment, as it is defined, discovered and evaluated, in intertwined feedback loops (Polese, Ciasullo, and Montera 2021).

4. THE IOC ECOSYSTEM

4.1 Course origins and design

The IOC course originates in the merge of two other courses: 'Innovation and Knowledge Management' (IKM), a 5-credit course lecturing an organizational curriculum, and 'Project 4' (P4), a 10-credit project course. Over the years, the two courses (IVL and P4) have gradually been integrated and continuously developed, as well as a network of partnerships was established, until they became integrated as IOC. The IOC course ran for the first time in Spring 2023 as a 15 credit, 20-week project-based course, where groups of students work with hospital wards as cases, one case per group.

The IOC course design uses 'active learning' and 'flipped classroom' as its key teaching methods. Students work in groups and need to apply the syllabus in practice ('active learning'). Each group is responsible for managing the workload from the course, which includes three mandatory deliverables, and one final implementation plan together with an 'innovation log' that documents needs and opportunities discovered through the process to the hospital department they are working with. To support their work, students are exposed to organizational theory, with literature available and have peer feedback sessions ('flipped classroom'). Moreover, there are several informal knowledge-sharing sessions in the class.

4.2 Hospital wards as cases

The first healthcare case was introduced in 2016, before IOC was created. The hospitals soon proved to be the ideal arena for learning innovation, as it says in one of the course guides:

"A hospital ward is a complex organization where changes constantly are taking place in a bubbling cauldron of citizens with needs and feelings, their relatives, professionals, and specialists from many fields who work together and are interdependent. It is a hierarchical organization influenced by political interests, financial requirements, and intense technological development" (Keiding 2023).

In 2018, it was decided to focus entirely on healthcare cases. Gradually, as a network of case partners has evolved, the course established itself as an actor in the innovation ecology in the hospitals.

4.3 The story about the course

The systematic documentation of the departments' experiences by follow-up interviews has played an important role in establishing the course as an actor in the ecosystem. A narrative has formed around the course, built from statements extracted from the interviews. Currently, value creation has become the selling point of the course for the hospital wards. This extract of the invitation letter to new wards exemplifies the emphasis on value creation:

“You have a busy life and there are probably several things you would do if you had the time. Why not let a team of engineering students do the work? You don't need to spend time formulating a case because that's the students' job. They must […] create the most value for employees and patients” (Keiding 2023).

5. EXPLORATION AND DISCUSSION

In this section, we explore the empirical data and discuss the topics introduced earlier. We use extracts from the data (i.e., quotes from student reports and follow-up interviews) to exemplify and illustrate key aspects identified.

5.1 Response from the real world

The learning outcomes from the students are closely linked to the response from the hospital partners, as exemplified in one student report from Spring 2022:

"Just as the department benefits from our new eyes on their work, we must also value their view at our work and recognize that it is not us and our high expectations to our own work that determine whether we make a difference for others, but it is actually them for whom we create value” (Group 8, 2022).

Here, the group let go of a self-centred approach to learning, shifting to a real-life focused approach, acknowledging that the project should be guided by the value creation perceived by the partner.

The value of having *“new eyes on their work”* is often apprised in the follow-up interviews, which demonstrates the individually perceived and experienced perspective on value in the case-collaboration (Lusch and Vargo 2006):

"We become blind to our own practice, so having our eyes opened by someone who comes from the outside and is not immersed in all sorts of things is insanely good” (Group 8, 2022).

The significance of the foreign glance seemed to be mutual since *“their view at our work”* is claimed by the students to be a central motivational factor, obviously more important than ”our high expectations to our own work”, a figure of speech that presumably refers to normative project assessment. What determines the quality of the project from the perspective of the students is *“to make a difference”* and to *“create value for [the hospital partner]”*:

“We must therefore become better at taking in the praise but also seek their validation, as it helped to create peace and confidence in our work. Specifically, we want to strengthen the contact with our stakeholders in the further work, to gain a deeper insight into their perception of our work” (Group 8, 2022).

It is a learning outcome to actively aim for a close interaction with the real world.

5.2 Accomplishing a value creating role in the ecosystem

Some student groups experienced to be seen as a resource in the hospital wards. A group took part in an ongoing project about home monitoring of heart patients:

"Through this process, we have gone from being observers to being key players in helping the department to further develop the use of Apple Watches. It has been enormously rewarding and motivating that [the hospital contact person] appreciates our labour and believes in our work. It has energized us and pushed us to be careful and thorough in our work" (Group 9, 2022).

The group accomplished a valuable role in the ecosystem. Their conclusion indicates a strengthened self-esteem:

"Our delivery from this course will be one of the cornerstones in the future maturation and implementation of the system" (Group 9, 2022).

5.3 Self-efficacy and the mobilization of the ecosystem

It is an important learning for students that successful value creation is not only determined by individual skills and a good solution, but by the ability to adapt to the ecosystem. Some actors demand hard work to mobilize.

In the following example, doctors and a senior consultant physician were the key actors, but the group had only been able to access the physicians through the ward nurse. The project took a major step forward when the senior consultant physician finally became interested in the project. All began at a meeting with the ward nurse:

"The meeting boosted morale within the group and increased motivation for future work. Prior to the meeting, it had been unclear whether the proposed solution had real value for the ward and we ourselves had begun to doubt its relevance. The ward nurse had a drive and enthusiasm that was contagious. She encouraged us to just go out and try the solution and gave full support to the project" (Group 11, 2022).

The ward nurse had no doubt that the group could win the staff for the proposed solution. Energized by positive expectations, they approached the physician:

"We were very motivated to continue the work and test the prototype because we felt that we had mobilized the key person [the ward nurse] for the implementation of the solution […] However, we ran into a problem when the situation did not allow us to just walk into a doctor's consulting room and demanded that they tested the prototype without the ward nurse present […]" (ibid).

The group conducted a workshop to create a *"direct link"* to the doctors. During the workshop, it became clear, that the doctors did not share the positive expectations of the ward nurse. A turning point occurred while an interaction played out:

"[…] when asked about whether the information about the waiting time can be registered and viewed in the Health Platform (SP), the consultant physician and another doctor shared knowledge. The consultant physician realized that the other doctor has been using the Health Platform differently, with the effect that the current delay in relation to the schedule was visible to the entire staff" (ibid).

The debated feature was of value to the doctors since the registration happens automatically and reduces interruptions.

"The consultant physician ended up asking the facilitator [one of the students] whether the proposed solution would be a technical possibility" (ibid).

The workshop did not establish the wished *"direct link"*, but it made the students of use to the doctors. The situation led to an important learning:

"The idea of having to facilitate a person who has the daily leadership role was very challenging and made it difficult to stick to the framework and purpose of the workshop. […] However, the workshop resulted in great joy as the doctors started to share work process experiences internally. This is where the effect of the workshop really came into play, and it was a feeling of success to have "overcome" the participants who probably represent the most difficult to mobilize" (ibid).

This is a case of confirmation of the professional capability of the group. The doctors did not directly praise their proposal, but a change in perception occurred and confirmed the process, and thereby the professional capability of the group to manage that. *"This is where self-efficacy is learned"* with the words of Tinto (2017).

6. CONCLUDING REMARKS

6.1 The ecosystem evolves

In general, there is a positive dynamic in the ecosystem, pumped by a high degree of expectations from both case partners (i.e., hospital staff) and students. Hospital staff warmly welcomes the new students with expectations that they will create value and produce good results as their past cohorts. Students, on the other hand, are motivated to make the efforts to these meet expectations. In most cases, they succeed and add to their professional ethos and self-efficacy.

Later in the study program, some students continue with their projects or other projects in the healthcare sector and become role models to the new students. At the hospitals, among the healthcare departments, the word about the IOC course and the results are spread when managers bring the results to various forums and when staff move to new positions elsewhere in the sector.

6.2 Final notes

This practice paper takes the ecosystem perspective on value creation and uses the example from the IOC course to explore the interconnectedness between students' motivation, self-efficacy, and learning outcomes, and the value creation for the case partners.

With this paper, we do not present a simple answer to the question raised, but a – still hypothetical – model seems to emerge. The learning dynamic plays out in a multi-connected feedback loop formed around 4 key concepts:

- Value creation in one year leads to positive expectations from the hospital wards towards the students in the next year.
- Positive expectations are expressed in a welcoming attitude from hospital staff and leads to strong student motivation.
- The students benefit from the strong motivation in the form of enhanced self-efficacy and learning outcomes.
- Enhanced learning outcome goes together with improved value creation for the wards.

The model is expanding as the ecosystem is mobilized, both by the students as a mean for them to learn and in the process of recruiting more department as cases. In the end, to the students, the dynamic seems to be able to provide a lot more *"than getting an A grade"* in terms of self-efficacy and motivation.

REFERENCES

"Bachelor of Engineering (BEng) in Process & Innovation." 2023. July 7, 2023. https://www.dtu.dk/english/education/undergraduate/undergraduate-programmes-in-danish/beng-programmes/process-and-innovation.

Blomkvist, Pär, and Lars Uppvall. 2012. "Learning to Love Ambiguity: Authentic Live Case Methodology in Industrial Management Education." *International Journal of Case Method Research & Application* XXIV (4): 272–85.

Buchanan, Richard. 1992. "Wicked Problems in Design Thinking." *Design Issues* 8 (2): 5–21. https://doi.org/10.2307/1511637.

"Budgetaftale 'Tid Til Patienten.'" 2020. . https://www.regionh.dk/presse-og-nyt/pressemeddelelser-og-nyheder/Documents/20186%20-%20Budgetaftale%202020%20Tid%20til%20patienten%20WEB.pdf.

Chandler, Jennifer D, and Robert F Lusch. 2015. "Service Systems: A Broadened Framework and Research Agenda on Value Propositions, Engagement, and Service Experience." *Journal of Service Research* 18 (1): 6–22.

Gibbs, Graham. 1988. *Learning by Doing: A Guide to Teaching and Learning Methods*. Oxford: Oxford Further Education Unit.

Hillerbrand, Rafaela, and Claudia Werker. 2019. "Values in University-Industry Collaborations: The Case of Academics Working at Universities of Technology." *Science and Engineering Ethics* 25: 1633–56.

"Innovation in an Organizational Context. Course Description." 2023. https://kurser.dtu.dk/course/2023-2024/62041.

Keiding, Villads. 2023. "Innovation in an Organizational Context. Course Materials."

Lusch, Robert F, and Stephen L Vargo. 2006. "Service-Dominant Logic: What It Is, What It Is Not, What It Might Be." In *The Service-Dominant Logic of Marketing: Dialog, Debate, and Directions*, 43–56. Armonk, NY: ME Sharpe.

Maslen, Sarah, and Jan Hayes. 2020. "Case Based Learning among Practicing Engineers: Design, Facilitation and Lessons Learned." *Cognition, Technology & Work* 22 (2): 307–19. https://doi.org/10.1007/s10111-019-00569-0.

McAdam, Maura, Kristel Miller, and Rodney McAdam. 2018. "Understanding Quadruple Helix Relationships of University Technology Commercialisation: A Micro-Level Approach." *Studies in Higher Education* 43 (6): 1058–73. https://doi.org/10.1080/03075079.2016.1212328.

Orazbayeva, Balzhan, Carolin Plewa, Todd Davey, and Victoria G Muros. 2019. "The Future of University-Business Cooperation: Research and Practice Priorities." *Journal of Engineering and Technology Management* 54 (October): 67–80. https://doi.org/10.1016/j.jengtecman.2019.10.001.

Osorno-Hinojosa, Roberto, Mikko Koria, and Delia del Carmen Ramírez-Vázquez. 2022. "Open Innovation with Value Co-Creation from University-Industry Collaboration." *Journal of Open Innovation: Technology, Market, and Complexity* 8 (1): 32. https://doi.org/10.3390/joitmc8010032.

Perkmann, Markus, and Kathryn Walsh. 2007. "University Industry Relationships and Open Innovation: Towards a Research Agenda." *International Journal of Management Reviews* 9 (4): 259–80.

Polese, Francesco, Maria V Ciasullo, and Raffaella Montera. 2021. “Value Co-Creation in University-Industry Collaboration. An Exploratory Analysis in Digital Research Projects.” *Sinergie Italian Journal of Management* 39 (2): 117–34. https://doi.org/10.7433/s115.2021.07.

Silva, Muthu de, and Mike Wright. 2019. “Entrepreneurial Co-creation: Societal Impact through Open Innovation.” *R&D Management* 9 (3): 318–42.

Tinto, Vincent. 2017. “Through the Eyes of Students.” *Journal of College Student Retention: Research, Theory & Practice* 19 (3): 254–69. https://doi.org/10.1177/1521025115621917.

Tripathy, Manas Ranjan. 2008. “Case Methodology for Adult Learning.” *Asian Journal of Management Cases* 5 (1): 5–19.