KNOWLEDGE CREATION IN LAB STUDIO MODEL EDUCATIONAL SETTINGS

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Abstract:
In this article we present a study of the LAB studio model from the perspective of knowledge creation. The LAB studio model is a pedagogical model, which develops connections between working-life based problems and the recognition and development of the related business prototypes and start-up companies. The LAB studio model is theoretically grounded in a constructivist view of learning with a project-based learning at its core and has a key goal of educating entrepreneurial competences in higher education. Based on the case study, consisting from a literature review of knowledge creation and a survey, the qualitative results analysis suggests that the model offers good support for the organizational knowledge creation. As a future research more studies are suggested to study the aspects of knowledge creation in the LAB studio model.

Keywords: LAB studio model, interdisciplinary education, knowledge creation, higher education, SECI-model

1. INTRODUCTION

Universities and schools all across Europe are facing challenges related to economical issues and level of teaching. Globalisation and new innovations pose new challenges for science universities and universities of applied sciences. The industry landscape is changing so rapidly that technologies, knowledge and skills obsolete in ever-faster pace. This means that meta-learning skills and innovation skills are crucial for students (Juvonen, 2014). In addition governmental funding for higher education has also been decreasing in Europe (European University Association 2012). This means that new, more effective forms of learning are required. In the Oulu University of Applied Sciences in Finland these challenges have been recognized through the establishment of the LAB studio model (LSM).

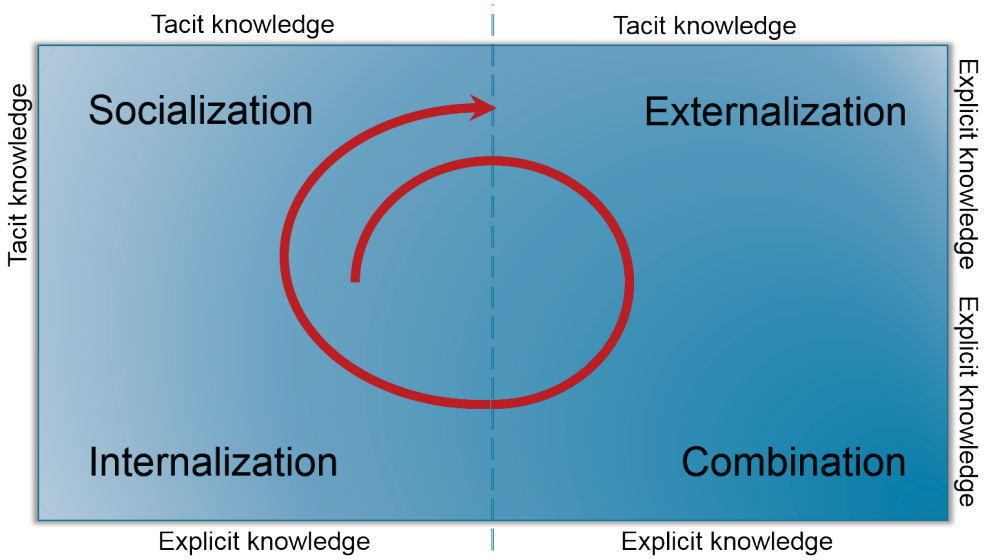
Today, learning is generally seen as both constructive, i.e. learning is done on top of previously gained knowledge, (Tuomi, 1999) and cognitive, i.e. learning is a mental process influenced by intrinsic and extrinsic factors (Kim, 2005). One way to understand learning is to look at it through the concepts of knowledge. Knowledge should be something more than information; otherwise there is nothing new or interesting in knowledge management (Fahey and Prusak, 1996). Thus, following Tuomi's (1999) view Alavi and Leidner (2001) state, "information is converted to knowledge once it is processed in the mind of individuals". In this view knowledge is information plus something more. This "something more" is the associations, memories, past experience – previous knowledge that the individual possesses – that are related to the information. In this view knowledge is "information possessed in the mind of individuals: it is personalized information" (Alavi and Leidner, 2001). An interesting part of this definition is that "knowledge becomes information once it is articulated and presented in the form of text, graphics, words, or other symbolic forms" (Alavi and Leidner, 2001). So knowledge doesn't exist without individuals. Constructive and cognitive learning plays a key role in knowledge creation.

Previously knowledge creation and its methods have not been applied to educational settings extensively. Thus in this paper we focus on LSM from knowledge creation perspective. The research question of this paper is: *Does the LSM have support for the dynamic theory of organisational knowledge creation?* The article is organized as in section 2 dynamic theory of organisational knowledge creation, SECI-model, is introduced. In section 3 the LSM for higher education is introduced, in section 4 the LSM is analysed through the literature review of knowledge creation theories and the interview study. Finally, the section 5 discusses and concludes the paper.

2. KNOWLEDGE CREATION

There are many different models and theories that try to explain how new knowledge is being created, e.g. (Alavi and Leidner, 2001). Nonaka et al. (2000) state that "knowledge is created in the spiral that goes through two seemingly antithetical concepts such as order and chaos, micro and macro, part and whole, mind and body, tacit and explicit, self and other, deduction and induction, and creativity and control." The dynamic theory of organizational knowledge creation, also called the SECI-model, has four modes of knowledge conversions that are created when tacit and explicit knowledge interacts. The modes are (Nonaka, 1994; Nonaka and Takeuchi, 1995): 1) socialization, 2) externalization, 3) combination, and 4) internalization, see Picture 1.

Picture 1: The SECI-model of knowledge creation.



Source: Räisänen, 2010.

Socialization is a process of sharing experiences (Nonaka, 1994). It creates new tacit knowledge from existing tacit knowledge. For example by observing a colleague the observer can learn through imitation or practice. Typically the new tacit knowledge is in a form of shared mental models or technical competences. *Externalization* is a process of articulating tacit knowledge into explicit concepts (Nonaka, 1994). Externalization is the key process in the theory as it is the process that creates new explicit concepts from the tacit knowledge. *Combination* is a process of systemizing concepts into a knowledge system (Nonaka, 1994). It creates new explicit knowledge from existing explicit knowledge. It is the kind of knowledge creation that happens in formal education or training at schools. *Internalization* is a process of embodying explicit knowledge into tacit knowledge (Nonaka, 1994). Reading documentations or watching videos is an example of the kind of "re-experiencing" that internalization requires. Also "learning by doing" can be seen as an example of internalization. In the Table 1 the aspects identified in literature review are displayed.

Table 1: Models and aspects related to knowledge creation identified.

Aspect	Description
Socialization	Sharing experiences, creating new tacit knowledge from tacit knowledge
Externalization	Process of articulating tacit knowledge into explicit concepts
Combination	Creating new explicit knowledge from existing explicit knowledge, combining existing knowledge into new knowledge
Internalization	Process of embodying explicit knowledge into tacit knowledge

Source: Nonaka, 1994.

3. THE LAB STUDIO MODEL CHARACTERISTICS

The LAB studio model (LSM) is an interdisciplinary higher education model aimed at training competent new professionals, self-directed teams and new businesses with an industry focus. In general, the LSM can be defined as a *business pre-incubator*, created to produce promising teams with solid and proven potential for creating their own new business (Heikkinen et al., 2015). As a pedagogical structure, the LSM utilises the *studio based learning* (SBL) for its pedagogical model. SBL can be defined as an instructional strategy that provides students with opportunities to engage in relevant, authentic learning in a school setting (Boyer and Mitgang, 1996; Burroughs et al., 2009). Educational concepts (studio models) utilising SBL are increasingly being developed across Europe, introduced by e.g. (Gielen, F., De Cleyn, S., & Coppens, 2013) and (Bull and Whittle, 2014). The recent study (Heikkinen and Stevenson, 2015) has shown LSM to include several new factors compared to the existing definition of SBL by Bull et al. (2013). These factors include: the offering a form of instruction that is more *competitive in structure* in contrast to other studio models; integrating *experienced professionals and coaches* from the industry; including problems or ideas directly from targeted industries; and building *interdisciplinary* project teams that cross professional and higher education faculty boundaries. The project teams are diverse as they are *interdisciplinary, intercultural* and *inter-generational*. This wide range of experience and expertise is expected to cover the key areas of competences necessary for establishing new ventures (Timmons and Spinelli, 1994), start-up companies for the industries in focus.

LAB studios (LABs) are established around a certain industry theme meaning that LABs are filled with participants having a common interest in a particular industry. The common interest towards certain industry, LAB's *industry focus*, is helping students with different cultures, experience and professions to interact with each other. This connection with the work-life is emphasised by organising common events, seminars and happenings, where *social interaction*, *networking*, non-formal *peer-coaching* and *critique* or *constructive feedback* is promoted. Representatives from the focus industry frequently visit LABs, so thus these visits are often used for *industry feedback* opportunities, during which teams present their progress by demonstrating prototypes and asking for feedback, which in turn can lead to coaching from the visiting specialist. In order to support a climate of critical consciousness, feedback in LABs is given to individuals and to groups during *formal and in-formal* sessions. In this way, giving and receiving feedback is a regular part of LAB studio daily activities. Formal project feedback is also given during weekly progress reviews where participants are invited and *peer-feedback* is given. A LAB studio assessment is completed at the final phase of the LAB in a development discussion, where the student, team leader, profession coach and possibly also the project coach can be present. The discussion is a good opportunity for giving and receiving *constructive feedback* for *reflective* practice (Schön, 1983, 1987). The main focus of these discussions is on increasing the *professional and personal development* of the student (Heikkinen and Stevenson, 2015). Common events are arranged for enabling networking and project introductions between students and coaches. Mostly the students arrange also *impromptu kinds* of events for project feedback sharing. *Excursions to industry companies* or *events* are also an excellent opportunity for receiving feedback. Experiencing real-world contexts and meeting industry professionals give students an opportunity to *reflect* their own professional competences and work.

LAB studio model is strongly focused on having students in a business-orientated location separate from the main campuses of the university. It is this choice that allows for the LAB studio to support the impression of being in a work environment as opposed to a university environment. The physical LAB studio space is located in a *downtown urban area,* in a *small company-like open environment*, as the target is that students *treat the studio as their own company*. Project teams arrange the LAB studio premises, including the seating structure and space usage, according to their needs and organize their work independently. The working space consists of *rooms of differing sizes* for the project teams and individuals (Bull et al., 2013; Heikkinen and Stevenson, 2015). Facilitation of a LAB studio is principally the LAB master's and LAB coaches responsibility. The LAB master is a person belonging to the staff who is responsible for the LAB's activity and functions as a contact person for cooperation partners. The LAB coaches are teachers who through their own professionalism and contacts, participates in both teaching and tutoring of teams. However, in practice *the studio belongs to the students*, and staff only suggest the use of the LAB studio. Access to the *premises enables work in the evenings and weekends*. Since the mode of pedagogy heavily relies on coaching, *staff availability* is a priority (Bull et al., 2013; Heikkinen and Stevenson, 2015). While the notion of coaching is not unique to the LSM, the

interaction between staff and students draws heavily from working life interactions, rather than traditional instructor relations at the higher education level.

According to Bull et al. (2013), "the people in the space" are a critical component of a studio and the LSM has been designed to parallel this view. The values of a LAB studio are similarly person-centric and reflect the LAB's inherent drive to build entrepreneurial thinking and support a problem-solving approach. The LSM *values* focus on two key traits: *Care and Trust.* The value of 'Trust' refers to the fact that students are trusted in their activity to learn and produce results, as well as they also trust to share their ideas with everyone and share their work progress. The creation and maintaining the *'climate of trust'* is LAB masters and coaches responsibility to enhance knowledge creation. The value of 'Care' means taking proper care of everyone and everything involved, from the educators and students to the production and learning results of the projects and teams. This value also emphasizes tutoring as a means for ensuring *professional development*, which is guided by different methods e.g. *development discussions*. The LSM values enhance the social activity in general, meaning the creation of a *safe and respectful environment* for learning as well as for failing, since LABs are also built around a *permission to fail*. Since LABs are open environments for everyone and are more like *'bazaars'* in outlook and feeling, *open events and happenings* occur in *formal and informal* ways as determined by the teams themselves. A high *tolerance of ideas* can also be seen as demonstrated by the wide variation of the happenings arranged on a voluntary basis and by related industry interests. (Heikkinen and Stevenson, 2015)

The key mode of education in LSM is a constructivist approach, utilising *project based learning* (Blumenfeld et al., 1991). Since projects aim to create a real demonstration of their solution, the approach of *learning-by-doing*, initially promoted by John Dewey (1897), is also a critical pedagogical principle of the model. Each student and profession in that project team is served by *coaching* specifically targeting these different roles. In addition, projects are also served by *mentoring* to ensure an industry customer relationship (Carnell et al., 2006). The coaching and mentoring is performed by the teachers according to their skills and strengths and in this way the learning process is viewed as a process of learning and building knowledge is shared within and between professions as *peer-learning* (Boud et al., 1999; 2014). Furthermore, knowledge is generated in cooperation between students, coaches and work-life partners, forming a *community of learners* (Brown and Campione, 1994; Rogoff et al., 1996). The role of coaches and tutors as supervisors of learning is to direct the students to find and build new knowledge and to commit them to work toward the promotion of learning. Additionally, coaching often requires the *improvisation of teaching* (Sawyer, 2004). In LABs the improvisation of teaching is seen as a variation of the methods used at the moment of coaching, and thus can enhance the knowledge creation. The main characteristics of the LSM are summarised in the Table 2.

Table 2: Characteristics of the LAB studio model.

Characteristic	Description
Studio Model of teaching	Instructional strategy that provides students with opportunities to engage in relevant, authentic learning in a school setting.
Critique	Formal and informal, direct and constructive feedback, industry based feedback, peer-feedback, development discussions, reflection
Internal and work-life events	Events between LABs, excursions to industry companies, participating to the industry events and conferences, impromptu events
Culture	Common values: care & trust, commonly created work ethic, treated as an own company, permission to fail, climate of trust, 'Bazaar' of activities, tolerance of ideas, Master-Apprentice learning.
Modes of education	Project based learning, learning-by-doing, peer-learning, community of learners, coaching & mentoring, impromptu teaching, development discussions for professional development.
Physical environment	Open, company like environment, reconfigurable furniture and spaces, students control aesthetic factors and shared, individual, social and private spaces, location in city centre.
Facilitation of studio	Studio belongs to the students, the students create the rules, 24/7 access, high availability of staff
Start-up company, pre-incubator style	Competitive structure, prototype development and business opportunity, coaching for business development

Diverse teams, 3 i's	Projects are interdisciplinary, intergenerational and intercultural with a common interest towards the focus industry.
Collaboration	Teamwork and leadership is supported by physical environment and social media, entrepreneurial thinking.

Source: Partly Heikkinen and Stevenson, 2015.

The LAB studio model can be utilised in educating professionals for various areas of industry and currently is utilised in software applications and game industry education. Oulu Game LAB is an example implementation of the LSM tailored for the game industry needs. Other possible focus areas include urban environment, healthcare and energy.

4. CASE OULU GAME LAB

In this chapter we present the methodology used in the case study, the results of the literature review and the student survey.

4.1 Methodology

For the need for the research method set by the article research question the case study method was chosen. According to Creswell (2012), "case study research is a qualitative approach in which the investigator explores a real-life, contemporary bounded system (a case) or multiple bounded systems (cases) over time, through detailed in-depth data collection involving multiple sources of information." Case study can include either quantitative or qualitative evidence, even both, and it usually relies on multiple sources of evidence and benefits from the prior development of theories (Yin, 1994). In general, LSM offers a potential environment to conduct research and collect data for it. According to Creswell (2012), the data collected for the case study is usually in extensive forms, such as documents and records, interviews, observation and physical artefacts. For the benefit of the data collection the LSM operates in a one physical environment and thus the participants are relatively easy to be invited for an interview. In addition, LABs have a constant flow of students and coaches participating and both are staying at the university after the LAB studies.

To study if the LSM supports knowledge creation two evaluations were conducted. First, in 2014 the different aspects of knowledge creation identified in literature were compared to the characteristics of Oulu Game LAB (OGL). Secondly feedback surveys from the OGL participated students were conducted to get more insights into the knowledge creation processes. Since the OGL has been developing the model for the longest time, over three years, it was chosen for the LAB environment to be studied.

4.2 Results of the literature review

To find the characteristics for knowledge creation support, a comparison how the different aspects of knowledge creation identified relate to the studies in OGL was conducted. Results of the comparison study (Räisänen et al. 2014) suggest that the LSM overall offers support to most the aspects related to knowledge creation. The results suggest also that LABs offer a potential environment for the knowledge creation in the infrastructure point of view, as well as in the learning point of view. To study the learning factor further on, the survey focusing on the SECI-model for the LAB participating students was carried out.

4.3 Results of the student survey

To gain understanding of the dynamic theory of organizational knowledge creation, SECI-model, of the LSM, a survey was done among the OGL-students. Total of 72 students who had taken part of the OGL during the years 2013 and 2014 were surveyed individually. The survey was carried out as an electronic web survey, where the questions were open type of and focused on the socialization, externalization, combination and internalization modes of knowledge creation. The focus for the questions was mostly on the learning aspect but also general aspects related to the Game LAB were asked. Two researchers did the analysis for the data by using Nvivo-tool. All answers, total number of 648, were uploaded to the tool and the researchers read through all the individual answers and made

keyword matches to find similarities between them. The results were gathered to summary sheets provided by the Nvivo-tool. Next the findings of the survey are presented.

Socialization. Based on the survey it was evident that the LSM supports socialization to a great extent. The students were divided into interdisciplinary teams that worked on their game ideas. For socialization it would seem that interdisciplinary nature of the LAB was the biggest benefit: *"The experience of working in such interdisciplinary teams is something that is just not learned in most schools and as such is very good to experience"*. This helped the students in "*…learning good working practices, [gain] an understanding of the industry, and how other disciplines work within it…"*. Working with other disciplines is a good source of tacit knowledge as it is very beneficial e.g. for a graphic designer to see how programmer thinks and vice versa. Or, as one student put it "*[I learned the…] difference of artistic ways vs. technical methods".* In addition the students worked and studied together with like-minded people: *"…other people who have an energy and drive for their passion as you do"*. All in all the students felt that the OGL provided them with a "*…unique opportunity to experience what game development is like, in an environment that's very close to working in a real game company"*. For the socialization the experience and the environment was probably the main source of tacit knowledge. Lastly one other aspect of socialization and working together that was not so evident was that the students were *"making existing and future contacts within the field"*, building networks for learning. While this was not directly beneficial to knowledge creation processes it would surely be important later on in their careers.

Externalization. Externalization is the SECI-mode of transferring tacit knowledge into explicit knowledge. There was no specific part of the OGL that focused on externalization. The teams had to produce high-level concepts of their ideas as well as prepare elevator pitches and presentations about the games. When the students were designing the game concept they felt that sharing was crucial as it helped the teams develop their ideas further: *"the fact that you should share ALL the ideas that you get, even the stupid ones because someone else can improve that stupid idea to a great idea"*. Sharing plays a major role in externalization. Some students also indicated that they liked the peer group meeting (e.g. all the programmers had weekly meetings where they discussed the problems they had faced). Within these weekly peer group meetings externalization was probably easier than normally. The reasoning for this is that people in these peer groups had similar backgrounds and knowledge so articulating tacit knowledge might be easier than with somebody with no relevant background. Peer groups were also excellent place for sharing ideas.

Combination. Combination is about combining existing explicit knowledge into new forms of explicit knowledge. One student explained one clear example of this: *"[Oulu Game LAB is…] all about transferring your existing skills to the computer games industry and acquiring new skills along the way"*. Part of the skills is surely tacit but they also have explicit elements that can be applied into another industry. Again interdisciplinary teams seem to provide good starting point for combination. By working together students were able to learn how to focus their initial ideas and combine them into the design concept: *"how to get a concept together from an idea"*. Designing high-level concepts seemed to require the most combination. All team members had some ideas and solutions and it was up to the teams to combine them into one. At the same time this was a challenge and opportunity for the teams: *"Working with the game design document, especially […] with new people in the team. It showed how much it helps having assistance when working with such thing. Also on the other hand it showed what happens when several designers have slightly different views on the same game feature or mechanics".* Or as another student put it: *"recalibrating your first idea with new teammates."* Some students indicated that they had gained understanding of the *"big picture"* and *"the whole meaning of the lead phase"*. This could indicate that they managed to see how their own and their colleagues' competences and knowledge relate to game industry and game design.

Internalization. Internalization is producing new tacit knowledge from explicit knowledge. In OGL this was best characterized by learning-by-doing: *"working with the project was the main source of education"*. Also the project work *"helped a lot to realize that without teamwork and leadership it is really hard to achieve good work"*. Since OGL students are mostly third-year students they all know that software is done in teams and projects. It is still interesting to see that while they knew it they had not internalized it before OGL: working with actual project with actual deadlines made them realize the importance teamwork and leadership. Or as one student put it: *"…working with other is mostly [difficult], but you somehow you have to manage the 'More-people-more-chances-to-go-wrong'-ratio."* Another simple thing that the students had not internalized was communication: "*I think in this first few*

weeks the main part that I learn was: communication. Communication with people whit different backgrounds: nationality's and working-fields". Everybody knows communication is important but usually students fully realize it only after they run into some problems with it. As part of the learning-by-doing the students are also required to make most decisions by themselves. This causes them occasionally to make mistakes but in most case this was another source for learning: *"mistakes and such were beneficial and it's good that they were done"*. Indeed *fail fast, fail often* is one of the key elements of the LSM and it seems to be a good for internalization.

5. DISCUSSION AND CONCLUSION

Study in this paper is about how the LAB studio model (LSM) supports the dynamic theory of organizational knowledge creation. For that, the characteristics of LSM are presented and the model supporting the SECI-model (Nonaka, 1994) of knowledge creation is investigated. A case study of Oulu Game LAB, an example implementation of the LSM is provided by evaluating the OGL both theoretically and by collecting data using a survey among the students of the OGL. The results would indicate that LSM and similar models provide good support for organisational knowledge creation. Based on the results of the survey and by the comparison of how the LSM matches with knowledge creation we propose that LSM offers promising support for knowledge creation aspects, especially the SECI-model seems to be well supported. This would indicate that traditional classroom is not the optimal form of education from knowledge creation perspective. The more we can get the students to actually work on actual projects the better it is for knowledge creation.

If we critically look that the LSM a lot of the success is based on the location of the LAB as well as the expertise of the coaches. Optimally the LAB is based on a place that stimulates start-up mentality and allows the students to interact with non-students. This way there will be a lot of informal learning. Also the coaches have to be familiar with the model in order to be of use to the students. If there are many teams with many different problem domains this can be a challenge. Our understanding is that LSM is worth of more investigation from the area of knowledge creation. As in this paper we focused on game industry education, in the future research the results provided by this study should be tested also in another industry sectors, like health care sector.

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