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Studying the Aspects of Knowledge Creation in the LAB Studio Model

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The organisations of higher education are constantly changing. Universities, colleges, private schools and online universities refine their pedagogical methods and learning models in a competitive market. This article is a study on whether one such model helps students to gain new knowledge. A study of the LAB studio model (LSM), which is a pedagogical model developing connections between working-life based problems and the recognition and development of business-related prototypes and start-up companies, is presented. The LSM, theoretically grounded in a constructivist view of learning with a project-based education at its core, has the key goal of educating entrepreneurial competences in higher education. Based on the case study, comprisinga literature review of knowledge creation and a survey, the qualitative results analysis suggests that LSM offers a promising support for knowledge creation. The results lead to the conclusion that LSM provides support especially for the various modes of the SECI model, such as socialisation and internalisation, and seems to support organisational knowledge creation aspects as well.

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

Introduction

There is a demand for professionals who are able to create new knowledge across boundaries of disciplines, professions and perspectives. These so-called knowledge workers are lifelong learners who continually acquire and develop new knowledge (Cremers, 2016, p. 11). Universities and institutions for vocational education are all challenged to educate these knowledge workers to rapidly changing industry landscapes, where technologies, knowledge and skills obsolete in an 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. At the Oulu University of Applied Sciences (OAMK) these challenges have been recognised through the establishment of the LAB studio model (LSM). The LSM is a

higher education, interdisciplinary education model utilising studio based learning (Bull, Whittle, & Cruickshank, 2013) and aimed at training competent new professionals, self-directed teams and new businesses with an industry focus.

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 – as we learn we gain new knowledge. In IT literature, knowledge is defined usually by distinguishing between knowledge, information and data. Data is seen as raw numbers and facts, information as processed data and knowledge as personalised information. What is important in this classification is the distinction of knowledge and information. Knowledge should be something more than information – otherwise there is nothing new or interesting in knowledge management (Fahey & 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 regard. knowledge is 'information possessed in the mind of individuals: it is personalised information' (Alavi & 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 & Leidner, 2001). So knowledge does not exist without individuals. As such, constructive and cognitive learning plays a key role in knowledge creation. From an educational point of view, it is important to find pedagogical methods that help students to learn and generate new knowledge. Studies about knowledge creation and its methods applied to higher educational settings are done by, e.g., Omona, van der Weide, and Lubega (2010), Yeh, Huang, and Yeh (2011), Biasutti and Heba (2012), and Cheng, Ho, and Lau (2009). Despite the growing interest towards higher education settings utilising studio based learning – e.g., Carter and Hundhausen (2011), Bull and Whittle (2014), and Bosman, Dedekorkut, and Dredge (2012) – they are not studied by the theory of organisational knowledge creation. In this article, a study of the most commonly referred organisational knowledge creation theory, SECI model (Nonaka, 1994; Nonaka & Takeuchi, 1995), as part of LSM utilising education program, more specifically the case Oulu Game LAB (OGL), is introduced. As the studio learning models emphasise learning in interdisciplinary teams and projects, this paper focuses on organisational knowledge creation. For this, SECI model provides the theoretical background. The research question is defined as:

Does the LAB studio model have support for the most common knowledge creation model as identified by the literature? In the second section organisational knowledge creation is discussed. In the third section the LSM for higher education is introduced and in the fourth section the LSM is analysed through the literature review of knowledge creation theories and the interview study. Finally, the fifth section discusses and concludes the paper.

Organisational Knowledge Creation

There are many different models and theories trying to explain how new knowledge is being created. For an excellent review, please see Alavi and Leidner (2001). Nonaka, Toyama, and Konno (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 organisational knowledge creation, also called the SECI model, has four modes of knowledge conversions that are created when tacit and explicit knowledge interact. The modes are (Nonaka, 1994; Nonaka and Takeuchi, 1995) socialisation, externalisation, combination and internalisation, as illustrated in Figure 1.

Socialisation 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. *Externalisation* is a process of articulating tacit knowledge into explicit concepts (Nonaka, 1994). Externalisation is the key

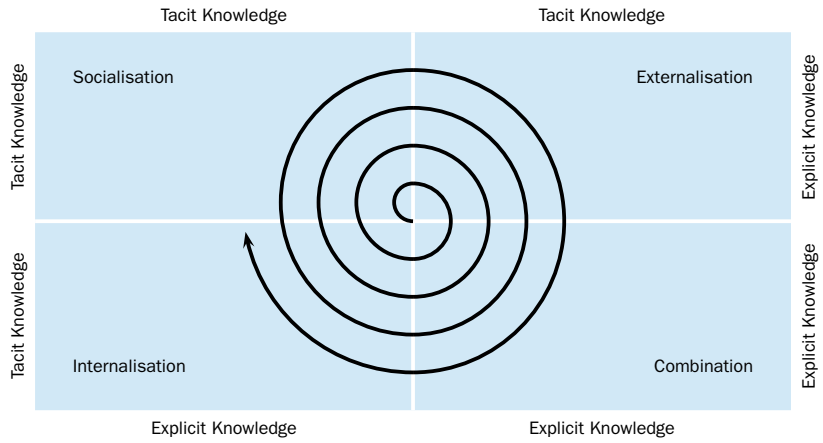

Figure 1 The SECI Model of Knowledge Creation

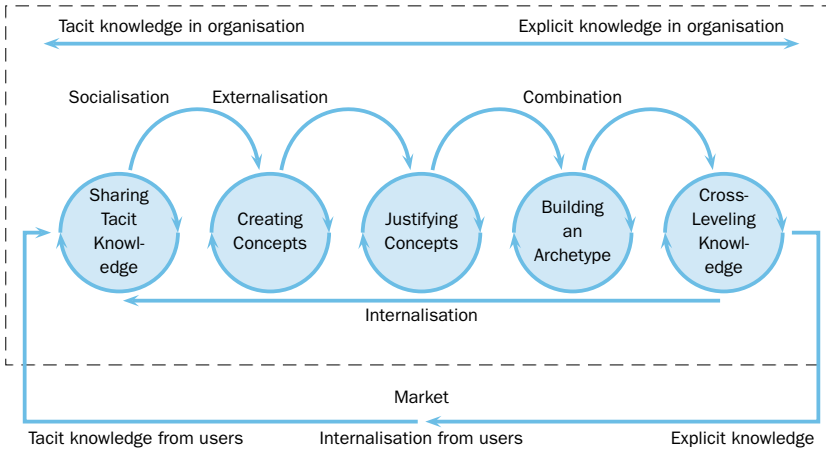

Figure 2 Five-Phase Model of the Organisational Knowledge-Creation Process (adapted from Nonaka and Takeuchi, 1995)

process in the theory, as it is the process that creates new explicit concepts from the tacit knowledge. *Combination* is a process of systemising 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. *Internalisation* 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 internalisation requires. Also 'learning by doing' can be seen as an example of internalisation.

In addition to SECI, Nonaka and Takeuchi (1995) also provide a five-phase model of the organisational knowledge-creation process. The model consists of the following phases: sharing tacit knowledge, creating concepts, justifying concepts, building an archetype and cross-leveling knowledge. Figure 2 illustrates the process.

As organisations cannot create knowledge by themselves the knowledge creation starts by harnessing the tacit knowledge residing in the individuals, *sharing tacit knowledge.* This phase matches with the socialisation mode of the spiral. The second phase, *creating concepts,* uses collective reflection to verbalise the shared mental models into words and phrases and, finally, into explicit concepts. The externalisation mode of the knowledge creation spiral is similar to the creation of concepts-phase. As these concepts are created, the organisation must screen them in order to justify the 'true beliefs' among the rest. This third phase, *justifying concepts,* does not have equivalent in the knowledge conversion modes. The organisation needs some sort of criteria for the justification. For example, some con-

Table 1 Models and Aspects Related to Knowledge Creation Identified

Aspect	Description
Socialisation	Sharing experiences, creating new tacit knowledge from tacit knowledge.
Externalisation	Process of articulating tacit knowledge into explicit concepts.
Combination	Creating new explicit knowledge from existing explicit knowledge, combining existing knowledge into new knowledge.
Internalisation	Process of embodying explicit knowledge into tacit knowledge.
Creating concepts	Collective reflection to verbalise the shared mental models and into explicit concepts.
Justifying concepts	Process of justifying that the created concepts are true.
Building an archetype	Build a prototype of the product under development.
Redundancy	The existence of information that goes beyond the immediate operational requirements of organisational members.
Requisite variety	Combining information differently, flexibly, and quickly, and by providing equal access to information.
Justifying concepts	Process of justifying that the created concepts are true.
Building an archetype	Build a prototype of the product under development.
Cross-leveling knowledge	Move the justified concepts on to another ontological level where new knowledge creation process can begin.

Notes Adapted from Nonaka and Takeuchi (1995).

cepts may be too expensive or otherwise not feasible. The justified ones can be taken to the fourth phase, *building an archetype,* which can be a prototype of the product under development, for example. As the prototypes are usually built by combining existing knowledge with the newly built concept, this phase is close to the knowledge conversion mode of combination. The fifth and final phase of the model is the *cross-leveling knowledge.* In this phase, the newly created, justified and modelled concept moves on to another ontological level where a new cycle of knowledge creation process can begin.

In Table 1 the aspects identified in the literature review are displayed. Sharing of tacit knowledge is omitted because it is equal to the SECI model of socialisation.

Collective reflection to verbalise the shared mental models and into explicit concepts. Justifying concepts Process of justifying that the created concepts are true. Building an archetype Build a prototype of the product under development. Redundancy The existence of information that goes beyond the immediate operational requirements of organisational members. Requisite variety Combining information differently, flexibly, and quickly, and by providing equal access to information. Justifying concepts Process of justifying that the created concepts are true. Building an archetype Build a prototype of the product under development. Cross-leveling knowledge Move

the justified concepts on to another ontological level where new knowledge creation process can begin.

The LAB Studio Model Introduced

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, Seppänen, & Isokangas, 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 & Mitgang, 1996; Burroughs, Brocato, & Franz, 2009). The recent study by Heikkinen and Stevenson (2016) 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 intergenerational. This wide range of experience and expertise is expected to cover the key areas of competences necessary for establishing new ventures (Timmons & Spinelli, 1994), start-up companies for the industries in focus.

LSM development process consists of two main parts: a concept development part called LEAD and a demonstration development part, called LAB. In the LEAD-part, students produce concepts needs provided by existing companies or organisations or by the participants themselves. Individuals are organised into groups associated with a particular idea and then engage in a process of concept design. The teacher's role is that of a coach and in most cases students have to solve the problems themselves, as coaches will help but only as little as needed. The process of concept design in the LEAD-part places considerable effort into finding the ideas that hold potential market value. This is done through the use of an internal competition process. The developed concepts are presented in a specific event named Gate 1 and Gate 2, where some of the projects are cancelled simultaneously as some of projects continue and new teams are formed in order to start building a demonstration of their concept. The decision of the continuing projects is done by a group of external judges consisting of industry professionals. In the LAB-part, teams set after the last stage of LEAD-part, develop demonstrations (demos) of the concepts including so-

lution and the business related-model. Roles within the development team are defined and effort is put into both demo development and individual's professional skill development. The LAB-part ends with an Expo-event, which is an event for all students meeting professionals from the industry. In the event, student teams present their solutions and business models with the aim of receiving customer-oriented and professionals feedback.

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 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 informal 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 & Stevenson, 2016). 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.

LSM 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 organise their work independently. The working space consists of rooms of differing sizes for the project teams and individuals (Bull et al., 2013; Heikkinen & Stevenson, 2016). 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, participate 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 & Stevenson, 2016). 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.

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, MacDonald, & Askew, 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 among professions as peer-learning (Boud, Cohen, & Sampson, 1999; 2014). Furthermore, knowledge is generated in cooperation among students, coaches and work-life partners, forming a community of learners (Brown & Campione, 1994; Rogoff, Matusov, & White, 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 knowledge creation. The main characteristics of the LAB studio model are summarised in Table 2.

The LSM 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 (see http://www.oamklabs.fi/oulugamelab) is an example of the implementation of the LSM tailored for the game industry

Table 2 Aspects to the LAB Studio Model

Aspect	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 and reflection.
Internal and work life events	Events held between LABs, excursions to industry companies, participating to the industry events and conferences and impromptu events.
Culture	Culture of excellence, 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 and Master-Apprentice learning.
Modes of education	Project- and problem-based learning, learning-by-doing, peer-learning, community of learners, coaching & mentoring, impromptu teaching, competitive structure and 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 and location in city center.
Facilitation of studio	Studio belongs to the students, the students create the rules, 24/7 access and high availability of staff.
Start-up company, pre-incubator style	Concept development, prototype development and business opportunity, coaching for business development.
Diverse teams, 3 i's	Projects are interdisciplinary, inter-generational and intercultural with a common interest towards the focus industry.
Collaboration	Teamwork and leadership is supported by physical environment and social media, entrepreneurial thinking.

Notes Partly adapted from Heikkinen and Stevenson (2016).

needs. Other possible focus areas include urban environment, healthcare and energy.

Case Study of Oulu Game LAB

Methodology

A qualitative case study method was chosen for the study. According to Creswell (2012) and Yin (1994), a case study can include either quantitative or qualitative evidence, even both, and it usually relies on multiple sources of evidence and benefits. For the benefit of the data collection, the LAB studio model (LSM) operates in one physical environment and thus it is relatively easy to invite participants for an interview. In addition, LABs have a constant flow of students and coaches participating and both are staying at the university after the studies in LABs. Since the Oulu Game LAB (OGL) has been developing the model for the longest time, over three years, it was chosen for the LSM environment to be studied.

The study was conducted in two parts. First, a comparison study using a literature review was made for understanding how different aspects of organisational knowledge creation identified in literature relate to the characteristics of OGL. Three researchers made the comparison study and the results were presented in an international knowledge creation workshop in October 2014. Secondly, student feedback surveys were conducted to get more insights into the knowledge creation processes. In these surveys, the aspects of the SECI model were on a focus, as the other aspects of the organisational knowledge creation are considered to support it. A total amount of 72 students were surveyed individually while taking part of the OGL during the years 2013 and 2014. The survey was carried out as an electronic web survey, where the questions were of open type. After uploading all the 648 answers to the Nvivo-tool, researchers read through all the individual answers and made a keyword match to find similarities between them.

Findings of the Comparison Study

The results of the comparison study by Räisänen, Heikkinen, and Stevenson (2014) suggests that the LSM overall offers good support to most of the aspects related to knowledge creation. Furthermore, the results suggest that LABs offer a potential environment for knowledge creation in the infrastructure point and learning point of view. Critical aspects of the study suggest that for LSM will be a challenge to find suitable locations and find coaches with relevant knowledge. This is due to that the fact that the LABs are based optimally in a physical place that stimulates a start-up mentality and where coaches encourage participants to interact with the particular industry.

Findings of the Student Survey

Based on the survey, it was evident that the LSM supports socialisation to a great extent. The students were divided into interdisciplinary teams that worked on their game ideas. For socialisation, it would seem that the *interdisciplinary* nature of the LAB was the biggest benefit. 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 a programmer thinks and vice versa. In addition, students worked together with *like-minded* and talked with like-minded professionals. All the students in the survey felt that the OGL provided them with an opportunity to experience what game development is like in a *company-like environment.* For the socialisation, the experience and the environment was probably the main source of tacit knowledge. Lastly, one other aspect of socialisation and working together that was not so evident was that students were *building networks* for learning. The excursions to the

Table 3 Socialisation Aspects and the Supporting Quotes from the Survey

Aspect	Quotes from the survey
Interdisciplinary	'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.' '[gain] learning good working practices, an understanding of the industry, and how other disciplines work within it.' '[I learned the] difference of artistic ways versus technical methods.' 'The creative process that brings different things together from different creative aspects.'
Like-minded people	'[meeting] other people who have an energy and drive for their passion as you do.' 'Talk with the professionals [. . .] Good tips, stuff about the same ideas we are working, [. . .] more like socialising.' 'This is probably the first time that professionals from the game industry give you feedback and you get to talk with them and hear them talk about what they have on their mind.' 'It's always nice to meet new people, you reach in your lives new people when meeting, and it's nice to use them in your script writing.'
Company-like environment	'[It's an] unique opportunity to experience what game development is like, in an environment that's very close to working in a real game company.'
Building networks	'Making existing and future contacts within the field.' '[The industry events are] really great and helpful, as it showed the important social part of this area of business.' 'If you are too afraid to open up, you can not succeed.' 'The parties are good for socialising.' 'We went bowling and got familiar with each other. It was a bonding moment.'

industry events and parties arranged were also considered to be beneficial for the socialisation. While this was not directly beneficial to knowledge creation processes it would surely be important later on in their careers. Table 3 presents the findings of socialisation aspects and the supporting quotes from the survey.

The LSM does not explicitly emphasise externalisation, instead externalisation happens naturally by working and collaborating together, and many aspects in LSM support it. The teams had to produce high-level concepts of their ideas, as well as prepare elevator pitches and presentations about the games. When students were designing the game concept, they felt that sharing was crucial as it helped the teams develop their ideas further. *Sharing* plays a major role in externalisation. 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, externalisation 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. Besides peer group meetings, *presentations* were also excellent places for sharing ideas and giving feedback. Table 4 presents the findings of externalisation aspects and the supporting quotes from the survey.

Table 4 Externalisation Aspects and the Supporting Quotes from the Survey

Aspect	Quotes from the survey
Sharing	'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.' '[. . .] marketing was missing, I had experience about it, [. . .] Yesterday [I was] sharing experiences about the marketing, very good for covering the marketing tasks.' 'I don't think we'd get this far without having feedback from outside.' 'You have to let let others influence to your work. Discover influences anywhere.'
Peer group meeting	'[The most beneficial were the] peer-group meetings on certain weekdays and the ways people crushed my soul.' 'Working in group with people I didn't know before.' 'Neighbours [students] are helping by giving feedback. Like how the figure fits into the game.'
Presentations	'Presentations are good learnings.' 'You learn via that feedback, it's really, really useful. Better products are coming via these testing sessions.' '[. . .] was a really beneficial in the end, it forced us to create a condensed package of our game, and present it.' '[. . .] good game idea is not enough. You also need to know how to know how to implement and present it, not just to your own team and company but also to the investors.'

Again interdisciplinary teams seem to provide a 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. *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. Some students indicated that they had gained understanding of the big picture and the whole meaning of the concept development. This could indicate that they managed to see how their own and their colleagues' competences and knowledge relate to game industry and game design. During the *development,* understanding new knowledge from other disciplines caused new learning in one's own discipline. Table 5 presents the findings of Combination aspects and the supporting quotes from the survey.

In OGL internalisation was best characterised by learning-by-doing. 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 internalised it before OGL: working with actual projects with actual deadlines made them realise the importance of *teamwork* and leadership. Another simple thing that students had not internalised was *communication.* Everybody knows communication is important but usually students fully realise it only after they run into some problems with it.

As part of the learning-by-doing, students are also required to make most decisions by themselves. This causes them occasionally to make mistakes but in most cases this was another source for learning. Indeed *fail fast, fail*

Table 5 Combination Aspects and the Supporting Quotes from the Survey

Aspect	Quotes from the survey
General	'[OGL is] all about transferring your existing skills to the computer games industry and acquiring new skills along the way.' 'I'm today looking games differently, from the mechanics point of view.'
Designing high-level concepts	'How to get a concept together from an idea 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 mechanic.' 'Recalibrating your first idea with new team mates.' 'Understanding the big picture [and] the whole meaning of the lead phase.' '[He] gave us Game Design angles hints, and we didn't take his advice. We were almost eliminated because of our wrong choice. So actually he gave us some good notes.'
Development	'I guess I've learned a little bit little bit how programmers think and how, I think [. . .] I know in this point that what I'm doing.' '[he] helped to reduce the amount of code by the sound design.' '[he] introduced new SW-tools for me, but I didn't take them then. Few weeks ago I took his recommendation and I see now what he means. He's little bit of a mentor, it's really needed.' 'I like my role as an artist here, even though my style is different than needed, and it took awhile to unite it. Now I understand how I should make the pictures. I learned a lot how to adjust my style to the need.' 'I met lot of professionals in Kajaani, I usually don't make notes, but now I had to make notes. I took those tips into use.'

often is one of the key elements of the LSM and it seems to be good for internalisation. Table 6 presents the findings of Internalisation aspects and the supporting quotes from the survey.

LSM supports the organisational knowledge creation by its development process. The LSM starts by students *creating concepts* including a solution and a business-related model to a recognised need. During the concept development, students were sharing their experiences freely in a dialogue withothers and external participants, as they own the rights to their work. *Justifying concepts,* as well as *building an archetype* concept, play a major role in the LSM development process. Gates were considered to be one of the most beneficial moments of learning. Especially the provided professional feedback, i.e., justifying, of their developed concept was seen as a learning moment. At the same time, the amount and quality of the feedback was not considered to be equal for all. Project cancellation at the Gate caused some disappointments, which, however, was considered to be a good learning moment. In the LAB-phase every team and student are involved into the development process, where they can utilise their skills in order to turnthe concept into real. The prototypes are tested by the external for receiving feedback, which is then analysed for further develop-

Table 6 Internalisation Aspects and the Supporting Quotes from the Survey

Aspect	Quotes from the survey
Learning-by-doing	'Working with the project was the main source of education.' 'Helped a lot to realise that without teamwork and leadership it is really hard to achieve good work.'
Teamwork	'[. . .] working with other is mostly [difficult], but you somehow you have to manage the "More-people-more-chances-to-go-wrong'-ratio." 'The teamwork lessons [. . .] helped a lot to realise that without teamwork and leadership it is really hard to achieve good work.' 'Greatest challenge for me was leading teamwork. I failed that, but learned so much.'
Communication	'I think in this first few weeks the main part that I learn was: communication; communication with people with different backgrounds, nationalities and working-fields.' 'Learned communication by mistakes.' 'Mostly our problems are communication problems.' '[. . .] communication could have been better. But OGL cannot do everything for us, we have to learn to ask our self too.'
Learning after failing	'Mistakes and such were beneficial and it's good that they were done.' '[. . .] because of rapid action failures are revealed quickly. That's effective way of turning theory to something concrete.' 'Best way to learn is by doing so I consider all the time spent on the development of the projects to be the most beneficial, fail fast.'

Table 7 Aspects of Organisational Knowledge Creation and the Supporting Quotes from the Survey

Aspect	LSM process and Quotes from the survey
Creating concepts	*LEAD-part.* 'Thinking outside of the box and bravely using own ideas was encouraged.' 'The concept development was a really fun and creative part of OGL. So many great ideas came up, yet so little time to realise them.' 'I really liked to do the concept development but I feel a little more guidance would be on its place.' 'I think that the first month (the concepting part) was the best and also the worst part of the whole course.'
Justifying concepts	*Gate-events and other organised events. Feedback given by peers, coaches and externals.* 'The gates were really good milestones and gave deadline for the concept work. Got really good feedback from professionals from game industry and trained for public appearances and pitching.' 'Gates were exciting, terrifying and a good learning experience. It was great to hear honest feedback about your game ideas, especially on gate 2.' 'Gate scores and feedback didn't really correlate. Lots of unexpected things happened.' 'Again, failure and how to climb back up from that deep and dark hole is most beneficial way of learning to me.'
Building an archetype	*LAB-part.*
Cross-leveling of knowledge	*Expo-event.* '[. . .] was giving really straight feedback from our game, e.g. pointing out the importance of business understanding. She was shaking her head when almost everybody told that they wanted to do a just a game instead of making money with it. Positive experience without drama.'

ment. The survey did not include questions about the demo development part. *Cross-leveling knowledge* can be seen happening in the Expo-events, where customer oriented and professional feedback is received from the industry professionals. Students respected the given feedback at the Expo-event.

Conclusion

In this paper it was studied how the LAB studio model supports knowledge creation and different aspects related to it. To achieve that, the LSM for higher education was presented and the model supporting the SECI model and organisational aspect of knowledge creation as identified by literature was investigated. Results from a case study of Oulu Game LAB were achieved by analysing the collected data from a survey among the students of the OGL. The results would indicate that LSM provides good support for SECI model and 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 a promising support for aspects of knowledge creation, especially the SECI model seems to be well supported. For example, socialisation is about working together and teams solving problems, and, more importantly, making mistakes together and learning from them. Actually, those shared mistakes often are important sources for their learning. In addition, the process of LSM seems to support organisational knowledge creation. These suggestions 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 at the LSM, a lot of the success is based on the location of the LAB studio, as well as the expertise of the coaches. Also, as in this paper we focused on game industry education, the results might not apply in other fields of education.

As an implication of this study, the studio-based learning is promising for knowledge creation purposes. Students work in teams and they learn both industry-specific knowledge, as well as knowledge and expertise related to their own field of study. This is important as the students get to practise previously acquired skills and knowledge in an environment more similar to work life. This might raise the question whether the opposite might also be true, since it might not be optimal to use studio-based learning to learn completely new skills or knowledge from their own field of study. For that case traditional way of learning might be more suitable. Managerial implications for higher education could be that the first three or four years should be planned for learning skills from the students' own field of study and studio model type of learning could be applied for the rest of their studies.

The study indicates also that LSM is worth of more investigation from the area of knowledge creation. For future research, we propose the rest of the knowledge creation theories by Nonaka and Takeuchi (1995); Ba and Enabling Conditions, should be studied. Also, as in this paper, we focused on game industry education; in future research, the results provided by this study should also be tested in other industry sectors.

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