Education in the North

UNIVERSITY OF ABERDEEN

ARTICLE

LAB studio model: Developing external networks for learning entrepreneurship in higher education

Kari-Pekka Heikkinen, kari-pekka.heikkinen@oamk.fi

Ulla-Maija Seppänen, ulla-maija.seppanen@oamk.fi

Jouko Isokangas, jouko.isokangas@oamk.fi

Oulu University of Applied Sciences

DOI: https://doi.org/10.26203/600j-v446

To cite this article: HEIKKINEN, K.-P., SEPPÄNEN, U.-M. and ISOKANGAS J., (2015) LAB studio model: Developing external networks for learning entrepreneurship in higher education. *Education in the North*, **22**(Special Issue), pp.49-73.

LAB studio model: Developing external networks for learning entrepreneurship in higher education

Kari-Pekka Heikkinen, kari-pekka.heikkinen@oamk.fi

Ulla-Maija Seppänen, ulla-maija.seppanen@oamk.fi

Jouko Isokangas, jouko.isokangas@oamk.fi

Oulu University of Applied Sciences

(Received October 2015)

Abstract

This article summarises a study of the purposefulness, structure and amount of external learning networks formed during an interdisciplinary higher education programme based on a LAB studio model. The LAB studio model is a learning model, which develops connections between working-life based problems and the recognition and development of the related business prototypes and startups. The LAB studio model is theoretically grounded in a constructivist view of learning with a project-based education at its core and has a key goal of educating entrepreneurship competences. The data for the study was collected through semi-structured interviews with six student teams (N=35) during May 2015. The data analysis took place through mixed methods, which as a method focuses on collecting, analysing, and mixing both quantitative and qualitative data. Findings show that the LAB studio model challenges and enables students to develop new learning networks external to the traditional university environment. New learning networks are created due to the demanding problem - solving process used in the teaching activities. Overall, the education programme broke down barriers between the education environment and external business environment through the establishment of learning networks. In conclusion, the learning networks formed during the education programme were wide-ranging, and the role of students was active and self-directive. Furthermore, we suggest that social capital was increased during the educational process.

Keywords: LAB studio model, interdisciplinary education, entrepreneurship education, learning network, social capital

Introduction

At the strategic level, education in the European Union is strongly encouraged to be smart, sustainable and inclusive. The education sector, especially higher education, is currently challenged, however, to develop new ways to connect smart learning and inclusive growth. Universities need to respond to the challenges of educating students who have the competences, mindset and confidence for innovativeness and entrepreneurship that can be turned into products and services for growth and jobs (Europe 2020, 2010.) The solution for this is to create and develop innovation - and entrepreneurship-friendly learning methods and environments that are connected to its operational environment. Learning that is closely connected to this environment also supports the modernisation of labour markets. This shift has the potential to empower people by developing their competences and skills.

Entrepreneurship is seen as a society renewing phenomenon (Kuratko, 2005). Despite efforts to develop entrepreneurship education in higher education institutions, the results have been relatively moderate, (e.g. Pihkala, 2007). The one key challenge of entrepreneurship and entrepreneurship education is to increase recognition of consumers' and market needs (Hobday, 1998), and to require the revision of products and services (Miettinen, Toikka, Tuunainen, Lehenkari and Freeman, 2006). Entrepreneurship education in higher education should not teach students to adapt to change, but rather to become agents of change. Traditional classroom, textbook and teacher-centred learning models and methods are differentiated from the operational environment and societal development. Connecting education and the development of working life requires the construction of a learning network (Coombs, Chappels and Shove, 1985; Miettinen, Isokangas and Peisa, 1997). As a result, one of the significant objectives of a learning activity (Engeström, 1987) is to increase the social capital within a learning network. Entrepreneurship education in higher education systems today is not fully utilising the benefits from master-apprentice methods alongside building opportunities for interdisciplinary work among students. Additionally, current learning in higher education does not allow for the development of wide networks, but instead focuses on contacts with a limited range of experience or professions.

In the Oulu University of Applied Sciences (Oamk) these challenges have been recognised through the establishment of the LAB studio model of learning. This article summarises a study of external learning networks as part of an interdisciplinary education programme, the main principles of the LAB studio model

and more specifically how this model supports the development of external learning networks during one example programme - Oulu App LAB (OAL).

The two research questions explored in this study were:

1. What types of external networks did students build and engage in as part of the programme?
2. To what degree did these external networks connect with the programme content areas?

Entrepreneurship education and learning networks

The main focus of entrepreneurship has shifted to the process of creating new businesses (Alvarez and Barney, 2006; Detienne and Chandler, 2004; Gaglio and Gatzt, 2001; Shane and Venkataraman, 2000). The new business creation process is recognised as producing economic value as well as personal relationships (Puhakka, 2002). It is also suggested that the creation of a new business is often an iterative process (Davidsson, 2005). The process is connected to changes in the operational environment (Bryat and Julien, 2000; Eckhard and Shane, 2003) and is used to develop knowledge and networks for the benefit of new businesses (Elfring and Hulsink, 2003; Sarasvathy, 2001). Miettinen, Toikka, Tuunainen, Lehenkari and Freeman (2006) define a network as a structure including individual units and the combination of bonds between units. Furthermore, a network provides timely access to knowledge and resources that are otherwise unavailable, while also testing internal expertise and learning capabilities (Powell, Koput and Smith-Doerr, 1996).

Entrepreneurs need to form social capital in order to obtain information, advice and support. Social capital refers to the connections between individuals, and those connections formed through social networks and norms of reciprocity and trust (Putnam, 2001; Miettinen *et al.* 2006). Social capital is essential for accessing and navigating support networks, which in turn reduce the level of equivocality and increase the credibility of the entrepreneur and his/ her project. Social capital is also important for building and utilising networks that give access to the external resources necessary to the success of the project (Fayolle and Lamine, 2013). Overall, social capital can be divided into the amount of social interaction, closeness of relationship and the commitment to relationship. According to Puhakka (2002), the amount and activity of social relationships promotes new knowledge, creates future

states and collective information processing through the recognition of business opportunities.

Entrepreneurship education should connect the phenomenon of entrepreneurship closely with the changing operating environment. Historically, formal education has differed from learning in the informal sector and in working life (Engeström, 1987; Miettinen, 1990). Teaching has typically been teacher-led, involving textbook- and individual-centred learning in classrooms with few connections with actors outside of the education context (Miettinen, Isokangas and Peisa, 1997). Tangibly, the focus of classroom-based learning has been the textbook. In contrast, the objective of educational change is to move beyond the lesson and textbook structure and move to connect more strongly with activities focused on societal use. Undoubtedly, this change will require networking with actors outside the education environment and the formation of learning networks (Miettinen, 1999; Miettinen and Peisa, 2002).

Entrepreneurship as new business creation is linked to changes in the environment and societal phenomena. Educational activities related to the recognition of business opportunities have increased as part of entrepreneurship education (Detienne and Chandler, 2004). Ultimately, linking the recognition of business opportunities to learning requires a detachment from traditional classroom pedagogy (Fiet, 2001; Honig, 2004) and building bridges with learning networks outside the education environment (Deakings and Freel, 1998; Elfring and Hulsink, 2003; Isokangas, 2009).

Already by 1985, Coomps (1985) stressed that ensuring interaction between education and society requires network-like structures for learning, in which ‘external to education’ experts share their experiences, insights and knowledge within a learning network. Entrepreneurship education research has shown that entrepreneurship-learning methods should include functional project-based learning (Pittaway, 2004), which contains a sufficient level of challenge and uncertainty (Cope, 2003). This type of education requires students to be active and self-directed (Bird, 2002; Cope, 2003). Additionally it requires the strengthening of the social dimension and networking (Rae and Carswell, 2000), encourages the student to take part in educational planning (Fiet, 2001), and uses versatile assessment (Honig, 2004).

The LAB studio education model holds the potential to integrate the teaching of entrepreneurial competencies in higher education with the operating environment, allowing the formation of networks for learning.

LAB studio model introduced

The LAB studio model is a higher education, interdisciplinary education model aimed at training competent new professionals, self-directed teams and new businesses with an industry focus. In general, the LAB studio model can be defined as a business pre-incubator, created to produce promising teams with solid and proven potential for creating their own new business. Similar educational concepts combining these elements are increasingly being developed across Europe (De Cleyn and Gielen, 2013; Malinen, Ahmaniemi and Raiskinmäki, 2013; Igartua, Errasti and Markuerkiaga, 2013; Bull and Whittle, 2014).

The LAB studio model was established in 2012 at the Oulu University of Applied Sciences (Oamk) in Finland as an innovative training approach in higher education that brings together training and workplace experience. This model was first put into practice in order to support the training of new professionals for the gaming industry (Oulu Game LAB, OGL), then for the software industry utilising cloud computing (Oulu Cloud LAB, OCL) (Heikkinen, 2014) and more recently for the application software industry (Oulu App LAB, OAL). Since its inception, the LAB studio model has expanded within the university to such an extent that now many LAB studios exist focusing on training in industries such as health, wellbeing, energy and the environment.

Traditionally, the studio model is theoretically grounded in a constructivist view of learning along with problem-based education (Heikkinen and Stevenson, 2015). Similarly, reflection on experiences is at the core of this type of teaching, which also has similarities with transformative learning (Mezirow, 1991), and with reflective practice or “knowing- and reflecting-in-action" (Schön, 1983). Another aspect of studio models is the use of real world problems around which teaching is constructed (Engeström, 1987; Schön, 1985). However, real world problems used in these learning spaces tend not to be well-formed, thus only simulating real life situations that are uncertain, complex, and unique. Additionally this form of problem-based learning demands a framework that enables an integrated approach and a clear response to this challenge. Overall, research related to design education suggests that a studio-based pedagogy is an effective method for cultivating students’

identities as designers, developing their conceptual understanding of design and the design process, and fostering their design thinking (Kuhn, 1998, 2001; Schön, 1983).

And yet, the LAB studio model has key characteristics which set it apart from the traditional studio model. The recent study of the LAB studio model (Heikkinen and Stevenson, 2015) suggests that the model improves upon the traditional studio model by focusing on instruction in a competition structure, integrating experienced professionals and coaches from the industry, including problems or ideas from industry and building interdisciplinary project teams. In addition, this comparison suggests that the LAB studio model is more closely aligned with industry needs and workplace realities, in contrast to existing studio models. In addition to being interdisciplinary, the LAB studio model encourages the participation of more experienced students in studies through participation as 'open university' students. This allows teams to be intergenerational and support transfer of tacit knowledge and networks during project work (Räisänen, Heikkinen and Stevenson, 2014).

Overall, challenging problems and demanding timelines are emphasised for entrepreneurship education (Cope, 2003; Deakins and Freel, 1998). Therefore, the methodological basis of the LAB studio model is to use project-based learning (PjBL) methods (Pittaway, 2004). Specifically, the LAB studio model focuses its content on three topical areas: Concept Development, Business Development and Solution Development. At the beginning of a LAB, students from different disciplines are provided with a problem to be solved based on industry needs for a solution. During the first six weeks of Concept Development, called LEAD, teams develop a Concept Proposal from a problem or an idea. As a result, project teams develop proof-of-concept demonstrations (demos) and the business model for their solutions. The Concept Proposal includes an investigation of the following content areas: the 'Need', 'Business Opportunity', 'Client and User' and 'Solution', all framed by the 'Context'. Figure 1 illustrates these programme content areas as a framework for Concept Proposal development used in the LAB studio model.

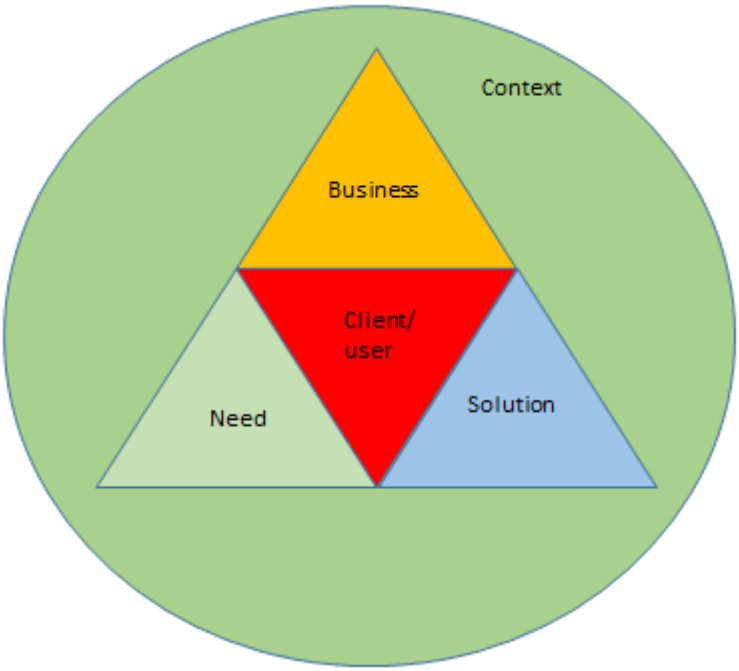

Figure 1. Programme content areas used in the LAB Studio Model

A LAB project is established because of a 'Need', or a problem, which is defined by industry companies partnering with the LAB. A user-centric approach is used so that a 'Solution' developed by the project fulfills the 'Need', which can be a product, service or method. The 'Need' and 'Solution' are directly linked to the recognition of a 'Business Opportunity', which ultimately is structured as a business model canvas (Osterwalder, 2004; Osterwalder and Yves, 2010). The 'Client' is defined as a potential customer for the solution, while the 'User' is the person using the solution. In some projects these might be different people. The 'Context' describes the environment within which the particular concept is developed. Overall, the networking needs within the LAB project should relate to these key content areas.

LAB Studio Model and network development

Through its methodologies, the LAB studio model supports the development of networks in a number of ways. The following section outlines these network-generating activities and procedures.

The LAB studios consist of multidisciplinary, multigenerational and multicultural participants: students and coaches / teachers. Students are selected for LABs based on their expertise and experience, so that the key areas necessary for establishing a new business company are covered. In addition, LABs consist of participants from several countries; this enlarges the possibility of growing networks beyond local

boundaries. The personnel associated with a LAB studio are a LAB master and various LAB coaches drawn together depending on the specific industry focus. The LAB master's role is as a leader for the LAB studio, whereas the LAB coaches are responsible for supporting student development, both in terms of specific professional career and in their project task and goal (Heikkinen and Stevenson, 2015). Since coaches are required to be well connected within their area of expertise or industry, they act as role models in making new connections and in establishing connections between LAB students and professionals. The coaches activate students to become active networkers within their profession and the industry in question.

Since the LAB studio model builds a type of work-life experience, students and teams work in close collaboration with each other exactly as in a small company environment. (Bull, Whittle and Cruickshank, 2013; Heikkinen and Stevenson, 2015) The environment allows for the practising and deepening of their professional competences, as well as affording them the opportunity to recognise their strengths and areas of development. As well as an open office environment for the project teams, the LAB studio premises include a kitchen area, meeting rooms and a lounge area with sofas. The open office premises can be modified according to the project needs, and furthermore the students have 24h/7days access to the premises. (Bull *et al.*, 2013; Heikkinen and Stevenson, 2015) The LAB joint office space enables sharing in formal and non-formal ways. Keeping doors open to enable an open environment for development enhances the opportunity to meet and respond to the unexpected. External LAB visitors are treated as potential customers and a source of new knowledge and critique.

Social media tools are used for internal and external collaboration. At the beginning of the LAB, Slack, Facebook or Google+ groups are established for information sharing and discussion between the project teams and all participants in the LAB. These forms of social media also have a role in linking the teams to the industries, companies or organisations. In addition, the project teams usually establish their own social media groups for the purposes of internal communication and information sharing.

The LAB premises are located in the downtown area of the city centre and the environment surrounding a LAB studio is built to support the development of competences necessary to be an entrepreneur. The LAB studio premises are located

within a business incubator ecosystem. This ecosystem includes activities from two local universities, student organisations, several local companies and startups, as well as organisations supporting the creation of new businesses, companies and funding. In addition, new startups established from the LABs remain in close connection, often visiting the LAB premises. This LAB alumni connection further enhances the industry startup and professional networking.

Another way that the LABs support networking is through the use of a competitive structure for improving the quality of the outcomes from LAB. This is done by an internal competition between ideas and by the principle of all new business developers: “Fail Early, Learn Fast” (Stata and Almond, 1989; Thomke, 2001).The process of selecting the projects that should continue is done during special events, called Gates. Gates are public events where professionals from industry act as judges, forming a Jury, to select which projects will be further developed based on the viability of solutions and business models. These events as well as others such as company visits, visits from industry experts, weekly project status reviews, peer reviews and project milestone reviews, act as milestones where the teams must introduce the results of their development to others and receive critique. Students are also encouraged to participate in externally organised events, such as industry specific seminars or conferences. For example, at least once during the LAB, all students participate in a conference, since these events give further opportunities to network with industry professionals.

Research Design

The participants of this study

This study was carried out with 35 students forming six project teams in the Oulu App LAB (OAL). OAL was a LAB studio model programme with both bachelor students and unemployed professionals studying together for one semester during the spring of 2015. Unemployed professionals were referred as students by the local employment office, since in the Oulu area major layoffs have taken place due to an increase in the number of large companies closing down operations. The effect of this trend has led to approximately 4000 people becoming unemployed between 2012 and 2014 (European Commission, 2015). The majority of these unemployed people came from an educational background within ICT engineering, leading to 90% of the unemployed professionals participating in the OAL education in spring 2015

belonging to this group. The rest of the OAL participants had various educational backgrounds and work experience from the areas of business or health care.

Students in OAL varied in age between 19 and 58 years old. The bachelor students joining OAL were third or fourth year students of occupational therapy and physiotherapy from different countries and cultural backgrounds, such as China, France, Philippines, Portugal, Finland, Romania, Belgium and Lithuania. Overall, students formed six teams, so that in every team there were five to seven team members. The concept topics of the projects are presented below on Table 1.

Team	Subject of the team
Team 1	Work condition assessment in order to improve workplace conditions efficiently.
Team 2	Peer learning app to guide a peer learning process and act as a platform for uploading and accessing materials and methods for teaching
Team 3	To develop a healthcare device to monitor glucose levels without needle and blood
Team 4	Local food: an app that allows people to scan and get information about the origin of foods and help local food producers to market their products.
Team 5	My buddy: app-game that will support children to become more active physically
Team 6	Product and service concept ideas for driving capacity assessment.

Table 1. The topics of the OAL project teams in spring 2015

Methodology

The aim of the study was to examine the purposefulness, structure and amount of external learning networks formed during an interdisciplinary higher education programme. In order to understand this phenomenon a mixed method approach with fixed design was chosen. Problems suitable for mixed methods are those in which solely a quantitative approach or a qualitative approach is inadequate to develop multiple perspectives and a complete understanding about a research problem or question (Creswell and Plano Clark 2011). Mixed methods studies may be either fixed or emergent. In a fixed design, the methods are predetermined at the start of the research process and the investigators have a specific intent to mix qualitative and quantitative approaches at the start of the study (Creswell and Plano Clark 2007). In this study the quantitative data was used for measuring the number and

structure of the learning networks, and the qualitative data was used for exploring their effectiveness.

The data was collected by the researchers during semi-structured team interviews held in May 2015. The interview questions were grounded in the concept of social capital in entrepreneurship (Puhakka, 2002) and the theory of school learning outlined by Engeström (1987). Before conducting the team interviews the interview questions were piloted with two students. Each team was interviewed separately by two researchers. During the interview process a map of the specific network under discussion was drawn on a large piece of paper. This activity helped both students and researchers to follow and remember what had been already discussed as well as find the connections between different parts of the network. Each interview took from 1.5 to 2 hours and was video recorded for later analysis. The qualitative data was collected in order to understand the extent to which the external network was connected to the programme content areas. In the interviews student teams described the content and meaning of their co-operation with the external partners. For the quantitative data student teams were asked to estimate how often they had been in contact with different external network partners. The data on the number of single contacts, meetings face-to-face, email or phone calls was collected in the course of the interviews.

The data was analysed according to the principles of mixed method research (Creswell, 2003; Driscoll, Appiah-Yeboah, Salib and Rupert, 2007) with both quantitative and qualitative data collected simultaneously. According to Creswell (2003), the researcher seeks to compare both forms of data to search for congruent findings. An iterative and reflexive process of analysis was undertaken simultaneously with the data collection. The data was collected as a network map, then coded into key actors according to the categories drawn from the theories used At this point, the researchers counted the number of connections with external networks and the amount of single contacts. During the data collection and analysis researchers realised that the quality of the co-operation was not solely based on the number of contacts, but also depended on the mutual trust and commitment of both teams and external partners.

Results

External networks generated in OAL

This study was conducted to explore the external learning networks of student teams in OAL in the spring of 2015. Overall, the findings suggest that the networks created were relatively large in size and used mainly for gathering information. The process of learning and network development is presented in Figure 2. Networks in this study are understood as the connections between students and persons outside of the OAL. Altogether, 37 students and 15 teachers were seen as internal participants in the LAB.

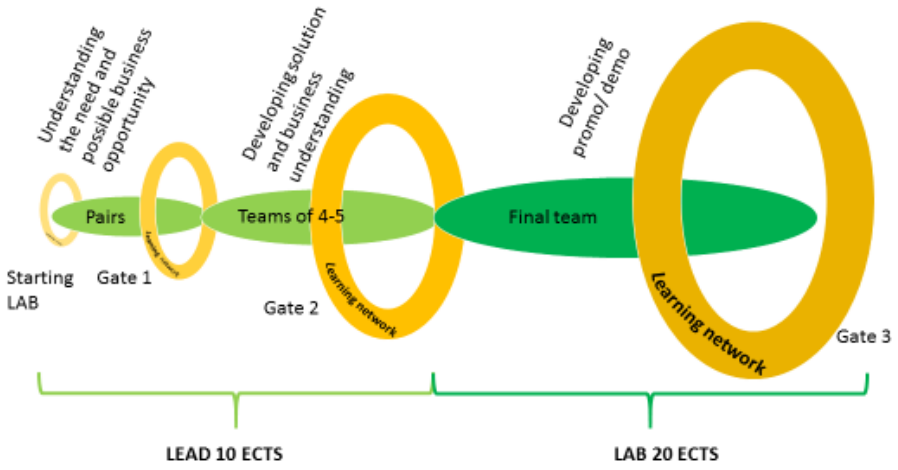

Figure 2.Expanding network during LAB studio model learning process

The actual and potential partners for learning are presented in figure 3. The middle of the dialogue represents the student team and the second circle other teams and coaches (teachers) for professional and project coaching as well as for tutoring. In the third circle, external groups that teams named during interviews are located. These groups were: teams from other Oamk LABs, startups and companies, staff members of Oamk, Business Kitchen and Business Oulu. This list also includes groups with whom co-operation could have been possible in the learning environment, but which were not named by the teams (highlighted in pale grey). The fourth circle represents the external network partners who are outside of university and were named by the student teams.

The biggest external partner group included companies (49.5%) via the Business Kitchen community (see Figure 3.). The second largest external partner were family members, neighbours, friends and ex-colleagues (18.3%). Since most of the students of OAL had been working for several years already, many indicated that they had been discussing with their ex-colleagues about their project. Local authorities (9.1%), and researchers and research institutions (6.2%) were also important partners of the external networks. Other minor partner groups included different events (5.5%), private persons (5.5%), contacts via social media (5.5%) and others (1.8%).

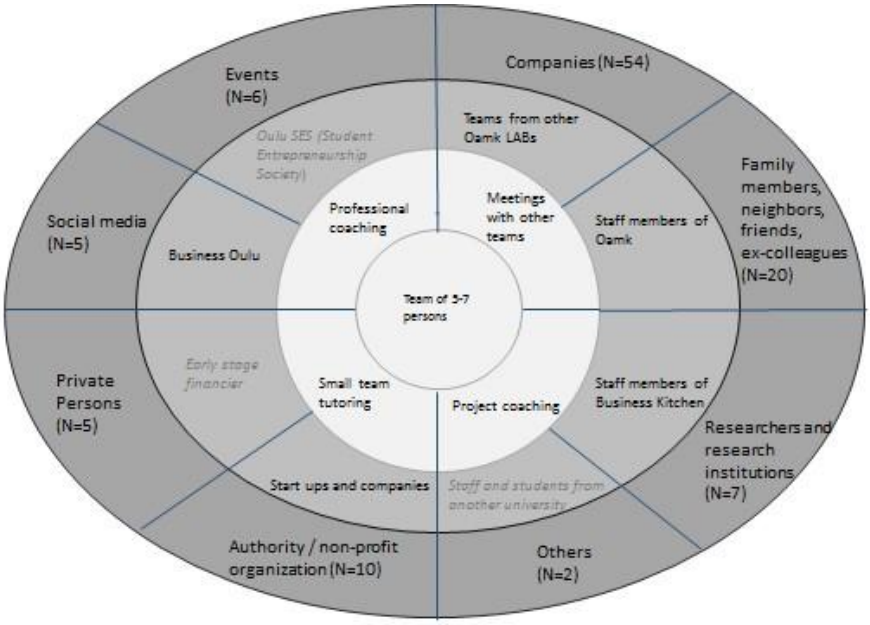

Figure 3. Potential and actual networks for OAL in spring 2015

Student teams estimated the amount of contact with each external network partner (Table 2.). The amount of single contacts, meetings face-to-face, email or phone calls, varied from one contact up to 60. All together student teams estimated that they had 898 single contacts with their external network. The largest amounts of single contacts were with family members (n=354), since some of the students were discussing their project with these actors several times per week. Also, a large number of contacts were by social media (n=191) and with companies (n=162). The amount of single contacts recorded per team varied from 76 to 225.

type of the partner	amount total	%	amount of contacts for each team with different kinds of partners team 1 team 2 team 3 team 4 team 5 team 6 all						
researcher/ research institution	7	6,2%	2	3	6	4	2	3	20
events	6	5,5%	3	6	6	3	4	5	27
private persons	5	4,6%	3	10	14	44	10	12	93
companies	54	49,5%	18	46	9	16	9	64	162
social media	5	4,6%	0	1	0	140	50	0	191
authority / non-profit organization	10	9,1%	4	6	1	10	1	22	44

Table 2. The number of partners within an external network for each team

Each team had contacts from outside of the university context. According to the classification created by researchers based on the results, the partner groups were divided into three categories; the ones teachers arranged for students, the ones teachers asked students to contact, and the ones student teams found themselves (Table 3.). The largest number (68.9%) of partners were arranged by the student teams themselves. These partners varied from 9 to 64, with the average being 28.

The ways of finding partners in external networks varied from student team to student team. It is notable that some partners were people found by social media, not face to face. Furthermore, it should be noted that the two student teams which had the largest external networks through social media were also developing products that were based on using social media or games. As a result, the external networks created by social media were highly relevant. In total, the coaches of OAL arranged 20.3% of the partners within external networks. These connections were with the companies that provided the original problems to solve. The coaches told student teams to make contact with them in order to discuss and gain more insight into the problem. 10.8% of the work undertaken with external networks was because the student teams were directed by coaches to contact them.

team/ how	team 1	team 2	team 3	team 4	team 5	team 6	all together	%
arranged by coaches	5	10	9	7	4	14	49	20,3%
suggested by coaches	5	7	5	1	3	5	26	10,8%
arranged by the team	20	9	15	64	37	21	166	68,9%
	30	26	29	72	44	40	241	100%

Table 3. Ways in which contacts were found

All together the total number of external partners was 241 (Table 4), with 109 different external partners defined, since many student teams were working with the same partners such as local entrepreneurship networks, private persons or companies. The largest amount of external network partners for one student team was 72, with significant differences between the student teams regarding the number of users and client contacts. For example, one student team did not have any external partners from the user point of view while another student team had 53 user partners.

team / programme content area	team 1	team 2	team 3	team 4	team 5	team 6	all together	
need	8	6	5	4	2	5	30	12,4%
client	6	2	7	12	1	9	37	15,4%
user	5	8	0	53	33	5	104	43,2%
solution	9	3	10	1	6	6	35	14,5%
business	2	7	7	2	2	15	35	14,5%
all together	30	26	29	72	44	40	241	100%

Table 4. The number of external partners / team and programme content area

Programme content areas (Figure 4) of OAL were divided into four different categories: need for the product/solution, user/client point of view, product/solution development, and recognising the business opportunities. The user and client are identified as one programme content area, but this is separated into two different parts because the actual end user of the product/service and the buyer are often not the same. The largest number of external network partners was from the group of users (43.2%). These were mostly potential users of the products, who were contacted about different phases in developing the solutions, and asked to test the

demos created or discuss pricing of the product/ solution developed by student teams. Other programme content areas had only slight differences with respect to the amount of external partners. For example, clients (15.4%) were mainly companies who shared their interest in the product and had the potential to become clients for these student teams in the future. In the category of need for the product/solution (12.4%), student teams either discussed existing needs or whether clients would use a certain kind of solution. From the solution point of view, the partners of external networks (14.5%) were persons and companies who had experience of developing and using similar products.

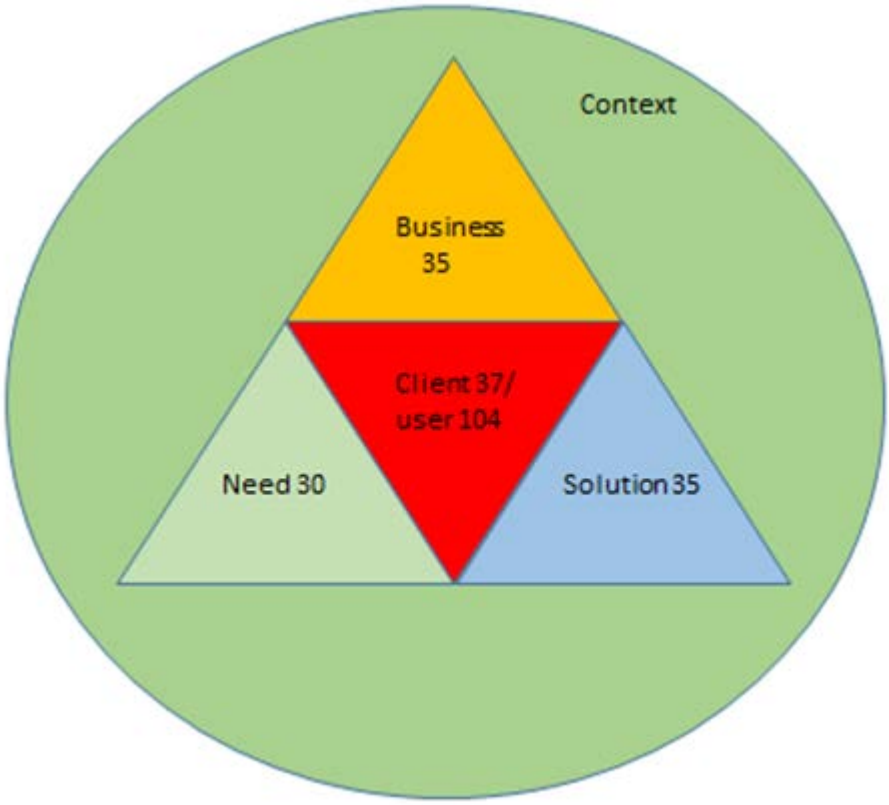

Figure 4. Amount of groups of collaboration in connection to the content areas framework

The content of co-operation with external networks was primarily information sharing. Only with 14 out of 241 external partners were students developing their concept and product. The issues discussed together were the need for a certain kind of a product, pricing, functionality and viability of the product. Also, issues relating to the development of the concept and developing a test were covered. From eight potential external network partners, student teams had no reply. With the remaining 219 external network partners, student teams noted that they were sharing information and knowledge. Information they received was, for example, about topics

such as concept development, games for children, technical issues, medical devices, different issues of health and well-being, business, intellectual property rights (IPR), funding and how to make a funding application.

Discussion

Learning through networks has advantages compared to traditional classroom learning (Coombs, 1985), which can be generalised as having few contacts from outside of the university (Miettinen 1999; Miettinen, Isokangas & Peisa 1997). This study suggests that the LAB studio model challenges and enables students to develop new learning networks. Overall, Oulu App LAB (OAL) broke down the barrier between university and the outside environment through the development of external learning networks. Creating meaningful new activities or solutions demands the establishment of active connections outside of educational environments, since these types of learning networks have a close connection to the reality of working life. Additionally, the role of external experts is essential, because they have different experience and knowledge to the teachers, and thus expand and update the knowledge areas available (Bull *et al.*, 2013, Heikkinen and Stevenson, 2015).

In Oulu App LAB, (OAL) student teams gained knowledge using their own initiative from outside the university. Partners were mostly arranged by the student teams themselves, indicating that they had an active role in a form of self-initiated learning, similar to the style of learning highlighted by Bird (2002) and Cope (2003). The most significant groups of collaboration were companies and the personal networks of the students. The fact that the teams of OAL created such large learning networks further indicates the creation of self-organised teams, and the expansion of meaningful and highly motivated learning. Overall, there were a significant number of contacts between student teams and external groups. The contacts focused especially on collaboration with companies, with social media also used to support the development of personal networks for the students. Experienced professionals studying in OAL were using their previous individual professional networks as important resource for the teams. According to the data, even one contact with a collaborator could be highly relevant to the process of developing a new business.

The purpose of co-operation in a learning network was focused on the sharing of knowledge. However, despite contacts with the collaborators of the learning network outside of the university common development with these partners was rare. In contrast, development mainly took place in the interdisciplinary student teams

themselves and in co-operation with the interdisciplinary team of coaches. For the majority of the student teams, recognising ways for common development during the programme was challenging. Data shows that product development was enriched by new knowledge gained from other collaborators within the learning network. A possible explanation for this could be the close co-operation inside each student team as a result of the interdisciplinary nature of the team itself and previous interdisciplinary teamwork experience of the students.

At the core of new business creation are the needs of the users and clients (Eisenmann, Ries and Dillard, 2012; Blank, 2013). According to the results of this research, the external learning networks of student teams focused on areas of needs of clients and user-oriented development. From the perspective of entrepreneurship education, networking focused on recognising the business opportunity. As result of the OAL process, two projects out of six are moving on to create a new venture. This result suggests that the main learning outcomes within the programme paralleled a real business creation process.

Conclusion

The results of this study suggest that the demanding problem-solving process during the LAB studio model enables teams to develop new learning networks in an entrepreneurial focused environment. This environment in turn offers a sense of opportunity for new business development, and a strong motivation for self-directive and self-organising activity. In LAB studio model entrepreneurship focused learning is supported by both theory and practice, where the teacher is creating a pedagogical environment with a strong focus on instilling empathy with entrepreneurial values and ‘ways of doing, feeling, seeing, communicating, organising and learning things’ which in turn enables students to internalise new knowledge. Ultimately, the findings of this study suggest that the LAB studio model represents an example of such a form of education and includes methods to increase social capital. The limitations of this study are that it focuses only on the team’s external learning networks and since the number of participants for this study is relatively low further research is needed to explore the long-term development of social capital in the LAB studio model.

Acknowledgements

The Oulu App LAB was supported by The Finnish Centre for Economic Development, Transport and the Environment, ELY-keskus, in Finnish.

References

ALVAREZ, S. and BARNEY, J.B., (2006). Discovery and Creation: Alternative Theories of Entrepreneurial Action. *Working Paper Series of Fisher College of Business.* WP 2006-01-005.

BIRD, B. J., (2002). Learning Entrepreneurship Competencies: The Self Directed Learning Approach. *International Journal of Entrepreneurship Education*, **1**(2), pp. 203- 227.

BLANK, S., (2013). Why the lean start-up changes everything. *Harvard Business Review*, **91**(5), pp. 63-72.

BRYAT, C and JULIEN P.A. (2000) Defining the Field of Research in Entrepreneurship. *Journal of Business Venturing,* **16**(2), pp. 165-180.

BULL, C. N., WHITTLE, J., and CRUIKSHANK, L. (2013). Studios in software engineering education: Towards an evaluable model. In: *35th International Conference on Software Engineering* (ICSE), 18-26th May, 2013, San Francisco. pp. 1063–1072.

BULL, C. N., and WHITTLE, J. (2014). Observations of a software engineering studio: Reflecting with the studio framework. *IEEE 27th Conference on Software Engineering Education and Training,* CSEE&T Proceedings, 23-25th April 2014, Klagenfurt, Austria. pp.74–83.

COOMBS, P. H., CHAPPELLS, H. and SHOVE, E., (1985). *The world crisis in education: The view from the eighties.* New York: Oxford University Press.

COPE, J., (2003). Entrepreneurial Learning and Critical Reflection: Discontinuous events as “triggers for “high level” learning. *Management Learning,* **34**(4), pp. 429- 450.

CRESWELL, J.W., (2003). *Research design: Qualitative, Quantitative. and Mixed Methods Approaches* (2nd ed.). Thousand Oaks, CA: Sage.

CRESWELL, J. W., and PLANO CLARK, V. L., (2011). *Designing and conducting mixed methods research.* (2nd ed.). Thousand Oaks, CA: Sage.

DAVIDSSON, P., (2005). The Entrepreneurial Process as a Matching Problem. In: Proceedings of the Academy of Management Conference**,** *A New Vision of Management in the 21st Century*, 5-10th, August, 2005, Honolulu, Hawai'i.

DE CLEYN, S.H. and GIELEN, F. 2013. iMinds Incubation & Entrepreneurship program: How to enable and reinforce entrepreneurship education through incubators. In: A. MEERMAN and T. KLIEWE, eds., *Good practice series 2013. Fostering university-industry relationships, entrepreneurial universities and collaborative Innovation.* University Industry Innovation Network. pp. 1-18.

DEAKINS, D. and FREEL, M. (1998) Entrepreneurial learning and the growth process in SMEs. *The Learning Organization,* **5**(3), pp. 144-155.

DETIENNE, D.R. and CHANDLER, G.N., (2004). Opportunity Identification and Its Role in the Entrepreneurial Classroom: A Pedagogical Approach and Empirical Test. *Academy of Management Learning and Education,* **3**(3). pp 242-257.

DRISCOLL, D.L., APPIAH-YEBOA , A., SALIB, P., and RUPERT, D.J., (2007). Merging Qualitative and Quantitative Data in Mixed Methods Research: How To and Why Not. *Ecological and Environmental Anthropology,* **3**(1), pp. 19-28.

ECKHART, J.T. and SHANE S.A., (2003). Opportunities and Entrepreneurship. *Journal of Management,* **29**(3), pp. 333-349.

EISENMANN, T. R., RIES, E. and DILLARD, S., (2012). Hypothesis-driven entrepreneurship: The lean startup. *Harvard Business School Entrepreneurial Management Research Paper Series Case Number:* 812-095.

ELFRING, T. and HULSINK W. (2003) Networks in Entrepreneurship: The Case of High – technology Firms. *Small Business Economics,* **21**(4), pp. 409-422.

ENGESTRÖM, Y., (1987). *Learning by expanding. An activity theoretical approach to developmental research*. Helsinki: Orienta –Konsultit.

EUROPE 2020., (2010). *A strategy for smart, sustainable and inclusive growth*. European Commission. 2020 Communication from the Commission. Available: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2010:2020:FIN:EN:PDF [Date accessed: 1st July, 2015]

EUROPEAN COMMISSION, (2015). *Commission proposes €1.3 million from Globalisation Fund for former workers of ICT sector in Finland.* Available: http://ec.europa.eu/commission/2014-2019/thyssen/announcements/commission-proposes-eu13-million-globalisation-fund-former-workers-ict-sector-finland_en [Date accessed: 1st July 2015].

FAYOLLE, A. and LAMINE, W., (2013). A social network approach to a better understanding of the survival-growth phase of innovative new ventures. In: A. FAYOLLE, P. KYRÖ, T. METS and U. VENESAAR, eds., *Conceptual richness and methodological diversity in entrepreneurship Research. European research in Entrepreneurship*. Cheltenham, UK: Edward Elgar. pp.232-256.

FIET, J.O., (2001). The theoretical side of teaching entrepreneurship. *Journal of Business Venturing,* **16**(1), pp. 1-24.

GAGLIO, C.M. and KATZ, J. A., (2001). The Psychological basis of opportunity identification: Entrepreneurial alertness. *Journal of Small Business Economics,* **16**(2), pp. 95- 111.

GIBB, A. and HANNON, P., (2006). Towards the Entrepreneurial University. *International Journal of Entrepreneurship Education,* **4,** p. 73

HEIKKINEN, K.-P., (2014). Perusteet LAB-oppimismallista. LAB-oppimismallin lyhyt kuvaus. ePooki, *Oulun ammattikorkeakoulun tutkimus- ja kehitystyön julkaisut* **19**.

HEIKKINEN, K.-P. and STEVENSON, B., (In press). The LAB studio model: enhancing entrepreneurship skills in higher education. *International Journal of Innovation and Learning*, special Issue on: "Intellectual Capital for Learning and Innovation in the Globalised Environment".

HOBDAY, M. (1998). Product complexity, innovation and industrial organisation. *Research policy*, **26**(6), pp.689-710.

HONIG, B., (2004). Entrepreneurship Education: Toward a Model of Contingency-Based Business Planning. *Academy of Management Learning and Education,* **3**(3), pp. 258- 273.

IGARTUA, J.I., ERRASTI, N. and MARKUERKIAGA, L., (2013). An Entrepreneurial Collaborative Approach: An example of how to foster entrepreneurship among students through University-Industry Collaboration. In: A. MEERMAN and T. KLIEWE eds., *Good practice series 2013. Fostering university-industry relationships, entrepreneurial universities and collaborative Innovation.* University Industry Innovation Network. Available: http://www.uiin.org/index/downloaddlreportbook/id/288 pp. 97-110.

ISOKANGAS, J., (2009). Partneriperustainen harjoitusyritys. Opiskeljat luomassa uutta toimintakokonaisuutta yrittäjyyskoulutuksessa. [Partner based practice enterprise. Creating a new activity system in entrepreneurship education.] *Acta Universitatis Ouluensis G Oeconomica* **40**. Oulu.

KUHN, S., (1998). The software design studio: An exploration. *IEEE Software,* **15**(2), pp.65–71.

KUHN, S., (2001). Learning from the architecture studio: Implications for project-based pedagogy. *International Journal of Engineering Education*, **17**(4&5), pp. 349–352.

KURATKO, D., (2005). The Emergence of Entrepreneurship Education: Development, Trends, and Challenges. *Entrepreneurship Theory and Practice*, 29 (5). pp. 577-597.

MALINEN, H., AHMANIEMI, R. and RASKINMÄKI, P., (2013). JAMK Generator: An example of how to build an entrepreneurial university of applied sciences. In: A. MEERMAN and T. KLIEWE eds., *Good practice series 2013. Fostering university-industry relationships, entrepreneurial universities and collaborative Innovation.* University Industry Innovation Network. Available: http://www.uiin.org/index/downloaddlreportbook/id/288. pp. 71-86.

MEZIROW, J., (1991). Transformative dimensions of adult learning. San Francisco, CA: Jossey-Bass.

MIETTINEN, R., (1990). Koulun muuttamisen mahdollisuudesta. Analyysi opetustyön kehityksestä ja ristiriidoista. Gaudeamus, Helsinki.

MIETTINEN, R., ISOKANGAS, J. and PEISA, S., (1997). Yrityksen perustamisen ja toiminnan tutkiminen partneriyrityksen kanssa-Partneriyrityksen käyttö kaupallisessa koulutuksessa. In: P. SALLILA and j., TUOMISTO, eds., *Työn muutos ja oppiminen. Aikuiskasvatuksen 38. Vuosikirja.* Kansanvalistusseura ja Aikuiskasvatuksen Tutkimusseura. pp. 104-130.

MIETTINEN, R., (1999). Transcending traditional school learning: Teachers works and networks of learning. In: Y. Engeström, R. Miettinen and R.-L. Punamäki, eds., *Perspectives on activity theory.* Cambridge: Cambridge University Press.

MIETTINEN, R. and PEISA, S., (2002). Integrating school–based learning with the study of change in working life; The alternative enterprise method. *Journal of Education and Work.* **15**(3). pp. 303-319.

MIETTINEN, R., TOIKKA, K., TUUNAINEN, J, LEHENKARI, J. and FREEMAN, S., (2006). *Sosiaalinen pääoma ja luottamus innovaatioverkostossa.* Helsingin yliopiston toiminnan teorian ja kehittävän työntutkimuksen yksikkö, Helsingin yliopisto.

OSTERWALDER,A., (2004). *The business model ontology: A proposition in a design science approach.* (PhD), Présentée à l'Ecole des Hautes Etudes Commerciales de l'Université de Lausanne. http://www.hec.unil.ch/aosterwa/PhD/Osterwalder_PhD_BM_Ontology.pdf [Date Accessed: 16th October, 2015].

PIHKALA, J., (2007) Yrittäjyyskoulutuksen vaikutukset opiskelijoiden yrittäjyysintentioihin. Teoksesta P., Kyrö, H. Lehtonen and K. Ristimäki, eds. *Yrittäjyyskasvatuksen monia suuntia.* Yrittäjyyskasvatuksen julkaisusarja **5**(2007), pp. 160-171.

PITTAWAY, L., (2004). Simulating Entrepreneurial Learning: Assessing the Utility of Experimental Learning Designs. *Lancaster University Management School Working Paper,* 2004/049.

POWELL W., KOPUT K. and SMITH-DOERR, L., (1996). Interorganizational collaboration and the locus of innovation: Networks of learning in biotechnology. *Administrative Science Quarterly*, **41**(1), pp. 116-145.

PUHAKKA, V., (2002). Entrepreneurial business opportunity recognition. *Universitas Wasaensis* No 104. Vaasa.

PUTNAM, R., (2001). *Bowling alone: The collapse and revival of American community.* New York: Simon and Schuster.

RAE, D. and CARSWELL, M., (2000). Using a Life-story Approach in Researching Entrepreneurial Learning: The Development of a Conceptual Model and its Implications in the Design of Learning Experiences. *Education and Training,* **42**(4). pp. 220-227.

RÄISÄNEN, T., HEIKKINEN, K-P. and STEVENSON, B., (2014.) *Knowledge Creation in Oulu Game LAB*. Unpublished.

SARASVATHY, S., (2001). Causation and Effectuation: Toward a Theoretical shift from economic inevitability to entrepreneurial Contingency. *The Academy of Management Review,* **26**(2). pp. 243-263.

SCHÖN, D., (1983). *The Reflective Practitioner. How Professionals Think In Action*. New York: Basic Books.

SCHÖN, D., (1985). *The design studio: An exploration of its traditions and potentials*. Portland, OR: Intl. Specialized Book Service Inc.

SCHÖN, D., (1987). *Educating the Reflective Practitioner*. San Francisco: Jossey-Bass Inc.

SHANE, S. and VENKATARAMAN, S., (2000). The promise of entrepreneurship as a field of research. Academy of Management. *The Academy of Management Review,* **25**(1), pp. 217-226.

STATA, R. and ALMOND, P., (1989). Organizational learning: The key to management innovation. In: C. E. Schneier, C. J. Russell, R. W. Beatty and L. S. Baird, eds., *The training and development sourcebook, 2.* Amherst, MA: Human Resource Development Press. pp.31-42.

THOMKE, S. (2001) Enlightened experimentation: The new imperative for innovation. Harvard Business Review, **79**(2), pp. 66-75.