Entrepreneurship Competence Using Educational Hackathons in Finland

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Abstract
This article addresses the educational hackathon as an innovation pedagogy method for developing entrepreneurship competence. Specifically, it focuses on the design and execution of the hackathon. This study is based on the ideas that entrepreneurship competence can be learned and taught, and educational hackathons are a specific type of innovation contest, which as a practical method can be used to induce practical entrepreneurial experiences. The paper reports a case study in the teaching of a higher education institution. We present both the hackathon process description along with students' outcome according to Entrepreneurship Competence Framework, EntreComp, and feedback, that is, suggestions for developing the method. By presenting conclusions for both academic use and the practical design of hackathons in entrepreneurship education, the paper clarifies the literature of innovation pedagogy as an intertwined part of entrepreneurship education, as well as hackathons as a type of innovation pedagogy method for developing entrepreneurship competence in university-industry collaboration in Finland.

Keywords: Educational hackathon, EntreComp, entrepreneurship competence, hackathon, innovation pedagogy

Introduction

Finland follows the European definitions of policy in regards to entrepreneurship education with a sequence of future-oriented strategies and programs from the past decade by a European Commission promoting the subject (European Commission 2010, 2012, 2016), which Finland has adapted to its national strategies, action plans, and guidelines (FINEEC 2017; Ministry of Education and Culture 2017; Ministry of Finance 2018). However, entrepreneurship education has been in the Finnish education discourse since the 1980s (Kolhinen and Vettenniemi 2017), and Finland is regarded as a forerunner in entrepreneurship education in

Europe (European Commission 2008). As competence, entrepreneurship is seen as one of the transversal skills which are needed for personal development, social inclusion, active citizenship, and employment and which transcend from an individual to the European level. Therefore, it is in the focus of policymakers in Europe (Bacigalupo et al. 2016). By its definition "entrepreneurship is when you act upon opportunities and ideas and transform them into value for others. The value that is created can be financial, cultural, or social" (FFE-YE 2012, 11), so it is intertwined with ideas and their transformation into value. Innovation inducing creativity is one focal individual attribute of entrepreneurial orientation (Bacigalupo et al. 2016; Hietanen 2015; Pittaway and Cope 2007). Thus, individual creativity and organizational innovation are an inherent part of entrepreneurship. Innovation is vital for the continuity and growth of companies, while entrepreneurship is vital for the economic growth (Hage 1999) and welfare of a country. Hence, Finland emphasizes that an advancing society is founded on entrepreneurial activity (Ministry of Education Finland 2009). Furthermore, entrepreneurship is regarded as a practice (Drucker 1985). This poses a challenge for higher education institutions (HEI) to prepare students for entrepreneurship and innovation for future working life, and from a pedagogy perspective, it frames a new role for a teacher in entrepreneurship teaching to have the enthusiasm to create learning environments where entrepreneurial actions can be practiced, real or simulated.

Entrepreneurship education has become an increasing focus among institutions of higher learning all over the world, yet proliferation in the offering has not been without problems (Robinson and Josien 2014). Currently, entrepreneurship is understood as both entrepreneurial behavior or mindset or the outcome of entrepreneurial behavior, for instance a new company or form of business (Hartshorn and Hannon 2005; Rae 2012). Beside competence (Bacigalupo et al. 2016), entrepreneurship is regarded as a practice (Drucker 1985) which can be learned and thus taught (Harkema and Schout 2008). Yet, there is a distinction between teaching about, and for or through entrepreneurship. The former is content-centered while the latter requires also different didactics and pedagogy, as the objective is to improve the student's ability to perform entrepreneurial actions as practical activities (Blenker et al. 2008; FFE-YE 2012; Gibb 2002; Laukkanen 2000), thus highlighting practice as an essence of entrepreneurship and being the focus of this study. It has been argued that in a learner-centered approach learning cannot be isolated from practice, which implies that learning in a classroom setting is far from ideal for entrepreneurship training and education (Harkema and Schout 2008). Furthermore, the situational approach requires the learning to take place in connection with practice, particularly as it is an aspect of entrepreneurial learning that can be simulated, for example in collaboration with industrial organizations (Harkema and Schout 2008; Pittaway and Cope 2007). There has also been a call for competence thinking and

especially practices that induce practical entrepreneurship experiences for students for entrepreneurship competence development (Bacigalupo et al. 2016; Harkema and Schout 2008).

Since the structure of traditional learning environments in higher education does not necessarily prepare a student for entrepreneurial actions (Blenker et al. 2008) or innovation (Higgins, Smith and Mirza 2013), and there is a lack of innovation training in companies (Michaelis and Markham 2017), frameworks for entrepreneurship education that are usable for multiple contexts are needed. Based on the view that entrepreneurship can be taught, in order to enhance the entrepreneurial capacity, an improvement tool, the Entrepreneurship Competence Framework, that is, EntreComp, has been formed aiming to establish a bridge between the worlds of education and work. Therefore, the curricula in the formal education as well as in the non-formal learning context can be reformed based on the views of EntreComp (Bacigalupo et al. 2016). However, the fifteen entrepreneurship competences of EntreComp can mainly be considered as creativity or innovation competences. Yet, this is understandable because entrepreneurship and innovation are interrelated and both entrepreneurship education and innovation pedagogy aim to bridge the gap between the educational context and working life (FFE-YE 2012; Kettunen, Kairisto-Mertanen, and Penttilä 2013). Innovation pedagogy emphasizes an interactive dialog between the educational organization, students, surrounding working life, and society. The methods of learning and teaching in innovation pedagogy extend the individual learning with collaborative group-based and networked learning, often in a multidisciplinary environment (Kettunen et al. 2013). Hackathon is defined as "one type of organized, goal-driven innovation contest, a short time-bounded event with a challenge to be solved creatively in coopetition and collocation of teams, whose results are presented and recognized in a ceremony at the end of the event." (Halvari et al. 2020, 9). Hackathons, which have also recently spilled over into the educational sector (Leckart 2012; Zukin and Papadantonakis 2017; Halvari et al. 2020; Suominen et al. 2018; Suominen, Halvari, and Jussila 2019; Medina Angarita and Nolte 2019, 2020), provide a promising methodology for teaching the front end of innovation and entrepreneurship competences in HEIs.

However, although entrepreneurial learning and entrepreneurship education have been extensively researched in higher education, more research is needed, especially on the practices that are used in entrepreneurship education (Bacigalupo et al. 2016; Hietanen 2015). Furthermore, there are only a few thorough descriptions of hackathons in educational use (Medina Angarita and Nolte 2020), particularly regarding the role of pedagogy (Duhring 2014). Thus, there is a research gap concerning educational hackathons and their feasibility to induce practical entrepreneurship experiences for innovation pedagogy.

This study focuses on practice methods that induce practical entrepreneurship experiences for entrepreneurship competence development.

This study investigates how the educational hackathon, one type of innovation contest as an innovation pedagogy method can be used to develop the entrepreneurship competences of university students. We study entrepreneurship education and innovation pedagogy, focusing on the methodology of the hackathon, especially the educational hackathon. There is detected multiple gaps in hackathon literature (Medina Angarita and Nolte 2020). We aim to clarify the design of educational hackathons, hackathons used particularly in educational context (Suominen et al. 2019), and their usability as teaching methods for developing entrepreneurship competence. The study describes the case of one educational hackathon, organized around Systems Applications and Products in Data Processing (SAP) -technologies. The SAP is the global leading Enterprise Resource Planning -software, as well as the name of the company. The hackathon challenges were defined by SAP user companies in Finland. In our study, we focus on the educational hackathon process design and development suggestions as a pedagogy method. Moreover, in accordance with constructivism (Löbler 2006; Paavola, Lipponen, and Hakkarainen 2004; Steffe 1995), the empirical data concerning the reflections of learnings and feedback from the learning method were gathered from the students. We reflect our case study to the entrepreneurship education guidelines and policies implemented in Finland today, that is, EntreComp, an Entrepreneurship Competence framework, prepared for European use in multiple contexts (Bacigalupo et al. 2016).

Our research question is the following: Does educational hackathon as innovation pedagogy method in university-industry collaboration induce practical entrepreneurial experiences for students of HEIs? In other words, is it a feasible method for developing entrepreneurship competence?

In the pursuit of our goals, the paper is structured as follows: in the introduction, we first acknowledge the need to study educational hackathons in teaching and developing entrepreneurship competence. In the second section, the literature regarding entrepreneurship education in Finland, entrepreneurship, and entrepreneurship education, innovation pedagogy, and hackathons, especially educational hackathons, is discussed. The method and case description entail the presentation of and the grounds for an empirical case study conducted in university-industry collaboration. In the results, we portray the process of the educational hackathon method as well as introducing the manifestations of learning together with feedback. In the discussion and further research sections, we contemplate the functionality of the educational hackathon as an innovation pedagogical method for enhancing entrepreneurship competence.

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Entrepreneurship Education, Innovation Pedagogy, and Hackathons

Entrepreneurship Education in Finland

Entrepreneurship education has been in the Finnish education discourse since the 1980s. In a report prepared for the South East European Centre for Entrepreneurial Learning (SEECEL), Finland is portrayed as a forerunner of entrepreneurship education. The strategy of entrepreneurship education led by the Ministry of Education and Culture promoted an "ecosystem approach" considered well-coordinated with other stakeholders (Farnell, Heder, and Ljubic 2016). Today, Finland follows the European definitions of policy in regards to entrepreneurship education. The focal part of the Lisbon Strategy for growth and jobs of the early 2000s was the elevation of entrepreneurship as well as innovation (European Parliament 2000). The emphasis of these matters at the EU-level yielded guidelines of entrepreneurship education in Finland in 2009 by the Ministry of Education Finland (2009). Furthermore, the central means of the Europe 2020 strategy, the EU's strategy for growth and jobs, is the increase of the enterprise quantity (European Commission 2010). Finland has adopted the strategy by launching in 2018 a national 2020 reform strategy (Ministry of Finance 2018). Consequently to the Europe 2020 strategy, the European Commission also established the Entrepreneurship 2020 program (European Commission 2012) with entrepreneurship education as one of its main foundations (Kolhinen and Vettenniemi 2017). In 2016 the New Skills Agenda for Europe was launched (European Commission 2016), which highlighted the need to promote entrepreneurship education and entrepreneurial learning (Bacigalupo et al. 2016). To promote these ideas at the national level in Finland, the Ministry of Education and Culture (2017) has published novel guidelines for entrepreneurship in education at each education level. The guidelines of entrepreneurship education have been drafted, utilizing earlier studies and research, in a broad collaborative process; these guidelines are based on strategic documents, such as government programs, provincial, over provincial, and local entrepreneurship education strategies, and focal EU-documents (Kolhinen and Vettenniemi 2017). According to 2009 set guidelines for entrepreneurship education by Ministry of Education Finland (2009), entrepreneurship education is part of lifelong learning where entrepreneurial skills are developed and supplemented at different points in life. In general education, the emphasis is on positive attitudes, basic entrepreneurial knowledge and skills, and an entrepreneurial mode of operation, whereas at the secondary level and in higher education the knowledge and skills are developed further (Ministry of Education Finland 2009). The guidelines of entrepreneurship education propose that learning environments that support entrepreneurship have the following characteristics:

- the focus is on the learner's own activity;
- learning also takes place in a simulated or real-world setting;

- learners can directly interact with entrepreneurship;
- instruction is based on problem-solving and interaction;
- the learner has the support of various expert organizations;
- the teacher's role evolves from a disseminator of information to an organizer, guide, and learning environment planner. (Ministry of Education Finland 2009, 17)

The novel guidelines of Ministry of Education and Culture (2017) are based on the previous ones of 2009 and include four policy viewpoints: (1) strategic level and leadership; (2) training for education and teaching staff; (3) training that supports entrepreneurship; and (4) learning environments, together with supporting questions for the evaluation of the viewpoints, as well as various tools to utilize for the enhancement of the viewpoints. Moreover, the Finnish Education Evaluation Center (FINEEC 2017) has completed the evaluation of entrepreneurship and innovative capacity in higher education and vocational education and training in 2018. The evaluation focused on entrepreneurship studies, an operating culture that supports entrepreneurship and students' experience of learning entrepreneurship. The evaluation was carried out from multiple perspectives, using a variety of materials.

Entrepreneurship as a Concept and Competence

With an abundance of definitions, of which researchers are not unanimous, we rest our research on broad views on entrepreneurship. "Entrepreneurship is when you act upon opportunities and ideas and transform them into value for others. The value that is created can be financial, cultural, or social" (FFE-YE 2012, 11). From its essence, "entrepreneurship…is a practice" to which "knowledge…is means to an end" (Drucker 1985, viii). Therefore, entrepreneurship is active doing, a practice that inherently includes ideas and multipurpose value creation. Furthermore, broadly viewed, entrepreneurship can incorporate both entrepreneurial behavior or mindset, which is an individual's way of acting creatively and innovatively and applying new ideas into practice; also, entrepreneurship can be the outcome of entrepreneurial behavior, for example, a new company or form of business (Hartshorn and Hannon; Rae 2012). Moreover, although Drucker said that "entrepreneurship is neither a science nor an art" (1985, viii), entrepreneurship is also a field of study, which focuses on the research of companies, entrepreneurs, and entrepreneurial behavior (Hartshorn and Hannon 2005; Rae 2015). Competence thinking, based on the concepts of competence or competency, has been assigned a variety of meanings in the literature (Mitchelmore and Rowley 2010), but it is often referred to as consisting of the knowledge, skills, and attitudes of individuals (Bartlett and Goshal 1997; Klink and Boon 2003; Le Deist and Winterton 2005; Tovey 1994). As competence, entrepreneurship is seen as one of the transversal skills, besides digital competence, critical thinking, problem-solving and learning

to learn. These transversal skills are needed for personal development, social inclusion, active citizenship, and employment. Consequently, the European Commission perceives these transversal skills as vehicles for strengthening human capital, employability, and competitiveness across Europe (Bacigalupo et al. 2016). Entrepreneurship as competence is a combination of skills, knowledge, and attitude that can be acquired, thus taught and learned (Harkema and Schout 2008).

Entrepreneurship and Innovation Intertwined

In his book Innovation and Entrepreneurship, Drucker defines innovation as

> the specific tool of entrepreneurs, the means by which they exploit change as an opportunity for a different business or a different service. It is capable of being presented as a discipline, capable of being learned, capable of being practiced. (1985, 19)

Studies of entrepreneurial orientation have also emphasized the focal role of creative problem solving as an individual attribute of entrepreneurial orientation (e.g. Hietanen 2015; Pittaway and Cope 2007) or capability for an entrepreneur (Harkema and Schout 2008). Thus, individual creativity and organizational innovation are inherent parts of entrepreneurship. Other attributes of entrepreneurial orientation include negotiating, networking, persuading, target orientation, ambition, risk-taking, self-confidence, and intuitive decision making in the case of uncertainty (Hietanen 2015; Passaro, Quinto, and Thomas 2017). In particular, negotiation skills and networking have been highlighted as integral elements of entrepreneurship education. We adopt a broad definition of innovation:

> [I]nnovation is the production or adoption, assimilation, and exploitation of a value-added novelty in economic and social spheres; renewal and enlargement of products, services, and markets; development of new methods of production; and establishment of new management systems. It is both a process and an outcome. (Crossan and Apaydin 2010, 1155)

Closely intertwined concepts (e.g., Drucker 1985; Harkema and Schout 2008), both entrepreneurship and innovation start at the individual level when the beginning entrepreneur scans the environment and searches for opportunities (Tidd, Bessant, and Pavitt 2005). Therefore, Harkema and Schout (2008) consider entrepreneurship an ability of an individual to see opportunities and translate them into interesting propositions. To keep the company competitive, an entrepreneur has to remain innovative, either by producing completely new solutions to a problem, such as radical innovations, small alternations, or incremental innovations. Furthermore, entrepreneurship and innovation as intertwined phenomena have been

argued to hold the keys to growth at different levels: companies need their employees to possess innovation competence (Jussila, Suominen, and Vanharanta 2008; Michaelis and Markham 2017), but innovation is also required at the organization level (Suominen and Jussila 2009) and furthermore entrepreneurship is essential from national viewpoint(Hage 1999; Harkema and Schout 2008). Thus innovation and entrepreneurship are focal interests of national economies, and measures to stimulate innovative and entrepreneurial behaviors are introduced in many nations (Bikfalvi et al. 2010; Harkema and Schout 2008; Ulijn and Brown 2004) and even at the continental level. These measures also incorporate different interconnected learning and pedagogical concepts, such as entrepreneurship education, entrepreneurial learning, and innovation pedagogy.

There are a variety of studies conducted across Europe regarding entrepreneurship education in HEI. The European Commission (2008) carried out a Survey of Entrepreneurship in Higher Education in Europe, where becoming an entrepreneurial HEI, was approached with six dimensions: Strategy, Institutional Infrastructures, Teaching and Learning, Outreach, Development, and Resources. In 2013, the first European self-assessment tool for HEIs "HEInnovate" (European Commission 2003) was published. HEInnovate was an initiative of the European Commission, Directorate General for Education and Culture, and the OECD LEED Forum, and the self-assessment was meant for HEIs to view the entrepreneurial activities, including leadership, staffing, and links with business. HEInnovate has eight areas of assessment: Leadership and Governance; Organizational Capacity: Funding, People and Incentives; Entrepreneurial Teaching and Learning; Preparing and Supporting Entrepreneurs; Digital Transformation and Capability; Knowledge Exchange and Collaboration; The Internationalized Institution; and Measuring Impact. Furthermore, SEECEL commissioned a thematic survey of the policies and practice regarding Entrepreneur education in EU in 2015 (Farnell et al. 2016). The main progress and challenges were identified in five areas: Policy, Policy Partnership, Curricula and Qualifications Frameworks, Entrepreneurship Education Ecosystem, and Monitoring and Evaluation. The Finnish Education Evaluation Centre FINEEC (2017) completed the evaluation of entrepreneurship and innovative capacity in higher education and vocational education and training in Finland in 2018. The results revealed that nearly all HEIs organized entrepreneurship studies. Around one third of the university students and around half of university of applied sciences students had completed entrepreneurship studies. The most common ways of teaching entrepreneurship in higher education were lectures, but there was co-operation with businesses and students from other fields. Students in higher education institutions reported that there is a positive attitude towards entrepreneurship, but the challenge for HEIs is to fit entrepreneurship studies into degree programmes. The study also highlighted multiple recommendations for development. For example, educational

organisations should develop methods through which students interested in entrepreneurship and entrepreneurship studies are identified.

Hietanen (2015) expresses the widely acknowledged need both at the European level and in Finland for entrepreneurship education with or without a business orientation in the studies. She claims that entrepreneurial learning and entrepreneurship education have been extensively researched in higher education, particularly in business studies. However, she emphasizes a "need for more research focusing on the practices used in entrepreneurship education" (512). Similarly, it is acknowledged within the European Union, that although broader experiential learning has been evidenced in across all EU member states, practical entrepreneurial experiences are not available—nor are they mandatory in EU states (European Union 2014). Therefore, there is a need for a pedagogy that allows these practical experiences to emerge in entrepreneurship education, whether entrepreneurship is taught and learned as a whole, covering integral parts of it, such as innovation.

Pedagogy and Learning Environments for Entrepreneurship and Innovation

Teaching the competence of entrepreneurship, or the individual attributes, such as creative problem solving, is dependent on the pedagogic approach and the learning context. Learning is defined as referring to "a change in behavior as a result of an experience an individual goes through" (Harkema and Schout 2008, 515). In the learning theory of constructivism, learning is a result of mental processes that construct meaning: "Constructivists believe that all humans have the ability to construct knowledge in their own minds through a process of discovery and problem solving" (Harkema and Schout 2008, 516), which takes place in social situations via interaction.

Entrepreneurship Education is practice-oriented education which involves the surrounding community, supports creativity, and encourages initiative and action. The pupil/student is active in the learning process, which takes place by interacting with others, and the teacher acts as advisor and role model. Entrepreneurship education is in the broad sense about pupils and students receiving information and gaining knowledge about entrepreneurship and entrepreneurial thinking and developing their abilities to act in an entrepreneurial way. (FFE-YE 2012, 11)

Entrepreneurship education is described to incorporate several aspects. Two major distinctions in teaching entrepreneurship affect the didactic and pedagogic choices (Blenker et al. 2008; FFE-YE 2012). One is the teaching of entrepreneurship as an academic subject. This content-based teaching concerns acquiring knowledge on the subject, called teaching about entrepreneurship, fosters domain-specific knowledge, and is traditionally received in the classroom. The other is teaching for (Blenker et al. 2008), or through (FFE-YE 2012) entrepreneurship, with the aim to improve the student's ability to perform entrepreneurial actions

as practical activities (Blenker et al. 2008; Gibb 2002; Laukkanen 2000). The latter is more practice-oriented: pedagogic and didactic teaching methods are adopted, which develop and strengthen the students' entrepreneurial behavior, that is, make students act, feel, and do simultaneously as they are acquiring knowledge and experience (FFE-YE 2012). This study focuses on the latter, in other word, on how students' abilities to perform entrepreneurial actions can be developed. Also, (Harkema and Schout 2008) stress the importance of practice included in learning, calling it a learner-centered approach; they view that a situational approach is more ideal for developing understanding and entrepreneurial and innovative capacities than a classroom setting. (Pittaway and Cope 2007) studied the key learning processes of entrepreneurial learning as a form of management learning, and how these processes might be simulated in a situated learning environment. They highlighted the role of emotional exposure, situated learning, action orientation, and discontinuity, by pointing out that emotional exposure and situated learning are aspects of entrepreneurial learning that are possible to simulate. They argued that, when seeking to simulate contexts similar to those in which entrepreneurs learn, the learning environment should be experiential, work-based learning. They also suggested that the course design should pay attention to the following identified features, which are required when simulating entrepreneurial learning through experiential learning:

- Uncertainty and ambiguity
- Forcing students to step outside normal educational processes
- Heightening emotional exposure by introducing entirely unfamiliar activities or projects
- Creating a communal work context by introducing group dynamics
- Using tutorial and course design to carefully manage emotional exposure
- Linking student academic performance to their "real" project performance
- Using project-based, "hands-on" approaches
- Ensuring reflection is built into course design
- Creating regular milestones and/or objectives that are exceptionally challenging
- Create pressure in timescales
- Using tutors or mentors to constantly challenge thinking and create social learning opportunities
- Applying established knowledge to new problems (Pittaway and Cope 2007, 2018).

Practical entrepreneurial experiences are described as educational experiences where the "learner has the opportunity to come up with ideas, identify a good idea and turn that idea into action" (European Union 2014, 36). They require the "involvement of external partners in

the design and/or delivery of this learning, to ensure relevance to the real world" (European Union 2014, 36). Practical entrepreneurial experiences provide students with a "supportive environment, where mistakes are embraced and failure is a learning tool" (European Union 2014, 36) so that they gain the confidence and experience to turn their ideas into action in the real world. Practical entrepreneurial experiences should be a student led initiative either individually or as part of a small team, involve learning-by-doing and producing a tangible outcome…The aim of such an opportunity is for learners to develop the skills, confidence and capability to spot opportunities, identify solutions and put their own ideas into practice. (European Union 2014, 36)

Furthermore, the entrepreneurial learning environment should support the development of the individual attributes of entrepreneurship by encouraging diverse forms of learning, such as learning by doing, as well as collaboration, argument, and debate as central elements of the environment (e.g., Harkema and Schout; Passaro et al. 2017).

As entrepreneurship and innovation are interconnected, it is not surprising, that innovation pedagogy seems to carry many features of the entrepreneurship education, particularly the practical experiences that are called for. Innovation pedagogy is "a learning approach that defines in a new way how knowledge is assimilated, produced, and used in a manner that can create innovations" (Kettunen et al. 2013, 336). Innovation pedagogy aims to bridge the gap between the educational context and working life (Kettunen et al. 2013). Additionally, the goal of Problem-Based Learning (PBL) is to mend the rift between education and professional capabilities (Poikela and Poikela 1999). Moreover, previous studies have shown that experiential PBL can be utilized in teaching the fuzzy front end of innovation (FFEI) (Koen et al. 2001), that is, idea generation, the first phase of the innovation process (Salerno et al. 2014) in universities when students are exposed to a specific, innovation-requiring business context and appropriate idea generation tools and methods (Martinsuo 2009). The front end phase is considered to be the most troublesome phase of the innovation process, but at the same time it provides the greatest opportunities to improve innovation capability (Järvilehto, Similä, and Liukkunen 2010).

Similarly as the aims of innovation pedagogy overall (Kettunen et al. 2013), Entrepreneurship Competence framework, EntreComp, aims to establish a bridge between the worlds of education and work (Bacigalupo et al. 2016). One of the uses EntreComp was intended for was to be an inspirational framework for education and training curricula reform. Based on the broad definition of entrepreneurship, EntreComp could be used for designing practical entrepreneurial experiences in non-formal learning contexts for creating cultural, social, or economic value for different entrepreneurship types, for example, intrapreneur, green or digital entrepreneurship, and sectors such as private, public, and third sectors and their combinations. Furthermore, it is applicable for various levels,

individual, team, or organization, and it is domain neutral. EntreComp has three tightly intertwined competence areas: Ideas and Opportunities, Resources, and Into Action, each area including five competences (Table 1) with their descriptors. These fifteen interrelated and interconnected competences compose the building blocks of entrepreneurship as a competence, and they should be treated as parts of one entity. Particularly interesting is for instance creativity, one of the competences in the "Ideas and Opportunities" area, although the creative process does include the use of resources, and is part of acting upon ideas. Yet, the learner can acquire different—or the same—levels of proficiency in all fifteen competences. In fact, the EntreComp illustrates eight proficiency levels with four main levels, of which each level is split into two sub-levels (Bacigalupo et al. 2016):

1. Foundation: With external support – Level 1. Discover, Level 2. Explore;
2. Intermediate: Building independence – Level 3. Experiment, Level 4. Dare;
3. Advanced: Taking responsibility – Level 5. Improve, Level 6. Reinforce,
4. Expert: Driving transformation, innovation, and growth – Level 7. Expand, Level 8. Transform.

Competence Areas	**Ideas and Opportunities**	**Resources**	**Into Action**
Competences of each area	Spotting opportunities	Self-awareness and self-efficacy	Taking the initiative
	Creativity	Motivation and perseverance	Planning and management
	Vision	Mobilizing resources	Coping with uncertainty, ambiguity, and risk
	Valuing ideas	Financial and economic literacy	Working with others
	Ethical and sustainable thinking	Mobilizing others	Learning though experience

Table 1. Three competence areas of the EntreComp framework (Bacigalupo et al. 2016).

In order to develop and test practices and learning environments that would foster entrepreneurship and innovation incorporated to it, we have chosen to follow the Entrepreneurship Competence framework, EntreComp, but paying attention especially to those framework's competences that foster innovation.

Hackathon as a Type of Innovation Contest

Stimulating innovations via contests has a long history (Maccormack, Murray, and Wagner 2013). Derived from "hack" and "marathon," hackathon events have their foundations in programming at MIT in the 1960s (Leckart 2012; Pe-Than and Herbsleb 2019; Zukin and Papadantonakis 2017). Hackathons have spread beyond their original IT-community, and nowadays are organized in educational, creative, corporate, and government sectors, and their essence lies in inclusiveness, the so-called "come-one-come-all ethos" (Briscoe and Mulligan 2014; Kienzler and Fontanesi 2017; Leckart 2012; Zukin and Papadantonakis 2017). Yet, the spread to other domains has caused proliferation of the concept (Medina Angarita and Nolte 2019). After conceptualization process according to (Podsakoff, MacKenzie, and Podsakoff 2016), hackathon has been defined as "one type of organized, goal-driven innovation contest, a short time-bounded event with a challenge to be solved creatively in coopetition and collocation of teams, whose results are presented and recognized in a ceremony at the end of the event." (Halvari et al. 2020). The research on hackathons is concentrated on their tangible and intangible outcomes, the design aspects, and the connections between the outcomes and design aspects. For example, learning and entrepreneurship have been detected as intangible outputs. (Medina Angarita and Nolte 2020) Furthermore, Medina Angarita and Nolte (2020) have listed the design elements that have been presented and researched in prior hackathon studies: hackathon design aspects, organizer, juror, participant, team, stakeholder, mentor, hackathon outputs. However, there are a great number of discovered research gaps in hackathon research, particularly regarding the hackathon design and the sustainability of hackathon outcome. Moreover, thorough descriptions of hackathons in education and particularly the role of pedagogy are missing from the literature (Duhring 2014).

There are some studies that portray hackathon use in educational context. Some of the studies have been carried out in Finland. In their studies of hackathons used in teaching software (SW) engineering in Finland, (Porras et al. 2018) have introduced particular features of hackathons. First of all, they present the fact that in teaching hackathons one can focus in two directions: on teaching (educational hackathons) or on innovating new teaching methods (innovation). In addition, they raise the point that different hackathons may have various and multiple stakeholders, such as students, teachers, companies, or a mix of them. Similarly, the composition of participants can come from various groups: students, intra- or inter-organizational participants, or a mix of them. Cost-wise they state

that a hackathon can either be for a fee or free of charge; a sponsor can also contribute to or cover the total costs of the event. Additionally, Porras et al. (2018) present seven uses of hackathons, although we disagree with them since they list competition as one type. However, generally in the literature, competition, or more specifically coopetition, lies at the core of a hackathon. Coopetition is simultaneous competition and collaboration (Ritala and Hurmelinna-Laukkanen 2013). The other listed uses of hackathon by Porras et al. (2018) can be seen more as part of collaborational learning that resort to programming events, instead of innovation contests. Moreover, an educational hackathon, revealed a dual-focus of the event: it combined urban and educational hackathon. In that dual-focus hackathon the university students yielded urban innovation for smart city concept in the City of Rauma, Finland (Suominen et al. 2019). Another education hackathon carried out in the City of Pori in Finland, portrayed the design elements of the educational hackathon, as well as the outputs of the events. The outputs the students reported were both complex solutions, but also integrated learnings (Suominen et al. 2018).

To sum up, when the essence of entrepreneurship and innovation as concepts are examined in parallel, multiple overlapping issues can be detected. First, both incorporate creativity and creative problem-solving at their core. Consequently, both entrepreneurship education and innovation pedagogy, including the learning environments, should be engaged with a problem-based, creativity-inducing situational social environment, where collaboration and networking are fostered. Thus, we claim that innovation pedagogy is an inherent part of entrepreneurship education. Innovation pedagogy's role should be stressed when instructors develop practical entrepreneurial experiences for entrepreneurship education. As there is a need for more research on the practices used in entrepreneurship education, we aim to focus particularly on the creative problem-solving attribute of entrepreneurial orientation. Thus, our goal is to study hackathons as a practice of innovation pedagogy, thus also entrepreneurship education, and more specifically, educational hackathons, which are regarded as one type of PBL-method.

Method and Case Description

We chose a case study approach (Dyer and Wilkins 1991; Montonen and Eriksson 2013; Siggelkow 2007; Weick 2007) to study educational hackathons in Finland. In our case study, first, the theory of entrepreneurship education and educational hackathons were reviewed in the literature. Then, an educational hackathon was planned and implemented together with main organizers from Tampere University of Technology (TUT), The Hermia Group innovation company (Hermia), SAP Finnish User Group (SAP Finug), and SAP Finland. The purpose of this empirical study was to research the educational hackathon method's feasibility and impact on entrepreneurial teaching and learning in Finland. The educational hackathon process was developed in university-industry collaboration.

The blueprint of the educational hackathon from the university teaching perspective is illustrated in Figure 2 below.

The case study is centered on the SAPSyke educational hackathon event held on 22–23 April 2016 in Kampusareena—a hub of science, research, and technology located at the heart of the campus of TUT in Hervanta, Tampere. The organizing of the hackathon event was supported by the DigiSyke -project funded by the European Social Fund (European Commission 2018). The research team consisted of members of the DigiSyke-project consortium, namely TUT and Hermia. The research team participated in planning meetings of the hackathon, training days organized to develop skills needed for participating in the hackathon, briefing events to the participants, hackathon days, and a #RACE2025 event, where the hackathon winners presented their concepts to SAP and SAP user companies in Finland. The hackathon was integrated into teaching at TUT using two options: either as an alternative project work for a course or by completing an additional 2-credit course. The hackathon was open to anyone interested in the SAP Finug challenges or SAP technologies, and it was distributed in the form of an open call through the SAP Finland, SAP Finug, TUT, and Hermia networks. The hackathon event and related training days were free of charge to all participants and were not limited to SAP enterprise resource planning (ERP) software users. More than one hundred people organized into twenty teams participated in the SAP Hana Cloud Platform -training days and the hackathon event. They included participants from SAP partners (professionals), start-ups, and several HEIs. Student participants originated from TUT, the University of Tampere (UTA), Tampere University of Applied Sciences (TAMK), and Metropolia University of Applied Sciences (Metropolia). This case study is focused on how the educational hackathon was integrated into teaching and learning at TUT involving a course organized by a research team member.

The main data collection methods included in the case study were participant observations (Gogdan and Biklen 1998; Smith 1978) performed by two DigiSyke consortium members of the research team, video recordings made of the hackathon event (including, e.g., the pitching of team results), course and hackathon documentation, written reports, and course feedback received from participating students from TUT. A third researcher was involved in the triangulation of all the documented course-, hackathon-, and student-created materials.

Results from the Empirical Study

The results from the empirical study are divided into three sections according to the research data: a) course and hackathon documentation, b) observations from the hackathon event as a whole, and c) written reports and course feedback by the students.

Course and Hackathon Documentation

The course and hackathon documentations are used to illustrate the background of the case and to spot potential good practices and areas needing improvement. The general four-month timeline of SAPSyke Hackathon 2016 from the perspective of the organizers is illustrated in Figure 1. Besides the two-day hackathon event, there were five SAP Hana Cloud Platform training days prior to the hackathon organized by SAP Finland. The hackathon participants, including students, were able to take part in any (or all) of the training days. After the hackathon, some of the winners were also invited to participate in #RACE2025 event in Helsinki.

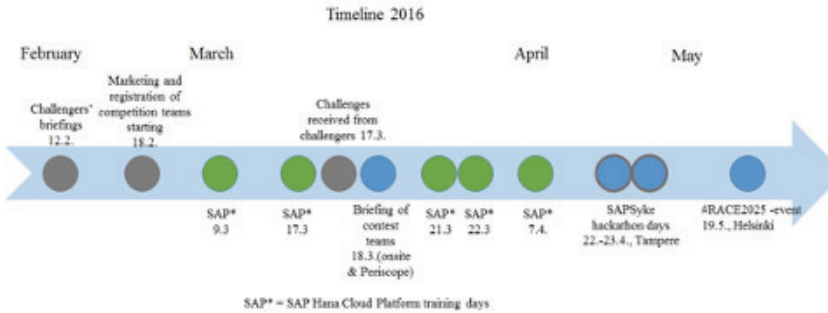

Figure 1. The timeline of SAPSyke Hackathon 2016 from the organizer perspective.

TUT-students were given two alternative options to further their studies by participating in the educational hackathon. The first option was to complete a project task related to "Data and Information Analytics" -course (4 credits.), by participating in the technology training day, generating an analytics-related solution to the challenges defined by SAP Finug, pitching this solution to the jury of university and company representatives, and creating a written report of the experience following an NABC-model, which has been found effective in various TUT innovation projects (Pippola et al. 2012). NABC-model for pitchning is an acronym of Need-Approach-Benefits-Competition created by Stanford Research Institute (Carlson and Wilmot 2013). The second option included similar student learning activities through which the students could receive credits from either the "Hypermedia Workshop" (2–3 credits) available for students of mathematics, or the "Topic of Current Interest in Information and Knowledge Management" (3 credits) available for students of knowledge management. In the latter case, it was agreed to fix the practicalities with the teachers responsible for the courses when and if students took this option. Preliminarily, this option was found to be feasible by the teachers and they agreed that this could be marketed for TUT-students. These opportunities were then communicated inside TUT through the intranet,

the Edutech Centre for Professional Development mailing list, and during the "Data and Information Analytics" course lectures. Information about the educational hackathon and related technology training days were added to the TUT-event calendar and public website, too. Nevertheless, no students signed up for the second option. Only 6 students out of 53 "Data and Information Analytics" course students chose the educational hackathon as a way to complete the course project work. As a result, it is debatable whether the lack of participation of students at the case university was the result of inadequate communication about the opportunity to participate in the educational hackathon and its potential benefits, insufficient perceived value (perceived benefits against perceived sacrifices), or the practical challenge of fitting the required activities into the tight schedule of the students (see Duhring 2014).

From the student perspective, in addition to receiving credits for completing a course the students were informed of the bonus benefits: the potential of a €3,000 monetary prize, free technology training, contacts, and networking with SAP Finland, SAP user companies, consultants, startups, and students from other universities, as well as the opportunity to develop entrepreneurship competence. The selection of the winning solution (one or more) in the educational hackathon included the following three assessment criteria: (1) innovativeness and novelty of the idea, (2) matching the goals and needs of the target company, and (3) demonstration of the idea using SAP Hana Cloud Platform technology. The assessment criteria were introduced to the participants before the hackathon and reintroduced at the beginning of the hackathon.

The schedule for the two-day hackathon event is illustrated in Table 2. The first day started in the afternoon and ended in the evening. The second day started in the morning and ended in the late afternoon. Altogether, the teams had five hours of teamwork during the day. Naturally, they could benefit from the break times too. During the hackathon, there were five challenger companies present (Apetit, Raisio, SOK, Posti, and SAP Finland). The challenger company representatives answered the questions of the teams and guided them when needed. In addition to the challenger company representatives, technical support was made available by SAP Finland during the contest.

Duration	Activity
1st Day	
1 hour	Registration begins, coffee
1/2 hour	Team formation for individuals not yet with a team
5 minutes	Welcome address by a representative of SAP Finug ry
40 minutes	Opening speech by mayor of the city of Tampere
15 minutes	Contest rules and launch of the contest by the chair of the jury, a university professor
2 hours	Teamwork; challengers' tables open for discussion
	Day ends with dinner and coffee

2nd Day	
1 hour	Morning coffee
1 hour	Teamwork continues, challengers available for team support
1 ½ hours	Lunch
2 hours	Jury visits each team for practice pitching round
2 hours	Pitching at the main venue, presentation order based on a lottery
1/2 hour	Jury meeting
1/2 hour	The announcement of winner/winners of the contest

Table 2. Two-day hackathon event schedule of activities and their durations.

Observations on the Educational Hackathon

When the documents and general observations of the case hackathon were gathered and analyzed according to the general design elements of hackathons (Medina Angarita and Nolte 2020), , a lot of design information regarding the hackathon, and particularly as educational hackathon, can be detected (Table 3). Furthermore, the educational hackathon blueprint (Figure 2) prepared according to the case hackathon, is an abstraction of the case study. The blueprint describes the actors involved (universities, SAP Finland, and SAP user companies), and the key activities from the university teaching perspective. The idea of presenting the abstraction is, first, to illustrate a transferable blueprint that could be applied in different countries, for instance, a university (or universities) in the U.S. collaborating with SAP U.S. and American SAP user companies, and second, to give an overview of the educational hackathon from the perspective of a university teacher, who integrated the hackathon into his course content and teaching.

When the observations of the case study were studied more closely, several issues were discovered. One issue prior to the launch of the hackathon process was presenting and selling the hackathon idea to the challenge owners by university people. Hackathon concept development and marketing cooperation, and the hackathon idea as an innovation tool for industry had to be presented and sold to the challenge owner, in this case, the SAP Finland, and SAP Finug. “In this case, the original idea came up with the DigiSyke-project team, who got the SAP-representatives excited and involved. After that, the progress was quite organic. Yet, without the initial trigger made by researchers and teachers, the hackathon would not most likely have been arranged.” This quote by university teacher highlights the importance of university personnel’s positive approach towards collaboration with industry.

Team building: It was possible to enroll in the educational hackathon with a team or as an individual without a team (and a clear focus). Seven teams and two individuals without a team registered from TAMK, one

team and two individuals without a team registered from TUT, one team registered from Metropolia and one individual without a team registered from UTA. Interestingly, the two individuals without a team from TUT dropped out during the educational hackathon, that is, they did not complete the educational hackathon assignment. On the other hand, these students had already chosen to complete the course project work from a personally acquired company project and had no need to complete the project or gain extra credits.

Design Elements	**SAPSyke Hackathon Design Elements**
Media and Infrastructure	Mixed: Offline with an online possibility; on university premises in a safe environment with the necessary space and equipment
Organizer	University (Tampere University of Technology) faculty members, innovation company (Hermia Group innovation company), a software company (SAP Finland), and the software company's user group (SAP Finnish User Group) 2 teachers from the University of Technology on the jury; 1 employee of the innovation company on the jury; 6 industry employees on the jury
Task/Topic Specificity (Problem Specification)	Low/Open task. The students created product and service concepts or ideas or products as self-formed teams according to the company assignment.
Focus of the Hackathon	Educational and Innovation
Output: Degree of Elaboration	Idea, concept, or prototype/product demonstration

Participation	Body of Participation: Majority students, but open to anyone: SAP partners (professionals), startups and several HEIs, student participants originated from TUT, University of Tampere (UTA), Tampere University of Applied Sciences (TAMK), and Metropolia University of Applied Sciences (Metropolia). Participation: Voluntary Case university students were completing alternate project work for a course, yet participation in the hackathon was voluntary Participation: Low number of case university students, altogether 100 people in 20 teams of which 10 student teams with 6 TUT students from a student body of 8,000 TAMK: 7 teams and 2 individuals without a team; Metropolia: 1 team; UTA: 1 individual without a team; TUT: 1 team and 2 individuals without a team, of which 6 TUT students aimed for course credits Heterogeneity of the participants: Main subjects of the students included knowledge management, information technology Signing up as an individual or self-selected team

	Team formation either in advance or at the hackathon event Specialized participant tools: SAP Hana Cloud platform
Stakeholders	Individual level: Students, teachers, employees of 3 organizations Organizational level: 4 participating HEIs; 11 participating companies and 3 participating start-ups, 5 challenger companies, 1 university, 2 companies and 1 user group as organizers; 4 partner organizations (Acando, Bilot, Fujitsu, SAP) Jury: 4 challenger company members, 5 organizer members (2 university, one innovation company, one user group, and one SAP member)
Collaboration/Competition	Individual/team level collaboration/competition (coopetition)
Contest Period	Short: Lasted for a total of 2 days
Design Process	Hackathon design made in university-industry collaboration. The entire process lasted 3 months including planning of the hackathon teaching and design, the educational events, as well as the hackathon event. The hackathon days included ideation and pitching.
Presentation of the idea/ innovation*)	5-minute pitch in two test practice rounds (one for challenger companies and one for the jury); 1 round in front of the jury and full audience

Evaluation	Jury evaluation Performance-oriented/ participation-oriented Jury including 2 university employees and 7 others
Feedback: Reward	Monetary reward for winners (€3,000 in total) that was split among 2 teams (of the case university) and course credits for students; Extra rewards for teams that matched another firm's business needs. Also, winning teams got to present their ideas in another event.
Mentoring: Facilitation	Professional: professional facilitation by professionals, teachers, and technical support Possibility to discuss the challenge with the challenge owner company
Attraction	Mixed: Online (university Intranet and public website, mailing list, event calendar) and offline during lectures
Contest Phases	One
Student Motivation	Technology training, contacts and networking with the industry, developing entrepreneurship competence in a memorable spectacle
Cost	Free of charge
Goals Reg. Course Content	Teaching students a platform technology software

Learning Material	Lectures and exercises on the platform technology software by the professionals and training of pitching by mentors
Assessment of Hackathon as Part Course	Hackathon reports were assessed

Table 3. The summary of the case according to educational hackathon design elements.

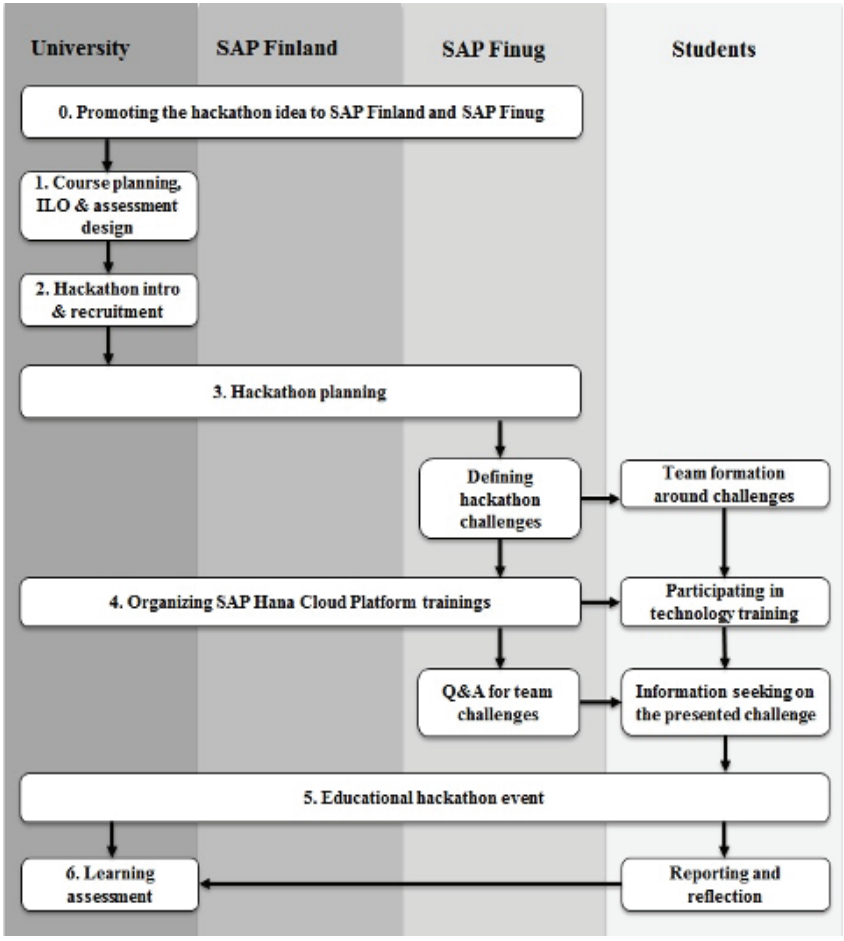

Figure 2. Educational hackathon blueprint from a university teaching perspective.

Students' collaboration with companies in Idea Generation phase: In the student teams, idea generation was perceived to have a slow start because of either unclear task/challenge definition or the students' hesitation to clarify it with the company. The students had the opportunity to discuss the challenge with the challenge owner company beforehand; however, during the educational hackathon, it became evident that many student teams had not done so. Officially, this was not a requirement for the "Data and Information Analytics" course of the case university, so there was no extrinsic motivation for TUT students to do so (Ryan and Deci 2000). As a result, part of the first day was spent on ideation of what the TUT team should do, which was also the case with some other student teams.

The role of challenge owners: The challenge owners were present during the hackathon and available for questions and further information. In addition, the organizers and challenge owners functioned as mentors to all teams. There were two practice pitch rounds, where the teams could pitch their ideas first to the challenge owners and second to the mentors and jury members, and receive feedback to improve their presentations. Overall, the quality of pitching was at a high level, and only one of all the student teams exceeded the given five-minute time limit and was thus unable to deliver their complete presentation.

Signs of entrepreneurial attitude and behavior were observable in the hackathon. For instance, an interesting development evolved with the TUT student team as it split into two teams during the hackathon. One team member was certain that he had a "killer idea" that he wanted to work on, but others from the team did not agree. After discussing it with the mentors, he decided to leave the team and form his own team around his idea. This can be considered an entrepreneurial attitude, following one's own vision and instinct.

Rewards from the outputs: According to the jury, there were many good solutions presented. The solutions provided by the students compared very well with the solutions of the professionals. In fact, some of the student solutions were more advanced concepts than the professional ones, although the professionals were able to demonstrate the solutions using SAP technologies better. Because of the many good solutions, the jury decided to split the €3,000 award into three (Table 4). The first, grand prize was awarded to a team which was a combination of professionals from two companies, Wärtsilä and Bilot. The two next best teams were a team of students and a three-person startup of former TUT students. An extra award for an innovative idea was granted to a TUT student who split from the original team of six TUT students. The winning teams were also invited to present their ideas at #RACE2025 business seminar organized by SAP Finug, held on 19 May 2016 at Virgin Oil Club, Helsinki. In addition to the official awards, one of the participating companies, Apetit Oyj, gave a €500 monetary award to two teams that best match their business needs. These company awards were won by the team "WESAP +

Bilot" comprising of professionals, and a team of four TAMK students. In total, the student teams received €1,250 in prize money for participating in the hackathon.

Prize	Team Members
1. Grand prize €2,000	Professionals: combination from two companies, Wärtsilä and Bilot
2a. €500	Metropolia students
2b. €500	3-person startup of former TUT students
Extra award for an innovative idea €250	1 single student
Apetit awards for the best-matched idea to company's business needs	
€500	Professionals: ABB and TMO Consulting
€500	TAMK-students

Table 4. Rewards granted to winning hackathon teams.

Development of entrepreneurial skills was evident in several entrepreneurship competence areas during the hackathon. The observations on the manifestations of entrepreneurship competence areas during the hackathon are summarized in Table 5.

One interesting example of skills development is next illustrated by a team of knowledge management students from TUT that decided to work on the SAP Finland defined IoT-challenge: "How to monitor any Thing, analyze & visualize measurements and take actions to keep it working?" Related to the Ideas and opportunities competence area, during the ideation phase one of the team members got an idea of a solution that would provide additional information about any product with a barcode to consumers and simultaneously offer an easy-to-use webstore for purchasing additional and complementary products. Thus, the student spotted a new opportunity that went beyond the challenge specifications. The other team members were in favor of keeping to the challenge specifications, and developing an IoT-solution for preventative maintenance of production machinery and equipment. What followed was that the team split into two, and the one student followed his own novel idea and vision of new service to consumers while the remaining team members worked on

a solution that was more fitting to the challenge specifications. Both of these teams displayed sustainable and ethical thinking. For the preventative maintenance team, the vision was to avoid break down of expensive machines and equipment and to increase industrial product life cycles. For the team of one, the sustainability of the "Social-tag" was demonstrated for instance in the pitch presentation, where a use case was presented that illustrated a customer reading a barcode with a mobile phone and seeing a "Facebook-like" discussion on the food product recipes and recommendations on how-to use the product. For example, consumers with food allergies could easily check potential problems with the different food ingredients and discover alternative products for preparing their meals while still at the store. This could reduce waste and, depending on the consumer preferences, also guide them towards more sustainable choices.

Ideas and Opportunities	**Resources**	**Into Action**
Spotting opportunities: The students spotted new opportunities beyond challenge specifications, e.g., barcode use at IoT-challenge Creativity: The students displayed creative combinations of technologies for new application areas and contexts, e.g., technology helping people with food allergies Vision: Solutions were envisioned that were not possible with existing technologies	Self-awareness and self-efficacy: Manifested, e.g., in believing in oneself and courage to work on one's own ideas and vision without support from others Motivation and Perseverance: Only one student group dropped out, motivation and perseverance to work on an idea even when others rejected it Mobilizing Resources: using the mentors to improve ideas, support development, and presentation of ideas	Taking the Initiative: Contacting mentors and challenge owners when needed Planning and Management: Preparing use case and data in advance for the hackathon, making use of formal planning and management methods, such as design thinking and service design Coping with Uncertainty, Ambiguity, and Risk: Making use of new technologies, e.g., SAP HANA cloud platform, and skills, e.g., pitching without knowing what the end result will be like

Ethical and Sustainable Thinking: Existing sources of waste were identified and also ways to eliminate waste by using technologies and new ways of working, e.g., IoT-solution of preventing maintenance and "Social-tag"	Financial and Economic Literacy: Development of revenue models and business models Mobilizing Others: Using outside resources and personnel to develop ideas and solutions	Working with Others: Team spirit and sense of community working toward common goals Learning Through Experience: The overall hackathon is an experience, but, e.g., pitching the team's ideas during the hackathon was a new experience for many students

Table 5. Observations on the manifestation of entrepreneurship competence areas during the hackathon.

Regarding the "Resources" competence area, the previous example also demonstrates the development of self-awareness and self-efficacy, as well as motivation and perseverance of a student following his own vision. Before breaking off from the team, the student came to talk to the mentors about his conflict on the team preference and his own idea. He was frustrated and disappointed about not being able to convince his team to follow his idea and vision—and at the same time sure that his idea was better, more innovative and something that really could make a difference. His courage, innovative ideas, and excellent pitch at the hackathon inspired the hackathon organizers to create an additional award for courage and innovativeness, which he was given as an extra prize. After confirming that he did not have to stick with the team, but could be his own team, he was visibly relieved and excited at the same time, which seemed to energize him for moving ahead with his own vision. In mobilizing resources and mobilizing others, there was much variance between the teams. Some teams actively sought for advice from the challenge owners and mentors, while others were content to meet with challenge owners and mentors at the times reserved in the schedule. Most interestingly, the professional teams also used their company's international resources and, for instance, involved off-site developers to enhance their solutions. No student teams were observed to make use of similar outside resources to improve their solution. During the hackathon, many student teams had advanced their ideas and prepared their presentations but were missing business logic and especially the revenue model of the solution. The biggest development during the hackathon days was perhaps seen

in the development of revenue models and the increase in financial and economic literacy. Many students said this was the first time they had to prepare a revenue model and its justification for professionals.

Regarding the "Into Action" competence areas, several occurrences of competence development were observable. Taking the initiative materialized in many ways. For instance, some student teams actively sought feedback and more information from mentors and challenge owners about their ideas. In addition, some student teams also made use of the opportunity to talk with SAP-experts for advice on creating the technology demonstration. Planning and management were observed to be lacking for many student teams before the hackathon. Those teams that planned in advance were able to move more quickly toward building a demonstration, whereas some teams began their hackathon with ideation of what they should do. Few teams had also prepared data in advance for the hackathon in order to spend more time on design and demonstration of their solution. At least one student team was familiar with design thinking and service design methods that enabled the team to create a story around their solution. Coping with uncertainty is somewhat inbuilt to the nature of hackathons. Mostly this was evident in the rush to create something concrete during the hackathon. Some of the student teams were uncertain whether they could use SAP-technologies to demonstrate their concept, and decided to concentrate on developing a mockup instead, while others did their best also to incorporate SAP-technologies in the demonstration. Hackathons are all about working with others and having a sense of community with other teams and organizers. It could be observed that the student teams were clearly enthusiastic and energetic in working with their team; the working also seems to be more fun compared to traditional classroom teaching. The organizers also aimed to build a sense of community, for example, by providing contest t-shirts for all participants and having invited speakers to motivate and highlight the importance of the work to be done in the hackathon. As this was the first hackathon experience for all the student teams, it was not possible to observe or interview comparative aspects from previous similar events.

Written Reports and Course Feedback

In their reports regarding the hackathon, the students portrayed their views on their output and impact of the hackathon, as well as their suggestions for improvement regarding the design of the event. Furthermore, in their course feedback, they also reflected on the hackathon as part of the course and suggestions for course planning.

In their output, the teams demonstrated their use of previously gathered factual and procedural knowledge, including various methods to yield new ideas. Furthermore, with their chosen tools and methods combined with the newly taught method, the teams were able to focus on the customer's business needs and produce customer-oriented solutions,

thus demonstrating entrepreneurial and innovative attitudes and actions combined with the novel technical skills they had acquired:

> We combined the NABC-method with other ideation techniques from (another) class, which provided a systematic method to define the needs. In practice, this meant that in the begining, we spent approximately half an hour on individual ideation. After that, we evaluated the ideas together by dividing them into six categories: why, who, what, when, where, and how.
>
> The NABC-method was well suited to innovation in a hackathon, and to demonstrate the was the exploitation of predictive analytics in preventative maintenance service. The goal was to measure, analyze, and visualize anything that could maintain the operations. The approach could be chosen freely, but the company wished to utilize the SAP Hana Cloud Platform while being innovative, which is also directly linkable to the NABC-method. Furthermore, the benefits of the solution developed by the team had to be presented to the jury and the customer company representatives comprehensively, although condensed within the five-minute time range. Naturally, the precondition for success in this hackathon was to differentiate your team from the 20 other competing teams.

The hackathon was perceived as a positive experience of innovation capability demanding a time-bound learning environment with industry collaboration:

> In general, the hackathon was positive and above all, a different experience for putting the competence of the team to the test in a time-bound task. We can be satisfied with our end result and performance in relation to other teams. Particularly as none of us had any previous experience of the industry environment or SAP HCP. Consequently, we would have needed more software development experience on our team during the hackathon, in order to develop a working concept of HCP. The essence of the event was the ideas, which our team had plenty of.

In their course feedback, the students commented that the hackathon was an unforgettable experience related to teaching in general:

> The last SAPSyke participation was an experience that stuck in my mind as a rarity out of all of the TUT courses. Well done teacher [X]!

> During the course, there was a splendid use of various tools. The topics and tools were very interesting. The lectures were informative and they were held in a good spirit. Participating in the hackathon was a good choice.

In their course feedback, the students also gave suggestions for improvement particularly regarding the support of hackathon methods in the course context. They regarded the HCP training by the professionals as too elementary.

> The lectures could have been in a more sensible place. The hackathon could have been supported within the course context. Now the practice was independent since the HCP training was really elementary.

Knowledge of the technology was deemed insufficient; the students were expecting more skill development. Although additional the students were introduced to e-learning material and online courses that they could use to further develop their programming and HCP skills prior to the hackathon event, they did not make use of such an opportunity.

Conclusions

This article contributes to the literature of entrepreneurship education. More specifically, it contributes to the educational practices that induce practical entrepreneurial experiences, thus answering to the need called for in the previous literature (European Union 2014; Harkema and Schout 2008; Passaro et al. 2017). The contribution our study makes is both conceptual and empirical. First, this article contributes to the concepts of entrepreneurship education and innovation pedagogy by emphasizing their theoretical interconnectedness, and clarifying the role innovation pedagogy plays within the entrepreneurship education as a whole. In this study, the educational hackathon is regarded as one type of innovation contest in educational use with specific design elements. Therefore, also the concept of the hackathon is further developed by highlighting the design and execution process involved within an educational hackathon as a method creating practical entrepreneurial experiences by means of innovation pedagogy. Second, the empirical contribution regarding the educational hackathon process portrays a case held in an industry-university collaboration involving four HEIs with voluntary, multidisciplinary student participation in Finland. Our case sheds light particularly on the educational hackathon as a method of innovation pedagogy for teaching innovation competence, which is a paramount and integral part of entrepreneurship competences. Furthermore, we describe students' entrepreneurial orientation manifestations in each of the fifteen competences of the Entrepreneurship Competence framework (EntreComp) (Bacigalupo et al.

2016). Thus, our study adds to the knowledge on utilizing EntreComp as a foundation for designing and executing practical entrepreneurial experiences in HEIs.

The goal of our empirical study was to explore whether an educational hackathon, would achieve practical entrepreneurial experiences for the students. When viewed through the theoretical lens of the EntreComp-framework, the observation results display that in our case this hackathon induced all of the fifteen competences described in EntreComp. As a method, the hackathon is originally aimed toward innovation purposes, naturally those entrepreneurship competences related to creativity and innovation (Ideas and Opportunities, or Spotting opportunities, Creativity, Vision, and Valuing ideas) were particularly visible with all of the observed student outcomes. As the case was in the context of HEIs with technology-oriented goals, the outcomes students presented was mostly based on the new technology provided by the assigning company, i.e. technical artifacts (Medina Angarita and Nolte 2020). However, the students presented a variety of complex solutions, even beyond the scope of the challenge specifications. Quite interestingly, the solutions provided by the students compared very well to the solutions provided by the professionals. In fact, some of the student solutions were more advanced concepts than the professional ones, although the professionals were able to demonstrate the solutions using SAP-technologies better. Besides manifesting competence for technological innovations, the students reported having applied models that they had learned previously in their studies, such as the "5 Ws and one H question" –method (Hart 1996) and having even combined it with NABC-method they learned during the course. Although sustainability was not at the core or particularly highlighted during this hackathon, at least two of the teams displayed in their outputs the Ethical and sustainable thinking, which is also one of the entrepreneurship competences of the Ideas and Opportunities.

Regarding the Resources-competences of EntreComp, particularly the ability to turn the Financial and economic literacy into new or developed revenue models was portrayed in the work of students, although for many students, this hackathon was their first attempt to prepare one—and even argue it to professionals. Thus, they were using their factual and procedural knowledge and integrating it into new knowledge during the hackathon process. Many of the "Into action"-competences of EntreComp are incorporated in the method of the hackathon, which as a method is inherently future-oriented, collaborative, requires planning and proactivity, and may be outside of one's the comfort zone. Specifically, the features of entrepreneurial orientation, such as time-bound problem-solving, communication and negotiation skills, and networking were also trained, developed, and expressed during the hackathon. As a comprehensive experience, creating and practicing a pitch is one of the focal activities of hackathons, and currently a vital skill in professional life in all branches. Our case hackathon offered the students an opportunity to

train the presentation skills of pitching, which was appreciated by the students. Although most of the fifteen entrepreneurship competences of Entre Comp were detectable via observation in the hackathon, some students did outperform others in some of the Resources-competences, such as in Self-awareness and self-efficacy and Motivation and perseverance with exceptional entrepreneurial orientation and mindset. Furthermore, we observed that some student teams were more prone to Mobilizing resources and Mobilizing others than other teams. These findings are in line with the aims of EntreComp-framework as whole, thus confirming the presumptions of the framework. That is, as a learner can acquire different—or the same—levels of proficiency in each of the fifteen competences, all students have an individual proficiency level in entrepreneurship competence as a whole, based on their background, education, and experience (Bacigalupo et al. 2016). Moreover, our empirical results also presented that hackathons with entrepreneurship and innovation stimulating learning environments in university-industry collaboration bring out advanced integrative learnings (cf. Huber et al. 2007; Huber and Hutchins 2004).

When a hackathon is evaluated as a method for creating practical entrepreneurial experiences for entrepreneurship education and innovation pedagogy, our observation results imply that the hackathon does incorporate multiple opportunities for creating such experiences. We observed that as a learning environment, a hackathon allows the students to exploit their knowledge, explore new knowledge, and be creative in a fun, motivating, and collaborative way that truly enhances their innovation competence—and thus entrepreneurship competence. Additionally, in general the students gave mostly encouraging feedback regarding the design of the educational hackathon: they considered the hackathon as a good opportunity to learn and try creative thinking methods and evaluate their ideas. They considered the opportunity to learn how to pitch their ideas in a condensed way, and reflect their result and performance to other students and people working in the industry as a positive one. Although the hackathon was an intense two-day-long event, they felt it was memorable and fit into the course syllabus well. However, regarding the hackathon design, in our case in both our observation and feedback results, we discovered three phases of the hackathon execution where there was room for improvement: (1) the pre-event preparations, (2) competence development supporting hackathon activities, and (3) the task definition and communication. First, the significance of selling the idea of the hackathon to the challenge owners was a crucial moment for the materialization of the educational hackathon in collaboration with the industry, which, in our case, was carried out by the university instructors. Furthermore, we noticed that there was perhaps not enough iteration with the challenge owners for developing the event properly. Second, our feedback results show that the hackathon activities that supported competence development carried out by professionals, most likely without significant pedagogical experience, were considered too elementary by the

students. Additionally, the students expected more hands-on skills development, for instance regarding technology or coding skills—not knowledge available online. Moreover, students did not appreciate additional e-learning materials or online courses to study on their own time, nor did they make use of such opportunities. On the other hand, during the hackathon event, there was very little time to teach and learn for instance coding or creative problem-solving methods. Third, in the context of an IT-intensive hackathon, our results show that the task definition, which did not provide enough boundaries, slowed down the ideation of some students at the beginning. Yet, our results showed heterogeneity in the pursuit of the students for additional information from the challenger company representatives.

To conclude our results and answer our research question, we claim that conceptually innovation pedagogy is an integral part of entrepreneurship education. Innovation pedagogy practices can lead to applied entrepreneurial experiences which yield and enhance entrepreneurship competences. Hackathon as an innovation contest is an innovation pedagogy practice which enables the development of various types of entrepreneurial orientation. In fact, all fifteen entrepreneurship competences according to EntreComp-framework were detectable in our case, and carried out in university-industry collaboration in the context of HEIs in Finland. Based on the empirical study we claim that the hackathon is a functional method for teaching and learning the competence of entrepreneurship, especially innovation competence in university-industry collaboration in HEIs. However, as a single case study, this research does have its limitations. Particularly, being a single case study in IT-context of HEIs in Finland, it portrays only a specific application of the method.

Discussion

The results of our case study produce multiple both academic and practical implications. As we have discovered that theoretically innovation pedagogy is inclusive to entrepreneurship education, we claim that hackathons, as one type of innovation contest and a practical innovation method, can also be used for practical entrepreneurial experiences. Moreover, the results of our empirical study confirm our claim: hackathons seem to induce the practical entrepreneurial experiences which, from a pedagogy perspective, benefit the students' development and/or the reinforcement of multiple entrepreneurship competences. Thus, both entrepreneurship education and innovation pedagogy would benefit from acknowledging hackathons as a versatile method, not only in IT or HEI but also in other contexts. We suggest, that hackathons should be considered as a fundamental and natural type of entrepreneurship education besides classroom lectures, exercises, and laboratory work.

Our empirical results were in line with the aims of the EntreComp-framework as a whole, confirming that an individual learner can acquire

different—or the same—levels of proficiency in all fifteen competences. However, each person has an individual proficiency level in entrepreneurship competence as a whole, based on their background, education, and experience. Thus, in practice, the students participating in the hackathon may have different proficiency levels in each entrepreneurship competence. Furthermore, the entrepreneurship and innovation stimulating learning environment in a hackathon carried out in university-industry collaboration resulted in manifestations of advanced integrative learning outcomes (Huber et al. 2007; Huber and Hutchings 2004) by combining learning new tools and capabilities via lectures and exercises held by technology professionals. Additionally, students were able to combine the understanding of the business side while competing in parallel against people working in the industry. In other words, hackathons provide the possibility for advanced integrative learning. These types of integrative entrepreneurship and innovation stimulating learning environments have been emphasized both in entrepreneurship education (Bacigalupo et al. 2016) and innovation pedagogy (Kettunen et al. 2013), which suggests the usability of hackathons as a learning environment for future competence needs. From pedagogy viewpoint, a hackathon is a collective experience, and our results imply that it is also a platform for individual growth: in a hackathon, all participants can build on their strengths and "test the waters" concerning their less proficient entrepreneurship competences. Some of the entrepreneurship competences may be more generic and, therefore, attainable and teachable for the majority of students as well. However, a hackathon may bring to the surface or encourage the potential entrepreneurship competences within an individual. Furthermore, as not all students can be at the same "expert" level, a hackathon as a collective experience may bring synergy: everyone learns a bit more than they would have in an individual experience.

Our empirical study does also implicate some areas, where attention should be paid to in practice, particularly when designing and executing educational hackathons in HEI-context. One area is the pre-planning in collaboration with the industry stakeholders and predefining the task as clearly as possible. Our results showed that it is important to sell the idea of the hackathon to the challenge owners in order for the hackathon to materialize. This action might naturally be carried out by the university faculty. This might not be the only direction of action, however. When faculty want to give their students authentic event experiences, our results indicate that taking the initiative, approaching and collaborating with the industry would be convenient for multiple stakeholders. Furthermore, iteration with the challenge owner prior to the hackathon could give more time for the development of the event properly. In addition, the clearly pre-planned task definition would benefit the event, as our results imply that the clearer the task, the faster the startup. Pre-planning could take into account the marketing of the hackathon events as a means of networking and university-industry collaboration, as well as image-enhancement for

the collaborating companies, the industry, and even the participating universities.

The second area would be the preliminary assignments for the hackathon. If the educational plan of the hackathon also included preliminary assignments, our results show that this should be clarified to the students, and this may increase greater pre-event involvement. In practice, this could be carried out, for example, by rewarding the "most prepared" participants (Duhring 2014) or by a flipped-classroom (Gilboy, Heinerichs, and Pazzaglia 2015) type of approach. Thus, the hackathon time would not be used on clarifying the challenge and task descriptions.

The third area of focus would be the better integration of the educational hackathon into the course content. Particularly, our results in an IT-context showed that a two-day hackathon is a too short of a period to teach or learn for instance coding or creative problem-solving methods. Therefore, industry collaboration with university teachers in lecture planning would benefit both parties to ensure that the pedagogic views have been taken into account. Moreover, the training prior to the course should develop the students' technology skills to such a level, that they would be able to demonstrate their ideas effectively with the new technology or technologies at hand. From pedagogy viewpoint, carrying out the training by means of practical exercises would be advisable because students are not eager to look for or go through e-learning materials or online courses unless it is integrated into the course content with mandatory exercises or opportunity to gain extra credit. Furthermore, if technology or programming skills should be developed in a short time window, skill workshops and coding camps (Porras et al. 2018) focusing on the challenge theme could be a more productive approach or supplement to the basic technology training in the classroom. In our empirical results, some student groups displayed sustainable and ethical thinking. This result is very encouraging, yet it would be advisable to emphasize sustainability and ethics more as an integrated part of the hackathons since it is an interdisciplinary skill and one of the entrepreneurship competences.

Fourth is the event executing in practice. Our result showed heterogeneity in the pursuit of the students for additional information from the challenger company representatives. Particularly in their first hackathon, when everything is new, seeking information outside one's own team should be emphasized and encouraged by the organizers.

In summation, the requirements for using hackathons as part of innovation pedagogy and entrepreneurship education must take three perspectives into consideration: first, the event design perspective; second, the syllabus and course planning perspective, with the integration of the hackathon seamlessly as a productive entity; and, lastly, the execution in practice perspective. After all, the aim of the teachers is to teach the students entrepreneurship and innovation competences in real business situation or a simulated situational environment.

Further Research

Further research is needed in general regarding practices that would induce practical entrepreneurial experiences. More research is needed regarding educational hackathons as innovation pedagogy methods, particularly as part of entrepreneurship education. More knowledge is needed about the various characteristics of entrepreneurship orientation and competences that could be enhanced via hackathons: the entrepreneurship competences and their interrelations in general, and the more generic versus context-specific competences, such IT or HEI-contexts. Furthermore, in terms of their generic or practice-specific character, some of these entrepreneurship competences may be easier to teach in any type of learning environment. Thus, more educational hackathons in other than in an IT-context would be beneficial. Several aspects about hackathons as a practice that leads to practical entrepreneurial experiences need more research. Especially, from the pedagogy viewpoint, the synchronization of competence building prior to the hackathon, should be studied.

Our findings will benefit academics studying and teaching entrepreneurship education and innovation pedagogy, particularly practical methods, such as educational hackathons. In addition, academics and practitioners focusing on innovation contests or hackathons will benefit from the results. Additionally, practitioners operating in industrial settings, particularly in retail and logistics product and service development, who aim to enhance their open innovation processes in collaboration with HEIs in Finland, will gain from our work through the examples of the ways hackathons can be organized and the benefits that can be achieved from collaborating with higher educations institutions, particularly with the hackathon-method in the fuzzy front end of innovation.

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