

Opening up the Black Box of Entrepreneurial Education

- Outline of an app-based action research project

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Questions we care about (Objectives). Most attempts to scholarly assess or explain the impact of entrepreneurial education have been made on anecdotal or macro levels. Quantitative survey-based studies outline correlations between stated input and output macro variables, but do not explore the black box of entrepreneurial learning in terms of how, when or why students develop entrepreneurial competencies. This methodological article outlines a novel research design capable of opening up this black box, leaning on the key role of emotional and critical learning events for developing students' entrepreneurial competencies.

Approach. We build on a new methodological tool consisting of a smartphone app capturing critical learning events as they occur followed by qualitative methods linking such events to key desired learning outcomes. Due to the methodological challenges with thought- and action-based assessment strategies, an emotion-based assessment strategy is applied, where emotional and critical learning events are viewed as a proxy between an educational intervention and students' developed entrepreneurial competencies.

Results. The article outlines how four teams of educators/researchers and their students at four different universities in Europe will be equipped with a tablet / smartphone app to longitudinally capture critical learning events, thereby exploring the more general question: How could a multi-site action research and mechanisms focused impact study of entrepreneurial education be designed?

Implications. The methodological steps will lead to a possibility to identify which pedagogical methods lead to desirable learning outcomes, and how the causal mechanisms generating them are constructed. The multi-site aspect of the research design allows for finding generalizable mechanisms present in many of the learning environments, allowing for reaching beyond the contextual and anecdotal good practice case into a possibility to construct new theory for further research as well as robust guidelines for practitioners.

Value and originality. While the method of sampling everyday experiences represents a growing tradition of conducting research in fuzzy, exception-laden and socially situated environments, this method has not yet been applied to entrepreneurial education in a multi-site and international setting. A novel characteristic is also the app-based capture of teachers' emotional events analyzed through multi-site composed focus group interviews allowing for better utilization of action research strengths. If the opening up of the black box of entrepreneurial education succeeds it can lead to more robust theory and evidence for entrepreneurial education, which could develop as well as increase the diffusion of entrepreneurial pedagogy. To illustrate this, expected findings are outlined in the article based on previous research and also based on an example given from on-going research. This has illustrated that the research design outlined in this article could very well be capable of opening up the black box of entrepreneurial education and contribute to uncovering key causal mechanisms in ways that have not been possible with more established research paradigms.

1 Introduction

The search for evidenced impact of entrepreneurial education (i.e. entrepreneurship and enterprise education, see Erkkilä, 2000) has so far been a challenging endeavor from a research point of view, and thereby indirectly also from a practitioner point of view. Most attempts to scholarly assess or explain the impact of entrepreneurial education have been made on anecdotal or macro levels, and do not meet a high standard of methodological rigor (Martin et al., 2013; Williamson et al., 2013; Volkmann et al., 2009). Many qualitative single case studies anecdotally outline contextual examples of entrepreneurial pedagogy, lacking deeper decontextualization, categorization or contrasting to other relevant educational environments. Many quantitative survey-based studies outline correlations between stated input and output macro variables, but fail to explore the black box of entrepreneurial learning in terms of how, when, whether or why students develop entrepreneurial competencies (Lackeus, 2014). Some also state that the randomized experiment method taken from natural sciences is largely inappropriate in meaning-laden social science settings in general (Little, 1991; Sayer, 2010) and in educational settings specifically (Biesta, 2007; Olson, 2004). The resulting deficit of robust theory and evidence for entrepreneurial education hampers development as well as diffusion of entrepreneurial pedagogy (Fiet, 2001).

According to Little (1991, p.197) there is a third alternative to giving up or merely providing narratives of particular phenomena. We can focus on uncovering causal mechanisms on a lower level, exploring the microfoundations of individuals' meaning-laden actions and experienced events, uncovering regularities in the mechanisms governing the behavior and experience of individual people. Sayer (2010, p.124) advocates for applying action research methodologies, i.e. iterative intertwining of reflection with participative action, leading to generalizable understanding of underlying mechanisms (Brannick and Coghlan, 2007).

Drawing on such a third alternative, this primarily methodological article outlines a research design leaning on the key role of emotional and critical learning events for developing students' entrepreneurial competencies, as advocated by scholars in the field (Souitaris et al., 2007; Kyrö, 2005; Gibb, 2002; Pittaway and Cope, 2007; Cope, 2003). We build on a recently outlined new methodological tool in the form of a smartphone app to capture critical learning events and explore linkages to key desired learning outcomes (Lackeus, 2014). We apply it within an action-based learning environment where teachers are action researchers and facilitators rather than lecturers transmitting subject expertise (Ollila and Williams-Middleton, 2011). The research design outlined investigates not only the immediate emotive and reflective reactions of the students to different events in the learning process (both designed and extra-curricular), but also the critical learning of the facilitating educators performing action research in entrepreneurial education. This is to recognize that in action- and emotion-based entrepreneurial education learning is co-created, between the learner and the facilitator / researcher, with learning reflections for both set of actors. Thus, to further understand the emotional learning in entrepreneurial education, we need to gather information from all involved in the learning process by applying mobile technologies in combination with action research methodology.

The purpose of this article is twofold. Firstly it aims to document an intended research design in order to generate feedback from the research community prior to launching a research project in four different cultural settings in four European countries. Here, the article outlines how four teams of educators / researchers and their students at four different universities in Europe will be equipped with a tablet and / or smartphone app to be used for longitudinally capturing and categorizing any critical learning events experienced. Secondly it aims to explore the more general question: How could a multi-site app instrument based action research and mechanisms focused impact study of entrepreneurial education be designed? Such a study has never been outlined or realized previously.

2 Theory and previous work

This section first briefly outlines entrepreneurial education in general, a specific focus on value creation as well as issues of impact assessment. It then outlines the proxy theory of assessing entrepreneurial education and its theoretical foundations. This theory posits that we can facilitate assessment by viewing emotional events as a proxy between educational design and developed entrepreneurial competencies (Lackeus, 2014).

2.1 Entrepreneurial education

Infusing entrepreneurship into education has been high on the political agenda the last few decades (Ball, 1989; Mahieu, 2006; Rosalinde-Hofer et al., 2010). Intended effects include job creation, economic growth, competence development, increased student engagement and societal change (Hindle, 2007; Kuratko, 2005; Hytti and O'Gorman, 2004; Moberg, 2014b; Rae, 2010). These effects have however shown to be difficult to achieve in practice due to generic school development challenges (Fullan, 2007; Elmore, 1996) and also due to more specific challenges with entrepreneurship in the educational system (Johannesson, 2010; Surlemont, 2007). Some common hurdles include resource scarcity, anti-commercialism among teachers, rigid educational structures, assessment difficulties and a lack of clear definitions (Sagar, 2013).

Whereas a narrow definition of entrepreneurship viewed as starting a company and becoming *an entrepreneur* is common in education and its related research, such a view is relevant only to a small minority of students and teachers. A broader definition is increasingly articulated (Mahieu, 2006) focusing on personal development, creativity, self-efficacy, initiative-taking, proactiveness and perseverance, i.e. becoming more *entrepreneurial*. Such a view has potential to make entrepreneurship relevant to most if not all students and teachers in the educational system. It however requires a clear view of what entrepreneurial competencies are in order to avoid being confounded with other initiatives in school development such as problem / project based learning and progressive / constructivist pedagogy (Blumenfeld et al., 1991; Helle et al., 2006; Savery, 2006; Tynjälä, 1999). Table 1 shows a framework for entrepreneurial competencies based on previous research in entrepreneurial education (Fisher et al., 2008; Lackeus, 2014), applying a tripartite division of competencies into knowledge, skills and attitudes (Kraiger et al., 1993).

Table 1. Framework for entrepreneurial competencies. Some competencies often deemed as entrepreneurial according to previous research (Fisher et al., 2008; Lackeus, 2014).

Entrepreneurial...	What is it?
...knowledge	Declarative entrepreneurship knowledge, procedural entrepreneurship knowledge, knowledge about oneself as entrepreneur/ial
...skills	Marketing, strategy, resource acquisition, opportunity identification/creation, learning skills, interpersonal skills, leadership skills, collaborative skills, creativity
...attitudes	Entrepreneurial passion, entrepreneurial self-efficacy, entrepreneurial identity, proactiveness, perseverance, uncertainty and ambiguity tolerance

2.2 Value creation as entrepreneurial pedagogy

To create some kind of value for someone – cultural, societal and/or economic – is a core aspect of entrepreneurship (Bruyat and Julien, 2001), and consequently also for entrepreneurial education (Moberg et al., 2012; Lackeus, 2015). This is however often de-emphasized when entrepreneurship is transferred to education. One reason could be its connotations to capitalism (Johannesson, 2010). Creating value to others

can however induce strong feelings of meaningfulness, perceived relevancy and personal well-being (Baumeister et al., 2012). Perhaps a focus on value creation activities could be one of the most important contributions entrepreneurship can make to an educational system frequently plagued by lack of student motivation and engagement.

Value creation as entrepreneurial pedagogy has previously been defined as letting students use their competencies acquired in education in order to create something of value to at least one (1) individual outside the educational institution (Lackeus et al., 2015). Important aspects of such a pedagogy are letting students get emotional ownership over the process, interact with the world outside school / university, work in interdisciplinary teams over extended periods of time, work iteratively and be encouraged to learn from failure. Figure 1 shows key dimensions of value creation pedagogy according to this definition. Two of the dimensions are highlighted; interaction with world outside class / school and value creation outside team / teacher. These two dimensions have shown to be particularly important in order to achieve student engagement in entrepreneurial education (Lackeus, 2014; Lackeus and Sävetun, 2014).

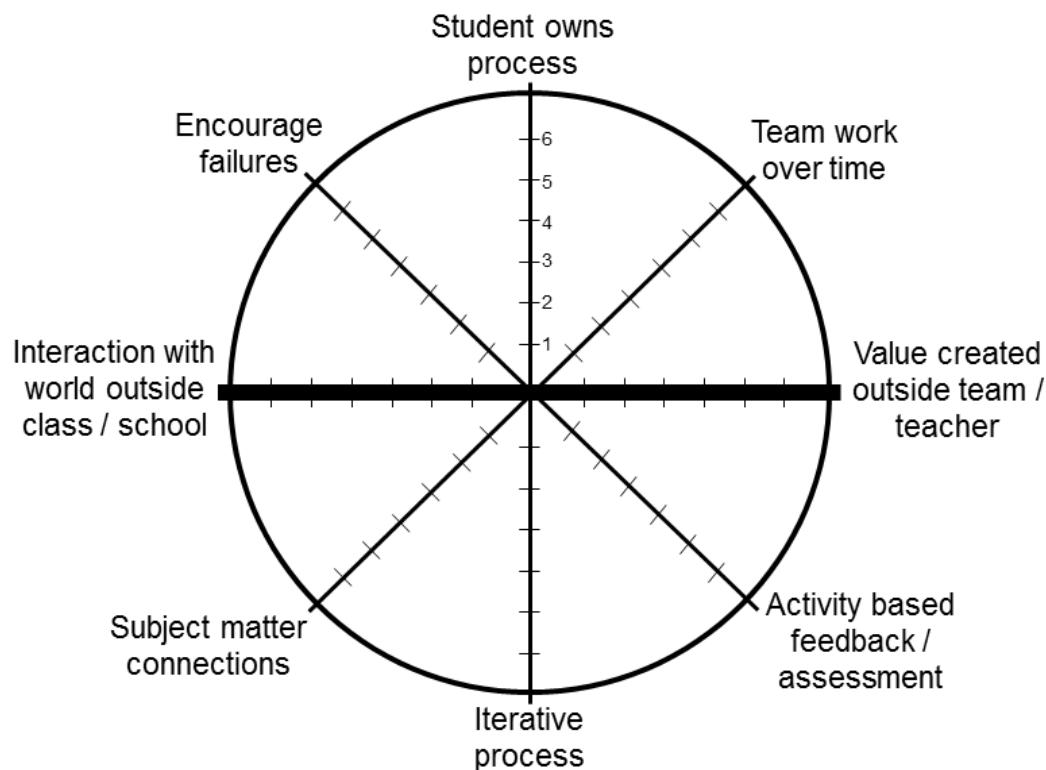


Figure 1. Spider diagram for key aspects of value creation as entrepreneurial pedagogy. Teachers working with entrepreneurial education can use these eight factors as a checklist in educational design.

2.3 Three strategies for assessing the impact of entrepreneurial education

Impact assessment of entrepreneurial education initiatives can be divided into three different strategies; thought-based, action-based and emotion-based assessment strategies (Lackeus, 2014). The thought-based assessment strategy probes for students' thoughts about their perceived ability and willingness to perform an entrepreneurial job. This is primarily done by using surveys leaning on the theory of planned behavior (Ajzen, 1991; Krueger and Carsrud, 1993). Students are asked to give their thoughts on their ability to perform an entrepreneurial job in terms of searching for ideas, entrepreneurship related planning and managing resources (see for example Karlsson and Moberg, 2013). Their thoughts before the educational intervention are compared to their thoughts afterwards. Differences are hypothesized to stem from the

entrepreneurial education having been administered. While this assessment strategy is easy to apply in large-scale studies, there are some major methodological challenges. Self-selection bias is virtually inevitable, since almost all entrepreneurial education today is voluntary. In addition, it does not penetrate the “black box” of entrepreneurial education, i.e. uncovering what happens during the education in terms of when, how and why students develop their entrepreneurial competencies. These challenges have led to the current situation where meta studies show that the evidence base for the impact of entrepreneurial education is largely inconclusive (Bae et al., 2014; Lautenschläger and Haase, 2011; Martin et al., 2013).

The action-based assessment strategy entails assessing actual entrepreneurial behavior post graduation. Entrepreneurial education alumni are followed for often substantial amounts of time, tracking their entrepreneurial activity in terms of start-ups and other entrepreneurial behavior related indicators (see for example Lundqvist, 2014; Lange et al., 2011). Establishing causation between an educational intervention and the resulting entrepreneurial behavior is however difficult. Two complicating factors are the challenge of self-selection bias and the time gap between intervention and impact (Fayolle et al., 2006; Liñán et al., 2011).

Due to the methodological challenges with thought- and action-based assessment strategies, an emotion-based assessment strategy was recently proposed by Lackeus (2013; 2014), leaning on the key role that emotions play in learning (Pittaway and Cope, 2007; Postle, 1993; Kyrö, 2005; Boekaerts, 2010; Dirkx, 2001; Jarvis, 2006). Emotional and critical learning events can be viewed as a proxy between an educational intervention and the developed entrepreneurial competencies among students, constituting an emotional events based proxy theory of assessing entrepreneurial education. The posited mechanism is shown in Figure 1, and leans theoretically on the key role of ‘critical learning events’ for how entrepreneurs learn (Cope, 2005; Pittaway and Thorpe, 2012; Cope and Watts, 2000). By empirically validating strong links between typical emotional learning events and developed entrepreneurial competencies, it has opened up for a new approach to assessing entrepreneurial education. Measuring the prevalence of certain key emotional learning events among students is proposed as an alternative to measuring the elusive entrepreneurial competencies. This can be regarded as a more fine-grained causal model than the common and idealized deductive-nomological model (i.e. ‘if C then E’) where the cause (C) is entrepreneurial education and the effect (E) is either the developed entrepreneurial competence (i.e. thought-based assessment) and/or the triggered entrepreneurial behavior (i.e. action-based assessment). Sayer (2010, p.107) states that “merely knowing that ‘C’ has generally been followed by ‘E’ is not enough: we want to understand the continuous process by which ‘C’ produced ‘E’, if it did”. This requires “opening up the black box and finding the causal mechanisms that have generated the macro-level observation” of C producing E (Hedström and Ylikoski, 2010, p.59). Viewing emotional events as a proxy between entrepreneurial education and its intended effects thus allows for studying more in detail the plethora of mechanisms that mediate between cause and effect, potentially opening up the black box of how, when and why entrepreneurial competencies can be developed through entrepreneurial education (Lackeus, 2014). While still exploratory research, the proxy theory of assessing entrepreneurial education has been corroborated in an empirical study by Kjernald (2014), largely confirming the key emotional events leading to developed entrepreneurial competencies outlined in Figure 1, albeit in the same empirical context that originally spurred the proxy theory.

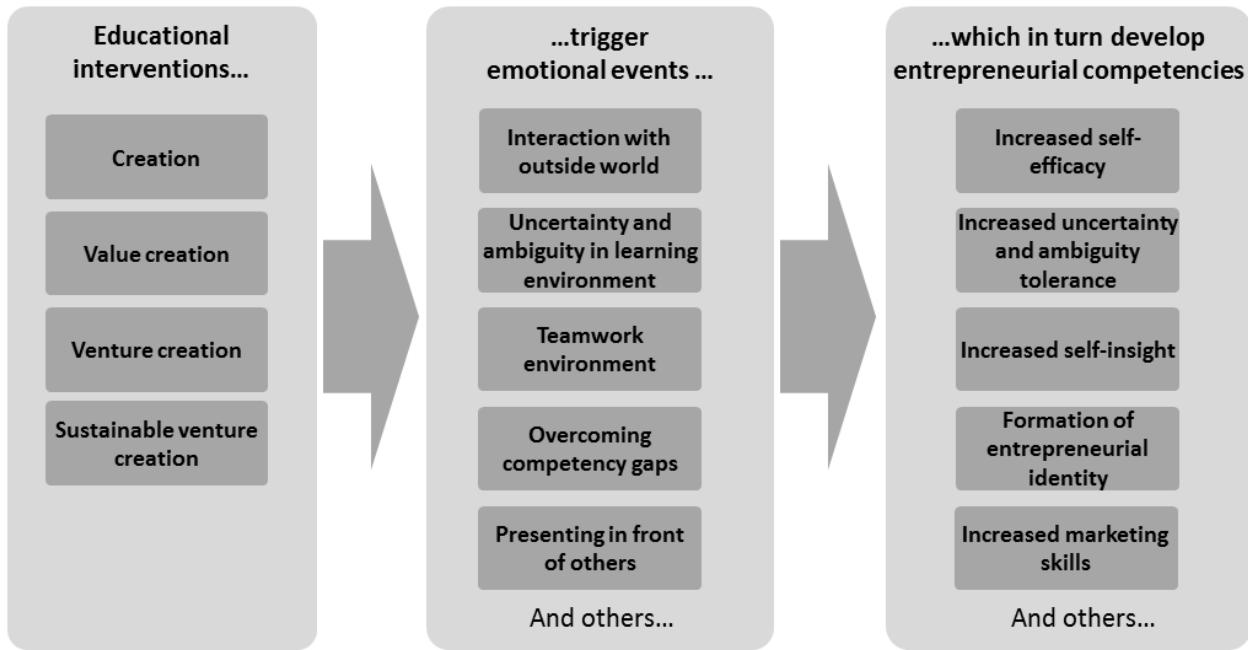


Figure 1. The proxy theory of assessing entrepreneurial education. Regarding emotional events as a proxy between educational intervention and developed entrepreneurial competencies. (adapted from Lackeus, 2013).

2.4 Previous work using the proxy theory of assessing entrepreneurial education

The proxy theory emerged from research conducted in a very rare educational setting labeled ‘venture creation program’ (VCP). A VCP is defined as a formal credit-giving educational program where a team of students is required by curriculum to try starting a real-life venture with the explicit intention to continue running the venture post graduation as lead entrepreneurs and co-owners (Lackeus and Williams Middleton, 2015; Williams Middleton, 2013). By definition it is the last formal step in the education system for students opting to continue running the newly founded business. Such a program balances on the border between formal entrepreneurial education and informal entrepreneurial learning, and can thus contribute with new insights in both these spheres, given its rare dual characteristic of educational environment and real-life entrepreneurship experience, see figure 2. As it is the educational setting that artificially triggers real-life entrepreneurial activity and learning, with realistic emotional and financial ownership of the lead entrepreneurs, the causal mechanisms of entrepreneurial learning can be studied in unique ways, perhaps even more so than when studying entrepreneurship as practice. Uncovered mechanisms can then be transferred to other educational environments and tested under less extreme conditions. One such uncovered mechanism is the educational concept of “value creation as pedagogy”, outlined in section 2.2. This mechanism has been transferred to primary and secondary education in Sweden resulting in strong increase in student engagement.

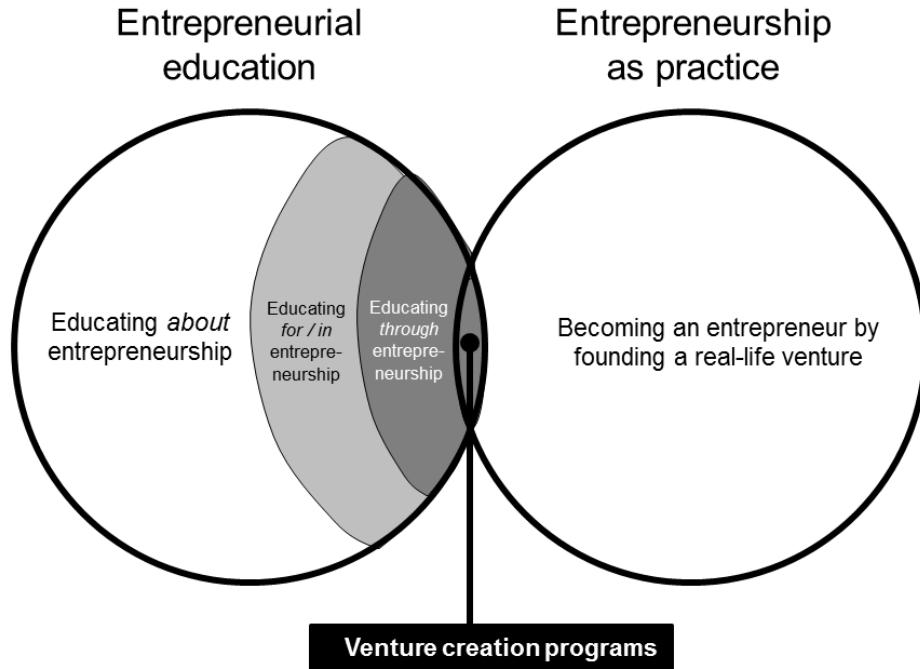


Figure 2. Venture creation programs on the border between education and entrepreneurship. The dual characteristic of a VCP, at the same time constituting an educational environment and a real-life entrepreneurship setting.

VCPs are ripe of highly emotional and critical learning events stemming from venture creation activity. Students have described it as riding an emotional roller-coaster and being asked to build a castle in the sky, triggering strong positive and negative emotions as well as deep learning (Lackeus, 2014). The proxy theory was developed by using a mobile app to capture very small but coherent units of experience from students at a VCP and linking them to entrepreneurial learning outcomes as well as to antecedents in terms of educational design. In this way, a web of causal mechanisms was evidenced empirically and with high ecological validity, uncovering how, when and why action-based entrepreneurial education can develop entrepreneurial competencies. It was shown how educationally induced interaction with the outside world, uncertainty in learning environment and a team approach triggered increased self-efficacy, uncertainty tolerance and self-insight among VCP students. Figure 3 shows the applied study design.

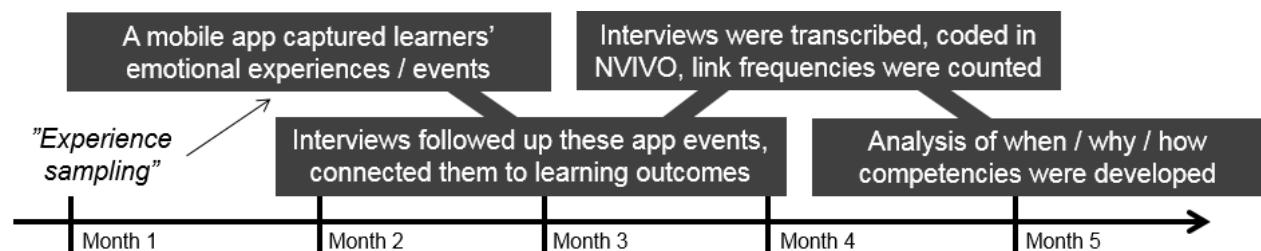


Figure 3. Method used for developing the proxy theory. A mobile app captured VCP students' emotional experiences. Interviews probed for details on these events and were transcribed and analyzed qualitatively.

The proxy theory has also been applied in other educational settings than VCPs, aiming to link educational design to developed entrepreneurial competencies. 12-13 year-old students were followed during three months when producing and broadcasting a radio program of one hour per group. They were asked to report any resulting emotional events using an app. This was later followed up with interviews using the emotional

events reported through the app as the main topic for the interviews, asking students to connect their experienced emotional events to any perceived learning outcomes. A slightly different set of causal mechanisms was uncovered in this study, corroborating the importance of letting students interact with the outside world, but this time leading to increased interpersonal skills, self-insight, strategic skills, proactiveness and developed mental models (Lackeus and Sävetun, 2014).

It has recently been proposed that an experience focus in entrepreneurship research represents a different paradigm from the more common process-based entrepreneurship research focus (Morris et al., 2012). Scholars are recommended by Morris and colleagues to try “capturing the streams and stock of events that comprise the venture creation experience” (p. 12). VCPs have been stated to be a particularly beneficial environment to conduct such research (Lackeus, 2014, p.18). Causal mechanisms in entrepreneurship as well as in education can be uncovered, and novel experience-based research methods can be developed.

2.5 Causal mechanisms research – a tradition aimed at opening black boxes of relevancy

The methodological perspective of studying causal mechanisms has gained popularity in the last two decades as a reaction to perceived shortcomings of the predominant covering law model of scientific explanation (Ylikoski, 2012). The covering law model stipulates that events can be explained by general laws or lawlike generalizations, i.e. if cause C then effect E (Little, 1991, p.5). The causal mechanisms model on the other hand stipulates that there is a series of causal mechanisms or events E_i leading from cause C to effect E (Little, 1991, p.14-15). Elster (1989) has described it as a method for opening up a black box to show “the cogs and wheels of an internal machinery” (Hedström and Ylikoski, 2010, p.51). This is often necessary in social science due to the weaknesses of social regularities on macro level. Macro level observations on collective level need to be connected to micro level observations on individual level in order to build social scientific explanations. This is why the discussion around causal mechanisms often emphasizes the study of microfoundations in terms of detailed accounts of individual-level processes (Little, 1991). A model based on Coleman’s boat (1994) accounting for this has been proposed by Hedström and Ylikoski (2010), see figure 4, showing how a causal mechanisms perspective studying micro level events can contribute to opening up the black box of social phenomena and generate deep understanding.

Figure 4 can also be seen as a relevance versus rigor dichotomy (Reeves, 2011). On a macro level researchers can design highly rigorous studies, often opting for a randomized controlled trial methodology with randomly assigned treatment and control groups. The challenge with such research is to come up with results that are relevant to practitioners in educational settings, i.e. to succeed in a top-down or macro-to-micro approach to educational research. On a micro level researchers focusing on educational design in practice instead start in what seems to work for teachers and students, and try to build a theory from that, i.e. a bottom-up approach to educational research starting in the black box. Here the focal point is relevancy, but the challenge instead becomes to adhere to the usual requirements for rigor such as prevalence of a control group, random sampling strategy, large sample size and statistically significant results (Reeves, 2011). According to Reeves, the macro approach is highly publishable but often fails to impact educational practice. The micro approach is highly relevant to educational practice, but can have difficulties getting published in top level scientific journals. Schön (1995, p.28) has stated the researcher’s problem succinctly: “Shall he remain on the high ground where he can solve relatively unimportant problems according to his standards of rigor, or shall he descend to the swamp of important problems where he cannot be rigorous in any way he knows how to describe?”. In this perspective, educational research based on the proxy theory and a mobile app approach can be viewed as an attempt to bridge the rigor versus relevance dualism.

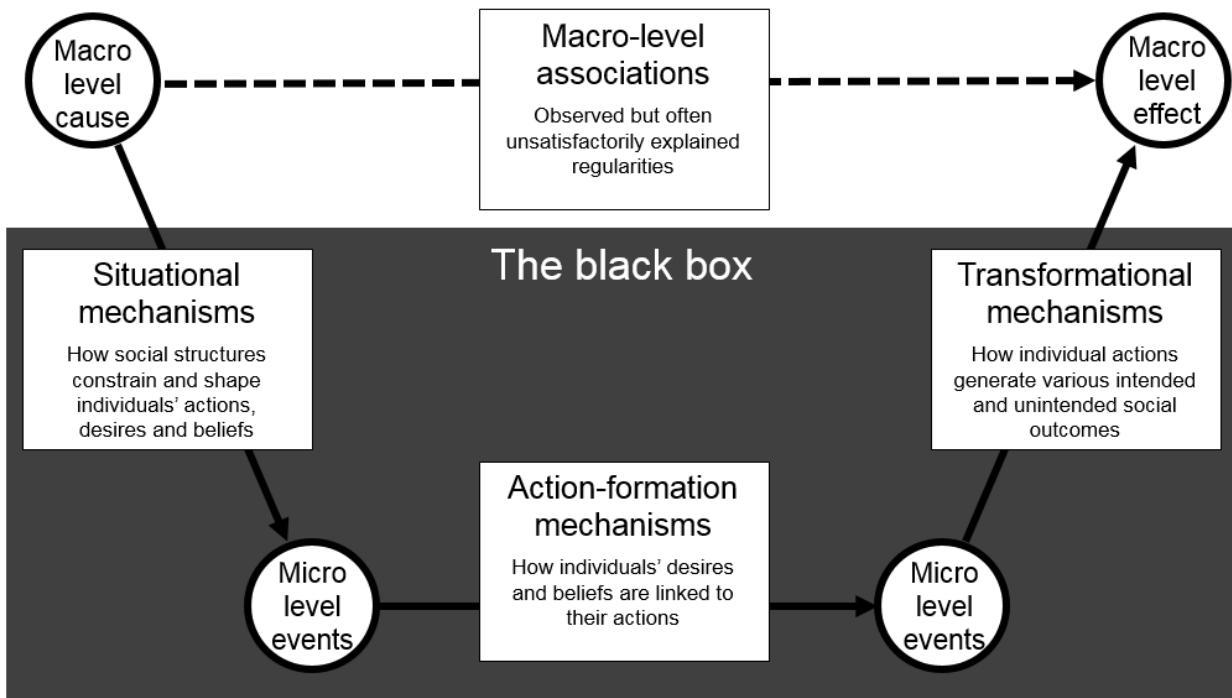


Figure 4. Coleman's boat outlining macro- and micro level social mechanisms. Deep understanding requires opening up the black box of micro-level events and mechanisms generating the macro-level observations (adapted from Hedström and Ylikoski, 2010, p.59).

3 Methodology

The proposed research design in this article is based on both a qualitative and a quantitative approach, i.e. a mixed methods approach. A quantitative approach is used to capture emotional events of both students and teachers in the four studied learning environments, viewing these emotional events as signs of relevancy and valid starting points for comparison and further inquiry. A mobile app has been designed and subsequently honed for this purpose throughout a series of studies over a period of three years from 2012 to 2015 (see primarily Lackeus, 2013; Lackeus, 2014; Lackeus and Sävetun, 2014). In order to cope with the growing costs for the development of the app-based measurement instrument, this work was incorporated in early 2014 into a Swedish company called Me Analytics AB. The app has since been used extensively in many places around Sweden and abroad, allowing for distribution of the development cost across several partners.

The data collected with the quantitative app-based approach is fed into a more qualitative phase where respondents to interview as well as topics to discuss are chosen largely based on app reports made during a period of months up to a year (or longer if deemed necessary and/or interesting). This could be labeled an app-based sampling strategy as well as an app-induced interview template. These two key methodological steps act as amplifiers and increase the signal to noise ratio of the subsequent steps in the research design. Choosing interviewees and issues to discuss with them based on relevancy allows the qualitative research phase to focus on the most relevant aspects of what teachers and students are experiencing in the four learning environments studied. Coupled with a multi-site research design it increases the possibility to identify and contrast theoretically relevant and coherent findings in terms of how, when and why teachers succeed in developing their students' entrepreneurial competencies.

As this article is an attempt to outline an intended research project, it is too early to outline the four learning environments of the study in detail. Some desirable characteristics of these environments can however be

stated. They should represent a sufficiently wide plethora of teaching approaches to entrepreneurship, allowing for contrasting similarities and differences. They should represent both wide and narrow definitions of entrepreneurship, aiming to produce both entrepreneurs and entrepreneurial individuals. In terms of timing and sample size, Figure 5 outlines a tentative research plan stretched across a two-year period allowing for capturing emotional events during a full academic year. In terms of student age this study should perhaps start with the higher education level in order to take advantage of the resulting action research design. Follow up studies could then be conducted at other levels in the educational system

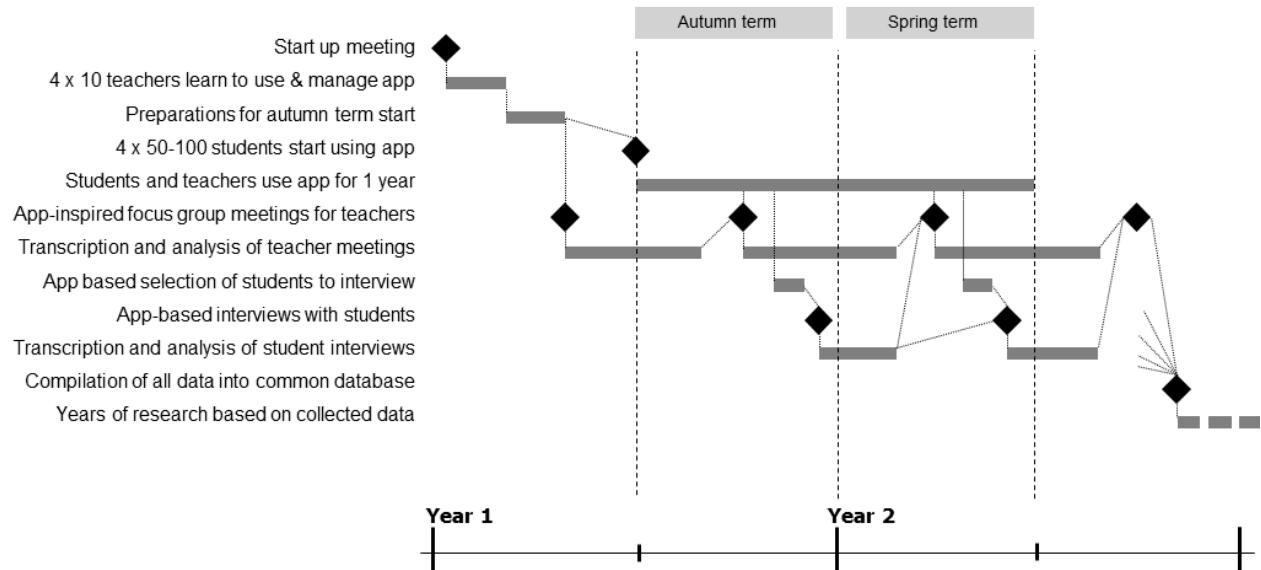


Figure 5. Tentative approach to research project outlined in this article. The GANTT scheme shows which activities happen when over a period of two years. Main dependencies between activities are illustrated in the figure.

3.1 Quantitative approach – a mobile app for students and teachers

Already in the 1970s, psychology researcher Mihaly Csikszentmihalyi used short surveys to capture respondents' experiences directly in their natural environment, attempting to capture the "flow" of everyday experience (Hektner et al., 2007). This method is called "Experience Sampling Method" (ESM) or "Ecological Momentary Assessment" (EMA) (Stone et al., 2003). By capturing subjective experiences with a previously unattained precision, a very high level of validity was obtained by combining "the ecological validity of naturalistic behavioral observation with the nonintrusive nature of diaries and the precision of scaled questionnaire measures" (Hektner et al., 2007, p.7). Today the availability and widespread use of smartphones has drastically reduced the distribution and management cost of the ESM approach to capturing human experience (Conner, 2013).

In traditional ESM the respondents are given random triggers to complete a short survey. In the method outlined here, the respondents decide themselves when to make a report. An advantage is that it is less intrusive and opens up for following respondents over longer periods of time than the usual 2-3 weeks in traditional ESM studies. A disadvantage is the risk for reporting fatigue and an introduced subjectivity in which events are captured or not captured, depending on habits and moods of respondents. An important part of the three-year app development phase preceding this study has been to identify strategies to reduce such risks. Students have stated that when they get periodical reminders to make reports (in class, through the app and/or through e-mail), when time is set aside in class to make reports and when there are multiple teachers to send their reports to, it increases the likelihood that students will send reports continuously. On a more general level, a strategy to increase the likelihood that students use the app is to make it a natural

part of the pedagogical environment, blurring the line between IT based pedagogy and data collection for research purposes. If the app instrument can be made a natural and everyday tool for students and teachers alike, it will give both higher quality and quantity of data collected and at the same time support teachers and students in their daily work. Another strategy is to have more respondents on more sites, increasing the likelihood that some students and some sites will render enough quantity and quality of data for robust inferences about causality to be made. Yet another strategy is to make sure all respondents – students and teachers alike – have a tablet at their disposal. A previous study has indicated that respondents send more data and of higher quality when using tablets than when using smartphones or laptops (Lackeus and Sävetun, 2014). It is however a significant cost driver, and one way forward could be to supply at least the teachers with tablets. A key factor for achieving good quality and quantity data is also to have an active project manager at each site making sure that small obstacles in the implementation are taken care of promptly.

The short survey to be used in this study is shown in Figure 6. It starts with asking the respondent student / teacher to first give a short description of what happened. Then an emotional categorization is made with a five-step likert scale from -2 to +2. The respondent is asked to categorize the experience in accordance with a set of meta-data tags. Finally the report is sent to the group, either with name or anonymously, making it visible to teachers but not to fellow students. The third screen in Figure 6 shows how the teacher can interact with the student based on the report (also with anonymous students), allowing the app to become a tool for the daily student-teacher interaction.



Figure 6. Short survey to be used in this study. New reflection (screen on the left): an example of a bad feeling after having tried to apply a theoretical concept outside the classroom. New activity (screen in the middle): an example of a good feeling after having completed a major hand-in. Reports overview (screen on the right): an example of student-teacher interaction based on a report.

Table 2 outlines possible meta-data tags for students to use, but a detailed version of meta-data tags needs to be done in the initial stage of the launched research project. If meta-data tags are chosen well, they can help significantly in comparison and contrasting between the four studied learning environments, as well as facilitate further qualitative analysis. Table 3 and Figure 6 outline some possible meta-data tags for teachers to use. Tags should be connected to theory, such as the tags in Figure 6 being connected to the theory outlined in section 2.2.

Table 2. Meta-data tags for students in the app. The table shows some possible meta-data types and their connections to common entrepreneurial competencies and activities.

Text in app instrument's meta-data buttons	Entrepreneurial relevancy	Interaction w. outside world	Uncertainty tolerance	Entrepreneurial self-efficacy	Marketing	Entrepreneurial passion	Self-insight	Proactiveness	Social skills	Strategic skills	Innovativeness	Perseverance
Activities												
Presented outside school	XXX	X							X			
Contact outside school	XXX	X							X	X		
Helped someone	XXX			X					X			
Convinced someone	XXX				X	X		X	X	X		X
Presented to others	XXX	X			X				X			
Taken initiative	XXX					X		X				X
Tried out an idea	XX		X									X
Made an important decision	XX		X						X			
Used theory in practice	XX								X			
Group conflict	XX		X					X		X		
Managed a difficult task	X			X				X				X
Other	-											
Thoughts												
Thoughts about someone outside school	XXX	X										
New thoughts about myself	XX							X				
Independent thinking	XX						X					
Group work	XX								X			
Group insight	XX								X			
Got to decide myself	XX						X		X			
Improved self-efficacy	XX		X					X				
Used my experience	XX		X								X	
Got a new good idea	X											X
Differences in the group	X		X						X			
Other	-											
Feelings												
Initiative	XXX						X		X			
Appreciated outside school	XXX	X										
Ownership	XX						X					
Team spirit	XX						X			X		
Joy	XX						X					
Uncertainty	XX		X									
Confusion	XX		X									
Creativity	XX											X
Relevancy	XX						X					
Hard work	XX			X		X						X
Stress	X		X						X			
Other	-											

Table 3. Meta-data tags for teachers in the app. The table shows some possible meta-data types for teachers to use.

Activities	Thoughts	Feelings
Made student reflect	Got idea of revised pedagogy	Good meeting w student
Listened to student	Triggered teacher reflection	Bad meeting w student
Helped student	Student increased self-efficacy	Student felt meaningfulness
Student created something	Student in teamwork	Student felt team spirit
Student presented to others	Student got group insight	Student felt ownership
Student took initiative	Student made own decision	Student felt joy
Student took important decision	Student decided self	Student insecure
Student tried own idea	Student increased self-insight	Student confused
Student used theory in practice	Student used own experience	Student hard working
Student managed team conflict	Student got new good idea	Student stressed
Student felt listened to	Student understood	Student wanted to learn
Student convinced someone	Student did not understand	Student felt joy to create
Student explored in the field	Student reflected	Student proud
Student explored on internet	Student thought critically	Student engaged
Student formulated something	Student thought creatively	Student sad
Other	Other	Other

3.2 Qualitative approach – teachers and students

In this study two kinds of interviews are conducted – focus group interviews with teachers and individual interviews with students. As shown in Figure 5, four focus group interviews of 4-8 hours each are conducted with all teachers from the four participating sites, allowing for cross-site sense-making and comparison based on collected app data from both teachers and students at all four sites. The first focus group session is conducted prior to app usage but after most of the preparations are done. The following three focus group sessions are based on app reports made by students and teachers from all four sites. The third and fourth focus group interviews will be able to take advantage of analyzed data from the first and second wave of student interviews respectively. Interesting and salient themes are identified based on app reports and analyzed data, and discussed in cross-site groups consisting of 1-2 teachers from each of the sites. In each group, app reports and related issues are discussed that are either made by the teachers in that group or by student that these teachers are directly involved with. All group discussions as well as plenary discussions are recorded and transcribed verbatim.

Two waves of individual student interviews are conducted. All interviews will be conducted in English to facilitate cross-site comparisons, so respondents need to be selected partly based on language proficiency. The first wave is conducted towards the end of the autumn term, and the second wave is conducted towards the end of the spring term. This might need to be adjusted for any participating teachers that want to include a course based educational intervention. Each wave consists of interviews with 5-10 students from each site. A necessary consideration is whether the spring interviews should be done with the same students or with 5-10 different students. A ‘same students’ strategy allows for capturing longitudinal changes and aspects, whereas a ‘different students’ strategy allows for applying an app-based sampling strategy also in the spring wave. Each student interview takes 45-60 minutes and applies the interview template outlined in Table 4. The template is designed to facilitate useful coding of interview data. All interviews are recorded and transcribed verbatim.

Table 4. Interview template to use in student interviews. Main emphasis is on app reports, but there are also some other key themes that are covered. Each interview takes 45-60 minutes.

Step	Theme	Time share	Content
1	Introduce the study	5% / 2-3 mins	Purpose, confidentiality, questions.
2	Capture general insights	10% / 5-6 mins	Define learning for the interviewee in terms of knowledge, skills and attitudes. Based on this, capture the interviewee's view of key learnings.
3	App-based questions	50% / 25-30 mins	4-8 of the most interesting app reports are selected. Each app report is read out. The student is asked to tell more about what happened, induced emotions, resulting learning and why so. An iterative 'five whys' question-asking technique is applied in order to drill down to the core of issues.
4	Critical events	20% / 8-10 mins	Interviewee is asked to try remembering any other critical events and/or creative moments not covered by these app reports. Associated learning is explored in the same way as in step 3 above.
5	Motivation	5% / 2-3 mins	A short question asking for key factors increasing or decreasing student motivation during the education. Purpose is to surface more critical events.
6	Similarities and differences	5% / 2-3 mins	A short question asking for similarities and differences between this learning environment and other learning environments. Purpose is to surface more critical events.
7	Decisions	5% / 2-3 mins	A short question asking the interviewee if he/she has taken any main decisions lately as a consequence of the education. Purpose is to surface more critical events.
8	Final reflections	5% / 2-3 mins	Can be used depending on previous topics.

3.3 Analyzing the data

All of the transcribed data from both teacher focus group interviews and individual student interviews is analyzed with interview coding software such as NVIVO or ATLAS.ti. Open coding as well as axial coding is applied (see Corbin and Strauss, 1990, p.98). Two theoretical frameworks are applied; one for emotional events and one for resulting entrepreneurial competencies. The emotional events coding framework is a development of a framework constructed by Aripainen et al. (2013), see Table 5. The entrepreneurial competencies framework is a development of a framework constructed by Fisher et al. (2008), and elaborated based on various sources (Lackeus, 2014; Moberg, 2014a; Moberg et al., 2014), see Table 6. In Figure 7 the relationship between different aspects of entrepreneurial skills is specified, which is important in order to achieve reliable coding. Consistency in coding is the focus here, not a claim to having outlined a "perfect" model of entrepreneurial skills.

Table 5. Framework for emotional events used for coding interviews. These are the axial codes used when coding all interview material. Open codes will be added during the project.

Codes per theme	Detailed description
Learning environment	
Support from outside of learning environment	Students take help from people outside school / university. They come to the students or the students come to them.
Theory into practice	Students use knowledge / theory in practice.
Uncertainty and confusion in learning environment	Students experience not knowing what/how to do, getting to work freely and decide themselves in personally challenging ways. Students experience messiness in their teams. Ambiguity. Unfairness.
Information from outside world	Students get information from outside the school / university environment.
General encouragement from teachers	Teachers encourage the students. Students experience engagement from teacher. Student feels “seen”.
Getting feedback on own performance	Student gets direct feedback on own presentation / performance from a teacher, other student or someone else.
Grades	Student experiences grades as an emotional factor, positive or negative.
Reflective interaction with teacher	Student reflects together with teacher.
Collaborative learning	
Individual differences	Student experiences individual differences in a team or in the class.
Team-work experience	Any student experience connected to team / group work.
Leadership and managing people	Student manages other people or is managed by other people.
Tasks	
Overcoming competency gaps	Student learns more about a subject.
Time Pressure	Student experiences time pressure.
Interacting with outside world	Student interacts with anyone / anything outside class / school / university.
Leadership over oneself	Student takes own responsibility for learning / tasks / own attitude.
Meaningfulness, create value for oneselve	Student experiences meaningfulness, joy, curiosity. Student decides to make own situation meaningful.
Meaningfulness, create value for someone else	Student creates something of value to someone outside own team / teacher. Could be social, cultural or economic value that is created.

Table 6. Framework for entrepreneurial competencies used for coding interviews. These are the axial codes used when coding all interview material. Open codes will be added during the project.

Codes per theme	Detailed description
Knowledge	
Declarative knowledge (wide definition of entrepreneurship)	Basics of risk management, project management, decision making. Knowledge about what value / need / target group is etc.
Declarative knowledge (narrow definition of entrepreneurship)	Business related knowledge, understanding of the role of entrepreneurship in society, etc.
Procedural entrepreneurial knowledge / methods in theory	Knowledge about how others get things done without resources, how others manage risk / uncertainty. How others create value for people – cultural, social, economic value for others.
Entrepreneurial self-insight	Insight about oneself in relation to entrepreneurial aspects. Changes in self-view.
Declarative school subject knowledge	Curriculum specific knowledge not specific to entrepreneurship. NOTE: This is not entrepreneurial competence, but needs to be coded to distinguish it from entrepreneurial knowledge.
General self-insight	General "life insight", based on what is valuable for oneself and based on friends etc. NOTE: This is not entrepreneurial competence, but needs to be coded to distinguish it from entrepreneurial knowledge.
Skills	
Marketing skills	Adapting a message to a target group. Conduct market research. Assess a market opportunity. Market products and services. Persuade people. Make people enthusiastic. Manage customers. Communicate a vision / dream.
Opportunity skills	Discover and create (business or not) opportunities. Skills in acting on opportunities. Develop a vision / dream.
Resource skills	Financial planning. Finding and attracting resources. Finding strategic partners.
Interpersonal skills	Leadership, motivating others, lead others, listen, resolve conflict. Be an active and functioning participant in a team. Be able to collaborate with others in a team.
Learning skills	Active learning from doing. Adapt to new situations. Learn from failure. Making up the path on the road.
Strategic skill	Business (or general) planning. Prioritize. Get things done. Focus on the target. Develop a strategy to reach a dream. Manage risks. Work under stress.
Studyskills	Learning to learn declarative and procedural knowledge. NOTE: This is not entrepreneurial competence, but needs to be coded to distinguish it from entrepreneurial skills.
Curriculum subject skills	Any skills mandated by curriculum. NOTE: This is not entrepreneurial competence, but needs to be coded to distinguish it from entrepreneurial skills.
Attitudes	
Entrepreneurial passion	"I want" - Create value for others
Entrepreneurial identity	"I am / I value". Deep convictions, identity, values, axiology. Increased consciousness about an entrepreneurial career.
Entrepreneurial self-efficacy	"I can" - Create value for others
Proactiveness	"I do". Activity oriented, initiative taker, inner drive. Takes responsibility to reach a goal.
Uncertainty and ambiguity tolerance	"I dare". Comfortable with uncertainty and ambiguity. Flexible, open to surprises. Focusing on the here and now in a mindfulness way.
Innovativeness	"I create". Novel thoughts/actions, unpredictable, radical change, innovative, visionary, pattern breaker.
Perserverence	"I overcome"
General passion (motivated)	"I want" – Create value for oneself
Self-Efficacy in general	"I can" – Other self-efficacy than entrepreneurial.

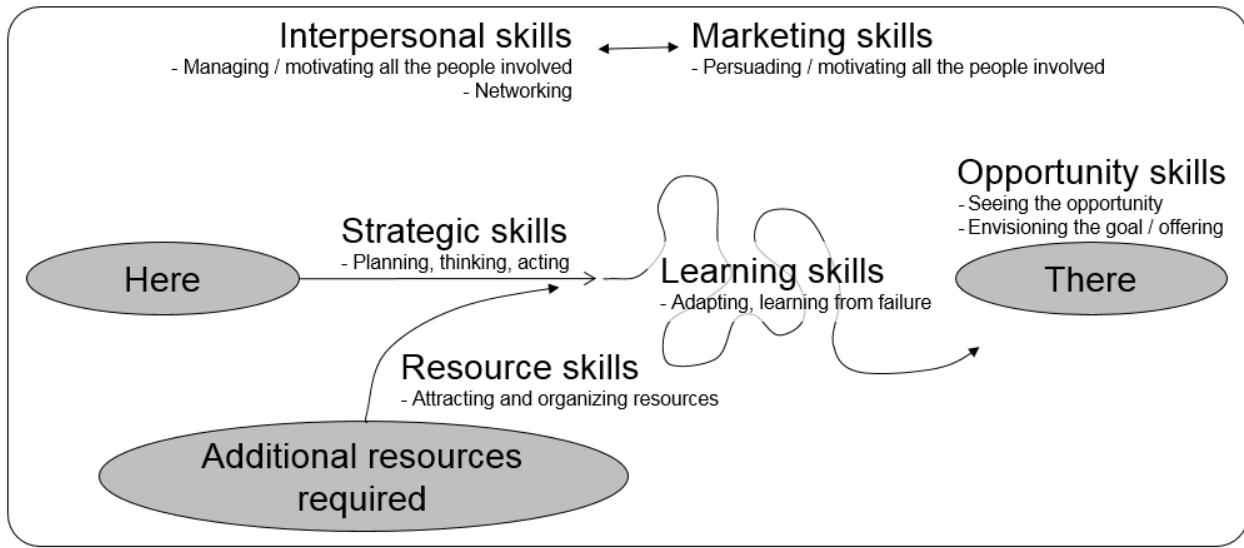


Figure 7. Framework for distinguishing between different entrepreneurial skills. Such a framework is necessary to specify or agree on for the coding researcher in order to achieve reliable coding.

When all interviews are coded in the coding software a number of tables can be generated that give an overview of all data collected, see table 7. These tables can be discussed among the teachers in focus group interview 3 and 4. Interesting themes to discuss can be both salient themes, less salient themes and differences between learning environments. The structured and app-based interview template in the student interview phase assures that the coding procedure yields many links between emotional events and developed entrepreneurial competencies. While tables give a general overview of data and links in the data, they cannot replace in-depth qualitative analysis of patterns, particular mechanisms and the creative search for theoretical and generalizable insight. They are merely the entry point of deep analysis. Therefore, the following and final steps in the data analysis are more difficult to predict, since they depend largely on what is uncovered in this phase. But when key themes have been identified and agreed upon among the action researchers, the final phase consists of finding illustrative quotes for these themes from the interview data collected and transcribed. This search can be significantly facilitated by use of the coding software.

Table 7. A summary of six tables needed for analysis. Six tables that need to be prepared in order to be able to enter the final creative phase of data analysis and theoretical generalization.

Table type	Origin	Purpose in analysis
Number of app reports per meta-data tag	App instrument	Shows what kinds of events are common, less common and rare according to the app reports made in the different learning environments.
Particularly interesting app reports by students and teachers	App instrument	Shows some of the most interesting app reports made by participating students and teachers in the different learning environments.
Number of occurrences per emotional event in interviews	Coding software	Shows what kinds of emotional events are common, less common and rare in the different learning environments according to the interviews conducted.
Number of occurrences per entrepreneurial competency	Coding software	Shows what kinds of entrepreneurial competencies are common, less common and rare in the different learning environments according to the interviews conducted.
Interaction matrix between emotional events and entrepreneurial competencies	Coding software	Shows salient and less salient links between emotional events and developed entrepreneurial competencies. One interaction matrix can be done for each of the four learning environments.
Most common links between emotional events and entrepreneurial competencies	Coding software	Shows which links are the most common in the data. Also shows which links are less common.

4 Discussion: expected findings

Previous studies using the proxy theory and the app instrument indicate that a research design as outlined above could generate somewhere between 1000-10000 app reports from students, whereof at least 500-5000 of them will be categorized according to the meta-data tag framework. These app reports will then be able to guide selection of student interviewees as well as guide specification of discussion topics in these interviews. As teachers have not been reporting their experiences through the app before it is difficult to speculate in what this added dimension will yield, or in the impact these app reports can have on the focus group interviews. A modest speculation could be that app reports could allow focus group interviews to stay on the most salient and relevant topics, increasing the possibility of generating relevant and interesting data.

Tables outlined above (in Table 7) will give information on which emotional events and entrepreneurial learning outcomes are most and least common in the studied learning environments. The tables will also indicate which causal links are strong and which are weak. These links will then be possible to connect conceptually backwards to educational design and lack thereof, allowing for outlining causal chains between educational design and developed entrepreneurial competencies.

As illustrated in previous studies (Lackeus, 2014; Lackeus and Sävetun, 2014) these methodological steps will lead to a possibility to identify which pedagogical methods lead to desirable learning outcomes, and how the causal mechanisms generating them are constructed. The multi-site aspect of the outlined research design allows for finding generalizable mechanisms present in many of the learning environments, allowing for reaching beyond the contextual and anecdotal good practice case into a possibility to construct new theory for further research as well as new guidelines for practitioners.

Previous research using ESM and related methods indicates some possible findings to expect on a more general level. Reis, Gable and Maniaci (2014, p.374) state that:

“...these methods allow researchers to develop understandings not easily obtained with other paradigms. For example, everyday experience studies may help establish the real-world prevalence and impact of particular processes and phenomena; may identify situational contexts in which effects are more or less likely to occur; may determine boundary conditions necessary or sufficient for the operation of basic processes; may help distinguish between-person and within-person processes; may identify patterns of cyclicity and covariation among social, cognitive, emotional and psychophysiological variables; and may clarify their interactions with other, naturally occurring processes.”

4.1 An example pedagogical method: “Talk-English”

As an example of the mechanism identification possibility in pedagogical methods, Figure 8 provides an example of a spider diagram for “Talk-English”. It is one of a few particularly interesting pedagogical methods deemed to have entrepreneurial characteristics, derived from an ongoing yet unpublished study on secondary education level. Six methods were identified through app reports from students, indicating the most salient themes in three studied schools. The app instrument allowed students to articulate in real-time which experiences made the most emotional impact on them. Further information about the six associated methods was gathered in subsequent interviews with students and teachers, based on app reports. In these interviews, triggered emotional events were connected to developed entrepreneurial competencies. The data collected was used to assess each of the eight dimensions in the spider diagram for each of the six different pedagogical methods, forming a table with 48 cells.

“Talk-English” lets students from two classes work in teams to create a theater play every week for an entire academic year. They practice their English skills by producing phrases and delivering them in front of an audience. They iteratively improve the theater play every week, and work in the same team for an entire year. The method develops pride, self-efficacy, creativity, perseverance, self-insight and tolerance for uncertainty. It also develops declarative and procedural knowledge and skills of the English language. Among other, the study uncovered a causal mechanism of performing a play in front of an audience leading to self-efficacy and pride, which in turn led to increased motivation to learn more English in order to improve following weeks, illustrating a positive self-reinforcing cycle of learning (cf. Farrington et al., 2012, p.33-35). While such findings might seem trivial in retrospect, the study showed that the teacher was not aware of the strong impact this particular educational design had on the students, in terms of presenting in front of others, working iteratively, learning from failure and over long periods of time in tight teams. The app instrument thereby became an eye opener for the teacher of what works in the classroom.

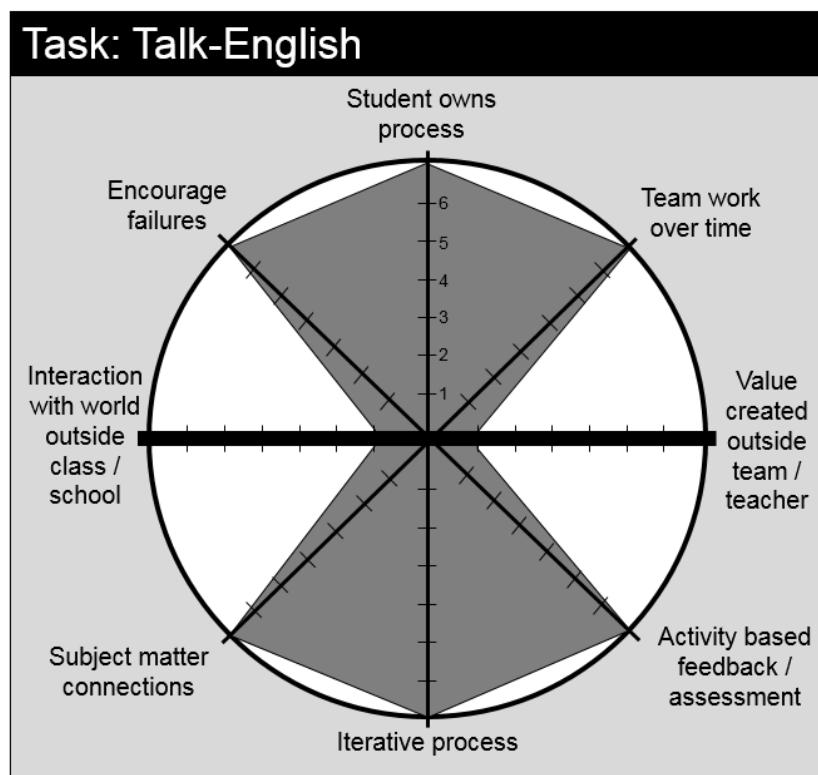


Figure 8. Spider diagram outlining the factors of a pedagogical method called Talk-English. The method is strong in all dimensions except for interaction with outside world and value created outside school.

5 Conclusions

This article has outlined a novel research design building on an innovative and quantitative app instrument feeding into qualitative research applying different kinds of interviews with teachers and students in entrepreneurial education. The method of sampling everyday experiences is however not new, but rather represents a growing tradition of conducting research in fuzzy, exception-laden and socially situated environments (Reis et al., 2014). Its application in entrepreneurial education is however very limited so far, perhaps even non-existent apart from work by the authors of this article. In entrepreneurship it is also very rare (Uy et al., 2010). In education it is slightly more common (for an overview, see Hektner et al., 2007).

Expected findings have been outlined based on previous research and also based on an example given from on-going research. It has been illustrated that the research design outlined in this article could be capable of opening the black box of entrepreneurial education and contribute to uncovering key causal mechanisms in ways that have not been possible with more established research paradigms. The international multi-site research design and the inclusion of teachers' emotional events and associated learning captured through teacher focus groups is a new addition compared to previous and on-going research. This could add important aspects of teacher-based sense-making and contrasting across learning environments as well as better utilization of action research strengths.

The aim of this article was to outline in considerable detail a plausible innovative research design in entrepreneurial education based on ESM and also to generate feedback from the research community. It is now the hope of the authors that such valuable feedback will surface.

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