Links between Emotions and Learning Outcomes in Entrepreneurial Education

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Abstract

This paper investigates links between strong emotions and entrepreneurial learning outcomes in an action-based entrepreneurship education program. Students' own experiences were assessed during their participation in a master level university program where they were expected to start a real venture as formal part of curriculum. An explicit focus on emotions in action-based entrepreneurship education is unusual in previous research, but can trigger new insights on antecedents to entrepreneurial learning outcomes. It also represents a novel approach to assessing learning outcomes of entrepreneurial education.

Methodology. A longitudinal design was applied following three students during nine intensive months. Students were equipped with a mobile app-based survey engine in their smartphones, and were asked to momentarily register emotions and critical learning events related to their educational experience. These app-based measurements were followed up quarterly with semi-structured interviews to uncover links between strong emotions and resulting entrepreneurial learning outcomes. Links were identified by using software analysis package NVIVO and theoretical as well as open coding of data.

Findings. Findings indicate a large number of links between strong emotions and entrepreneurial learning outcomes. Some links seem stronger than others. Three sources of emotions that seem to be particularly linked to entrepreneurial learning outcomes are interaction with outside world, uncertainty and ambiguity in learning environment and team-work experience. These sources of emotion seem to be linked to formation of entrepreneurial identity, increased self-efficacy, increased uncertainty and ambiguity tolerance and increased self-insight. Strong emotions induced by action-based entrepreneurial education seem to primarily impact attitudinal learning outcomes.

Implications. These findings represent a novel approach to assessing learning outcomes within entrepreneurial education. They also represent early empirical evidence for three seemingly effective design principles of entrepreneurial education. Educators aiming to develop entrepreneurial competencies should try to design a learning environment ripe of uncertainty and ambiguity where students frequently are able and encouraged to interact with the outside world in a working environment characterized by a team-based approach. This study also represents an attempt to open the "black box" of entrepreneurial learning, since it has been possible to uncover some of the mechanisms behind the links observed between emotions and learning.

Limitations. Important limitations of this study include a small number of interviewees, unknown transferability of results to other contexts and learning environments, risk for individual bias in the data coding procedure and a lack of established theoretical frameworks for strong emotions and learning outcomes within the domain of entrepreneurship education.

Introduction

Action-based approaches are by many scholars perceived central to entrepreneurial education in order to develop entrepreneurial competencies (Pittaway and Cope, 2007, Pittaway and Thorpe, 2012, Mwasalwiba, 2010). A project-based, hands-on and context-based approach is recommended, as it captures the social, emotional and experiential nature of entrepreneurial learning (Pittaway and Cope, 2007). Educators should try to build in opportunities for students to learn from emotional and risk-laden events and processes by letting them resolve uncertain, complex and ambiguous situations, preferably in authentic settings (ibid).

The role of emotions in educational settings is a growing but immature field of research. Both positive and negative emotions seem to play important roles. Positive emotions are necessary for experiencing "flow" (Csikszentmihalyi, 1991), and negative emotions help focusing attention (Derryberry and Tucker, 1994). Damasio is one of the pioneers in connections between reasoning, decision-making and emotions, and has stressed the importance of emotions in education (Immordino-Yang and Damasio, 2011). But it was not until in the late 1990s that emotions gained importance in educational research (Sutton and Wheatley, 2003).

According to Man (2007), "understanding entrepreneurial learning is essential for the design of enterprise education and entrepreneurship training programmes." (p.190). Markowska (2011) has described entrepreneurial learning as the process by which entrepreneurs acquire entrepreneurial competencies. Combining the two ambiguous terms *entrepreneurial* and *competencies*, we however get a concept that varies substantially in its meaning and interpretation. Still, scholars have found value in using the concept of entrepreneurial competencies (Man et al., 2002, Bird, 1995, Rasmussen et al., 2011). Man et al. (2002) see it as a higher-level characteristic that reflects the "total ability of the entrepreneur to perform a job role successfully" (p.124). According to Bird (1995) measuring entrepreneurial competencies is problematic, requiring multiple methods and approaches that to a varying degree are subjective. She lists 17 potential methods for assessing entrepreneurial competencies, such as diaries, observation, archival data, critical event interviewing, role set ratings, cases, think aloud protocols and job shadowing.

The search for evidence for developed competencies in education has led many scholars to advocate and apply research methods taken from natural science, such as the randomized experiment. It has been a recurring theme for some decades now, fuelled by research funding policy in United States and elsewhere (Slavin, 2002). This kind of evidence based approach has however been heavily criticized by scholars in education (Biesta, 2007, Olson, 2004). Olson (2004) claims that "the more simple cause-effect relations so important to the physical and biological sciences are largely inappropriate to the human sciences, which trade on the beliefs, hopes, and reasons of intentional beings." (p. 25).

This article represents a different approach to outcome assessment by exploring what entrepreneurial competency development can be tied to emotionally laden experiences caused by an action-based entrepreneurial education program. If developed entrepreneurial competencies can be robustly tied to specific emotional events occuring at an educational intervention, it represents a different approach to the assessment challenges inherent in entrepreneurial education (Fayolle, 2005, Fayolle et al., 2006). The paper thus asks the question: How are emotionally laden experiences and entrepreneurial learning outcomes linked in an action-based entrepreneurial education program?

This article proceeds as follows. Relevant literature within action and experiential learning, emotions in entrepreneurial education and assessment of entrepreneurial competencies is explored. Then the study design and underlying methodological assumptions are described, followed by the resulting data. This is then discussed and analyzed, followed by implications for practitioners and scholars.

Review of literature

This study draws extensively on work by entrepreneurship scholar Jason Cope, who has developed a comprehensive framework for entrepreneurial learning (Pittaway and Thorpe, 2012). Cope pioneered research on discontinuous and emotional learning "events" in the field of entrepreneurial learning, and states (2003) that they have "a prominent role to play in how entrepreneurs learn" (ibid, p.436). Cope (2005) states however that "the entrepreneurship discipline does not currently possess sufficient conceptual frameworks to explain how entrepreneurs learn" (ibid, p.373). According to Cope, we need to go outside the entrepreneurship domain to find learning theories that can help us explain the emotionally intense process that entrepreneurial activities constitute.

According to Gondim and Mutti (2011), Jarvis theory of human learning (2006) fully acknowledges the importance of emotion in the learning process. This is unusual in today's society where a rationalist bias is ever so present, emphasizing rationality, objectivity and cognition, and downplaying emotion and experience (Yorks and Kasl, 2002, Postle, 1993, Lutz and White, 1986).

A foundational statement in Jarvis (2006) theory of human learning is that "it is the whole person who learns" (ibid, p. 31, 32, 50, 116, 151, 181 and 186). This reflects a view of the learner as comprising both body (genetic, physical and biological) and mind (knowledge, skills, attitudes, values, emotions, meaning, beliefs and senses). Another key concept in Jarvis theory of learning is "disjuncture", which is a situation where a person's harmony is disturbed by something or someone in the environment, triggering thoughts, emotions and actions. This concept is similar to Cope's notion of discontinuous and emotional learning events (Cope, 2003). According to Jarvis, the trigger can be another person, a phenomenon (thing/event), a future phenomenon or self. This situation forces the person to raise questions such as "What do I do now?", "What does that mean?" etc., and subsequently initiate a learning process. Based on this, Jarvis outlines ten different types of learning (2010), where only one of them, action learning, fully takes thoughts, actions and emotions into account.

Action learning

According to a review of action learning conducted by Marsick and O'Neil (1999), the main theoretical base of action learning comes from David Kolb (1984) and Reg Revans (1971), representing the experiential school and scientific school respectively. Kolb's proposed experiential learning cycle has been widely used in entrepreneurial education theory and practice, and consists of four phases – concrete experience, reflective observation, abstract conceptualization and active experimentation (Kolb, 1984).

But experiential learning did not start with Kolb's seminal work. Hoover and Whitehead (1975) had earlier defined experiential learning as follows: "Experiential learning exists when a personally responsible participant(s) cognitively, affectively, and behaviorally processes knowledge, skills, and/or attitudes in a learning situation characterized by a high level of active involvement." (p.25). This definition is illustrative of aspects important in this study in that it leans on activities involving all three

faculties of mind, i.e. thoughts, actions and emotions (Hilgard, 1980), and also is similar to the "whole person" approach.

Revans did not consider the Kolbian cycle to be an appropriate theory base for action learning (Marsick and O'Neil, 1999). Instead Revans proposed three problem solving phases – Alpha, or situation analysis; Beta, or implementation of a solution; and Gamma, or the manager's mindset and its development (Marsick and O'Neil, 1999, Dilworth, 1998). Revans was reluctant to define action learning due to the risk of opening up to shallow thinking, and stated that "the day it is accurately described in words will be the day to stop having anything to do with it" (p. 49). In addition to Revans some other scholars also critique Kolb's experiential learning theory (Jarvis, 2006, Holman et al., 1997), stating that it cannot be empirically validated and that it omits considering emotional aspects of learning. This shows the importance of being able to empirically validate learning theory, which is the aim of this study.

Emotions in entrepreneurial education

The importance of studying emotions in connection with education has been highlighted in the fields of entrepreneurship (Kyrö, 2008, Gibb, 2002, Rae, 2005, Shepherd, 2004), education (Hargreaves, 1998, Hattie and Timperley, 2007, Zembylas, 2005, Dirkx, 2001), psychology (Schutz and Pekrun, 2007, Eynde et al., 2007) and neuroscience (Immordino-Yang and Damasio, 2011, OECD, 2007). Dirkx states (2001) that explicit attention paid to affective dimensions of learning can contribute to a more positive educational experience. Postle (1993) has identified emotion as the foundation on which all learning leans. Hargreaves states (2005) that schools are full of emotions, and that good teaching is all about emotionally connecting with the students, their feelings, their interests and their excitement. Teaching without emotion thus risks getting lost in boredom and stagnation, and educational reform not taking emotions into account can severely damage what teachers do well.

Within the entrepreneurship domain, Gibb (2002) leans on Kyrö (2000) when stating that emotion based perspectives "can lead to major reconsideration of approaches to research as well as teaching" (p.256). Kyrö (2005) in her turn leans on pragmatist John Dewey when stating that "the affective construct actually rare in entrepreneurship research, should take a more explicit place in learning and teaching practices." (p. 46). Pittaway and Cope (2007) point out that "emotional exposure … created principally via group dynamics … plays a major role in creating an environment within which effective student learning can take place." (p. 222-223). Gondim and Mutti (2011) show that teaching activities similar to real situations generate greater emotional impact. Souitaris et al (2007) conclude that the only factor affecting entrepreneurial attitudes and intentions is inspiration, and draw the conclusion that an educational intervention's capacity to make the students "fall in love" with an entrepreneurial career is vital if the goal is to increase entrepreneurial behaviour.

A recent literature review on emotions in entrepreneurial education (Lackéus, 2012) has highlighted a model putting more equal emphasis on the three faculties of human mind, i.e. thoughts, actions and emotions. This model has been called the tripartite division of mind (Hilgard, 1980). The review concluded that a main reason for the low utilization of recent decades' scholarly advancements in learning theory in the field of entrepreneurial education is a prevailing cognitive bias in society, both among researchers, educators, policymakers and others. Many of the articles studied in the literature review used the tripartite division of mind to put more emphasis on non-cognitive domains. Some labelled it as cognition, conation and affection, while others discussed it as thoughts, actions and

emotions. Yet others referred to knowledge, skills and attitudes which also could be attributed to the tripartite division of mind.

Entrepreneurial competencies

Sanchez (2011) defines competencies as "a cluster of related knowledge, traits, attitudes and skills that affect a major part of one's job; that correlate with performance on the job; that can be measured against well-accepted standards; and that can be improved via training and development" (p.241). Bird (1995) has explored various "laundry lists" of entrepreneurial competencies mainly derived from management theories, and proposes a model of entrepreneurial competency development starting with antecedents to competency such as family background, education, industry experience and work experience.

An aspect of a competencies approach of particular interest here is its emphasis on measurability. Some definitions of competencies include measurability, others do not (Moore et al., 2002). Measuring competencies is problematic, requiring multiple methods and approaches that to a varying degree are subjective. Bird (1995) lists 17 potential methods for assessing entrepreneurial competencies, such as diaries, observation, archival data, critical event interviewing, role set ratings, cases, think aloud protocols and job shadowing.

In the domain of entrepreneurial education an often advocated approach to assess the degree of competencies developed in an entrepreneurship course or program is the use of pseudo-randomized experiments with pre- and post measurements on treatment and control groups (Martin et al., 2012). The measurement instruments are often survey-based and try to capture the prevalence of entrepreneurial knowledge, skills, attitudes and intentions before and after an educational treatment. A problem with such quantitative approaches to measuring entrepreneurial competence development is their inability to open the "black box" of entrepreneurial learning, i.e. how and why entrepreneurial competence is developed rather than only determining if entrepreneurial competence has been developed or not. It is worth noting here that this study represents a novel attempt to open the entrepreneurial learning "black box" (for other attempts, see Markowska, 2011, Krueger, 2005).

Fisher et al. (2008) have proposed a framework for assessing entrepreneurial learning outcomes that leans theoretically on the tripartite division of mind, as outlined by Kraiger et al. (1993) in their article applying cognitive, skill-based and affective theories of learning outcomes to training evaluation. This framework has been adapted and elaborated for the purpose of this study.

Methodology

This study applied a longitudinal design following three students during nine intensive months starting in September 2012 and ending in May 2013. These students were all following an action-based entrepreneurial education program at Chalmers University of Technology. This program is known for its active and hands-on approach, requiring student teams to start a real-life venture based on a technology supplied by external inventors at or outside the university. This specific program as well as the "venture creation approach" used at this program have been extensively described in previous research (Ollila and Williams-Middleton, 2011, Lackéus and Williams-Middleton, 2011, Hofer et al., 2010, Rasmussen and Sørheim, 2006, Lindholm Dahlstrand and Berggren, 2010).

All students in this study worked with intellectual property developed by university researchers or individual inventors outside university, aiming to commercialize it through starting a venture. All three students belonged to a group of three students respectively, where only one of the group members was part of this study. All three student teams collaborated extensively with the inventors supplying the idea for the prospective venture. The educationally connected part of the attempt to develop a venture around the initial idea and related intellectual property was initiated in September 2012 and finished in May 2013. After that the students and inventors were free to continue on their own.

A mixed-methods approach was applied, using both quantitative and qualitative research methods. A quantitative approach was used to capture emotions as they occured through a mobile survey and a qualitative approach was used to reveal underlying mechanisms through semi-structured interviews, primarily searching for connections between strong emotions and learning outcomes.

Quantitative approach: mobile survey engine

According to Pekrun et al. (2011), measuring emotions quantitatively in educational settings is difficult due to lack of measurement instruments. One area where research on emotions has been quite in-depth is consumer research. The emotions that products and advertisements trigger have been studied in-depth by many scholars. An interesting non-verbal approach to measuring emotions can be found in this domain (Morris et al., 2002), where using a questionnaire consisting of images instead of words has been developed as a means to overcome challenges in cognitive translation of emotions among respondents. Morris and colleagues call it the self-assessment mannikin (SAM), see Figure 1.

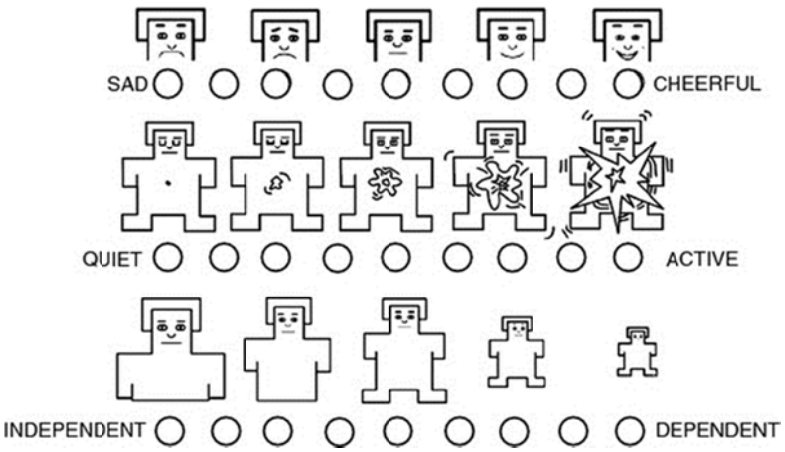

Figure 1. The self-assessment mannikin (Morris et al., 2002)

Looking at verbal approaches to measuring emotions, this is an area of controversy. The extremes could be illustrated with the many different ways used to measure emotions, from the circumplex model of affect involving only two independent constructs, valence (pleasantness) and activation (Russell, 1980, Posner et al., 2005), to up to 12 different constructs, all stated to be independent from eachother. The use of factor analysis is common in constructing these measurement instruments (Russell, 1980).

Even though factor analysis in this domain is extensive and convincing to many, scholars have disagreed for long whether or not there exists a set of basic emotions from which all other emotions are

constructed or derived. Ortony and Turner (1990) state that such a statement would be as unreasonable as stating that there is a basic kind of person or language, and that it is "an unsubstantiated and probably unsubstantiatable dogma—an air, earth, fire, and water theory of emotion" (p.329). But even these critics agree that it is reasonable to classify emotions in certain ways as a research strategy.

The approach opted for in this study is a mixture between the self-assessment mannikin and the circumplex model of affect. Students were equipped with a mobile app in their smartphones connected to a mobile survey engine, and were asked to momentarily register every strong positive and negative emotion they experienced related to their educational experience, and rate it according to the circumplex model of affect, i.e. to rate valence and activation for each event deemed worthy of registering. They were asked to quantitatively rate the following two questions from 1-7 in a likert scale manner each time they made a report; Q1: "How do you feel? (1=very sad/upset versus 7=very happy/contented)", and Q2: "How intensely do you feel this? (1=not at all versus 7=very intensively)", see figure 2. The self-assessment mannikin pictures were used when introducing the measurement instrument to the students in order for them to be able to use the instrument in a coherent way. The students were also encouraged to write a sentence or two on why they felt like they did in each app report produced.

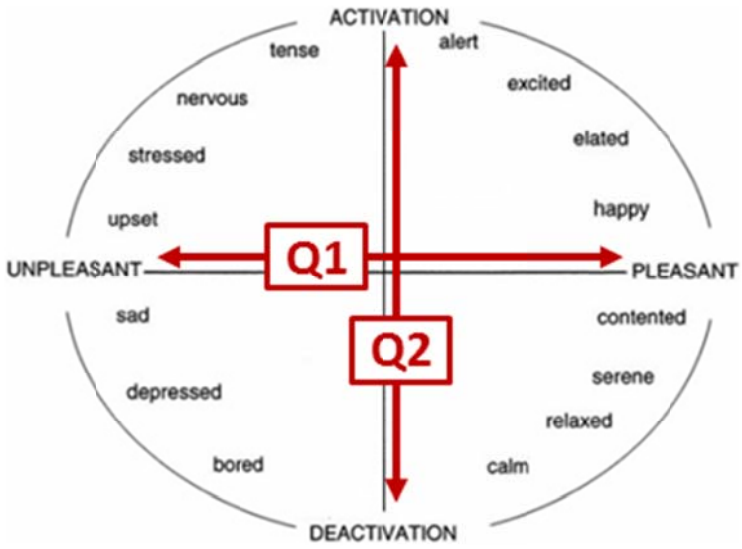

Figure 2. The circumplex model of affect and its relation to the two questions posed.

The mobile app also contained a possibility to report critical learning events, since this kind of events constitutes an important source of both emotions and learning according to Cope's entrepreneurial learning framework described previously in this article. The app probed for six different kinds of critical learning events: (1) changed personal norms, values or attitudes (Cope, 2003); (2) changed basic assumptions (Cope, 2003); (3) changes in important taken-for-granted matters (Cope, 2003); (4) changes in self-image or self-awareness (Cope and Watts, 2000, Woods, 1993); (5) changes in self-esteem or self-efficacy (Fisher et al., 2008); and (6) major revelations about oneself or significant others (Cope, 2003, Woods, 1993). These critical learning event reports were also coupled with an opportunity for the students to write a sentence or two about the reason for the critical learning event occuring.

Qualitative approach: Semi-structured interviews

The app-based measurements were followed up with three quarterly individual interviews aiming to uncover links between strong emotions and resulting entrepreneurial learning outcomes. A semi-structured approach was applied, using an interview template with themes covering learning and themes covering emotions. Themes in the learning part were: (1) sources of learning; (2) learning events; (3) learning outcomes; and (4) similarities and differences compared to previous educational experiences. Themes in the emotion part were (1) emotions experienced; (2) sources of motivation; (3) important decisions taken; (4) behaviour important to learning; and (5) connections between learning and emotions. In addition to the semi-structured parts, each interview also included a discussion around app reports deemed to be particularly interesting from a research perspective, aiming to guide the discussion to interesting events having occurred between interviews. All interviews were recorded and transcribed verbatim.

Data analysis: Coding procedure

All data collected in the study was coded in the qualitative data analysis software package NVIVO, using two coding frameworks – one framework for sources of emotions and one framework for entrepreneurial learning outcomes. Each framework consisted of 9 and 15 sub-themes respectively. The coding framework for sources of emotions was based on a working paper by Arpiainen et al. (2013) outlining main sources of strong emotions in two entrepreneurship education programs in Finland and Namibia and one entrepreneurship education course in Estonia, see table 1. This framework was developed through thematic analysis, iteratively going back and forth between longitudinal student interview data and interpretation of sources of strong emotions in the three different educational environments. The coding framework for entrepreneurial learning outcomes was based on a framework developed by Fisher et al. (2008), and was further developed by drawing on work by other scholars, see table 2.

Table 1. Sources of strong emotions in entrepreneurship education (Arpiainen et al., 2013)

Main themes	**Sub themes used for coding in NVIVO**
New kind of learning environment	Uncertainty and confusion
	Theory versus practice
	Support from outside of the learning environment
Collaborative learning	Team-work experience
	Time pressure
	Individual differences between the students
Challenging tasks	Overcoming knowledge and skills gaps
	Interacting with outside world
	Leadership and managing people

Table 2. Entrepreneurial learning outcomes framework.

Main theme	Sub themes used for coding in NVIVO	Source
Knowledge	Mental models	Kraiger et al. (1993)
	Declarative knowledge	Kraiger et al. (1993)
	Self-insight	Kraiger et al. (1993)
Skills	Marketing skills	Fisher et al. (2008)
	Opportunity skills	Fisher et al. (2008)
	Resource skills	Fisher et al. (2008)
	Interpersonal skills	Fisher et al. (2008)
	Learning skills	Fisher et al. (2008)
	Strategic skills	Fisher et al. (2008)
Attitudes	Entrepreneurial passion ("I want")	Fisher et al. (2008)
	Self-efficacy ("I can")	Fisher et al. (2008)
	Entrepreneurial identity (I am / I value")	(Krueger, 2005, Krueger, 2007)
	Proactiveness ("I do")	(Sánchez, 2011, Murnieks, 2007)
	Uncertainty / ambiguity tolerance ("I dare")	(Sánchez, 2011, Murnieks, 2007)
	Innovativeness ("I create")	(Krueger, 2005, Murnieks, 2007)
	Perseverance ("I overcome")	(Markman et al., 2005, Cotton, 1991)

During the coding process more codes were added when the coding frameworks did not capture important dimensions in the data. This kind of coding is called "open coding", and is a method suitable for developing theory or creating new theory (Corbin and Strauss, 1990). After the interviews were coded, a coding matrix was produced using functionality for this in the NVIVO software package. This matrix was used to identify salient connections between emotions and learning outcomes in the data.

Findings

Quantitative data – mobile app based survey engine

The mobile survey engine resulted in a total of 55 reports; 16 critical learning events, 13 negative emotions, 3 neutral emotions and 23 positive emotions (see Table 3). The mobile survey reports were predominantly done by the participating students in the two first months of the study, indicating that a certain reporting fatigue occurred for all three participants. One hypothesized way to counter this was to send out reminders by e-mail to the participants, but attempts to do this during spring 2013 were not effective. Some kind of incentive might be worth trying in future studies.

Two of the students reported both positive and negative emotions, and one of the students reported predominantly positive emotions. The level of difference in reported activation levels was rather small, indicating that this measure might perhaps be left out in future studies for simplification reasons since it does not add significantly to the study.

Table 3. Number of app reports done by each student in the study.

Student (anonymized)	Idea origin	# of app reports	# of emotions reported	# of CLEs reported
Anthony	Individual inventor	7	4	3
Barbara	University research	16	12	4
Carol	University research	32	23	9
Total		**55**	**39**	**16**

The reporting of critical learning events was perceived as difficult to understand by some participants, particularly the part where the kind of CLE was to be specified. In future studies this classification could be simplified or left out, instead captured through the text and subsequent interviews. The use of the mobile phone's keyboard to input text posed no significant problems for the users. All reports were accompanied with a text consisting of between ten and 100 words, which could later be used during the interviews to increase the quality of the discussion. Some examples of text supplied in emotion reports illustrating education related emotional moments are given:

> *"Similarly to before, I learn of my own interests and what I don't like. Accepting this as ok personally even though it causes some difficulty in group." (Anthony)*

> *"Excited!!! We handed in our business model and we hired a guy to develop our prototype and we are applying for money to go to this awesome fair" (Barbara)*

> *"Tough personal insight made me say I am sorry to my team. Felt great afterwards since they responded very well." (Carol)*

Similarly, the reporting of critical learning events contained text illustrating what was going on at that particular time:

> *"[Changed personal norms / self-awareness:] Interest in tech fields vs interest in business. Perceived bullshit in business world. Own academic learning. Self -ability higher than thought. Importance of doing what feels right in one's core." (Anthony)*

> *"[Major revelation about a person important to you:] Under pressure people's priorities clearly comes out. Time pressure, and its time to deliver" (Barbara)*

> *"[Changed personal attitude:] My thought of how the success of this project year will be defined was completely revised." (Carol)*

A full overview of Barbara's reportings is given in Figure 3. It illustrates how the app reports can inform the interviewer, giving a multitude of possible cues for good questions during the interview to quicker lead the discussion on to aspects of interest to the study, and thereby increase the usefulness of the interview data for the study. Figure 3 also illustrates the reporting fatigue, but it is still worth pointing out that those reports that were nevertheless done later in the study were very relevant and could be used to increase the quality of interview 2 and 3. It also shows that interacting with the outside world is a common source of positive emotions, and that confusion and ambiguity is a common source of negative emotions. Further, team-work experience can be a source of both positive and negative emotions.

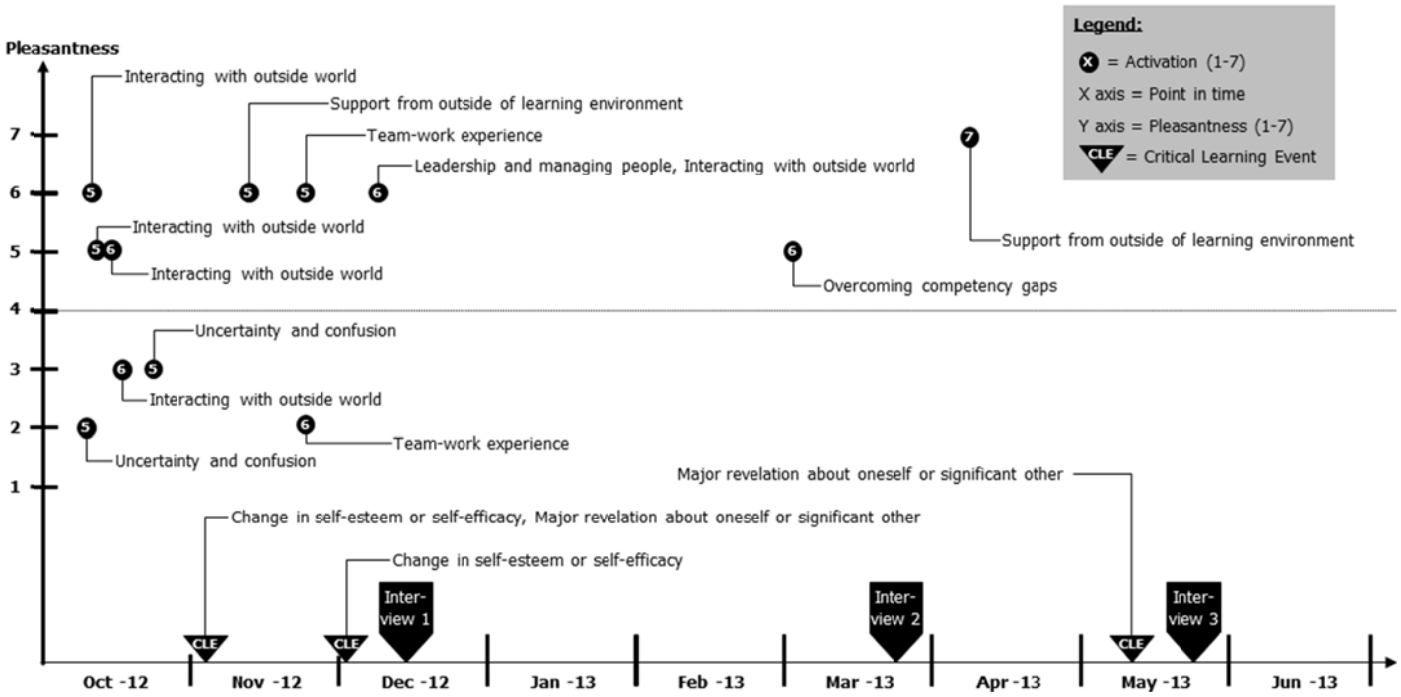

Figure 3. Overview of app reports and interviews for student Barbara.

Qualitative data – interviews and coding of interviews

Six interviews have been transcribed verbatim and analyzed in software package NVIVO. Since this is a working paper where some work remains to be done, three interviews remain to be analyzed. But already from the six analyzed interviews some patterns can be seen. The total number of occurences for emotion codes, learning outcome codes and other codes is displayed in Table 4.

The most common sources of emotions in the transcribed interviews are interaction with the outside world, team-work experience and uncertainty and confusion in the learning environment. In addition some sources of emotions not being part of the theoretical coding framework were identified, where the most common ones were presenting in front of others, getting feedback on own performance and reaching a "tipping point". The tipping point is defined in a preceding study on venture creation programs as the moment when students go from treating the project as a school project to assuming emotional ownership and treating the project as "their own" (Lackéus and Williams Middleton, 2013).

The most common entrepreneurial learning outcomes in the transcribed interviews are entrepreneurial self-efficacy, self-insight and entrepreneurial identity. The theoretical coding framework for this theme seems to be covering a higher proportion of the situations discussed by the interviewees, because only three open codes were introduced; autonomy, self-esteem and other.

Table 4. Number of occurences for theoretical and open codes in transcribed interview data

Codes			Total number of occurences
Main theme	**Kind of codes**	**Sub theme (theoretical codes)**	
Sources of emotions	Theoretical codes	Interaction with outside world	29
		Team-work experience	26
		Uncertainty and confusion in learning environment	24
		Theory versus practice	15
		Individual difference	10
		Overcoming competency gaps	9
		Leadership and managing people	6
		Support from outside of learning environment	5
		Time pressure	5
	Open codes	Presenting in front of others	12
		Getting feedback on own performance	8
		Reaching tipping point	8
		Other	6
		Relevancy	6
		Motivation	5
		Need for sacrifice	5
		Discrimination issues	2
Entrepreneurial learning outcomes	Theoretical codes	Self-efficacy	30
		Self-insight	20
		Entrepreneurial identity	20
		Uncertainty, ambiguity tolerance	16
		Marketing skills	12
		Entrepreneurial passion	12
		Perseverance	12
		Interpersonal skills	11
		Mental models	8
		Resource skills	8
		Declarative knowledge	3
		Opportunity skills	3
		Proactiveness	3
		Strategic skills	2
		Learning skills	1
		Innovativeness	-
	Open codes	Autonomy	6
		Self-esteem	4
		Other	2
Other themes	Open codes	Building castles in the air and imagination aspects	11
		Learning environment	10
		Roller-coaster discussions	6
		Make a difference in the world	3
		Being exposed, nowhere to hide	2
		Starting a business as a consequence of the program	2
		Difficult to find employer to work for	2
		Methodology	1
		Graduation hesitation – continue project or take job	1

In addition to emotion and learning outcome codes, nine open codes were added in the coding process, deemed to be of particular interest in this study. All three interviewees discussed aspects of building "air castles" (Swedish term), or as the expression is in English; "Building a castle in the sky / air". These quotes are illustrative:

> *"we started kind of three months ago but now we suddenly, now we have 9 people working for us and like okay where did they come from? What happened there? And we sat and ordered soldering and electronics components and built stuff as well - really succeeding like this, managing to take this from just an idea - this air castle and make it concrete - it's very cool. Wow, this was possible to get down to something. And also the feeling of making others think it is so interesting that they want to spend lots of time on it is very cool I think." (Carol)*

> *"There has to be a seed somewhere in order to grow a flower. Starting a venture is like convincing everyone that there is a flower even though you know that there is only a seed at this point. It is the entrepreneur's job to nurture the seed, replace the soil and water it until it becomes a flower in the end as promised in the beginning. Everyone else needs to see a flower while I see a seed." (Barbara)*

According to the interview data, this capability to create and transmit an initial vague idea and turn it into reality was improved as an effect of the program. This capability was related by interviewees to increased marketing skills, increased resource acquisition skills and increased capability to manage uncertainty and ambiguity. It was also clear that the act of building an "air castle" was not something that everybody perceived as desirable or positive.

Also, all of the interviewees talked of the education as representing an emotional roller-coaster:

> *"the whole trip was really like this - first we went up. … Coming in at the [potential customer], talking to all the people, coming out quite lyrical and then we go to the patent office and are told that we must have a patent, and it was only down again so that this will not go anyway then… But I think that [the feeling that] we can take over the world if we want to – you don't get it if it hasn't felt pretty damn hard before, I don't think so … Somehow you learn how terribly funny it is - it may still be worth all these pesky, pesky hours, and also getting to share it with someone." (Carol)*

> *"there is a lot going on for us right now, and the last 3 weeks have been really crazy and the last week now from Monday to Friday has been a roller coaster emotionally for me, … there was kind of a crisis in my head and there was crisis in my stomach" (Barbara)*

This indicates that an emotional roller-coaster can result in entrepreneurial self-efficacy as well as entrepreneurial passion and identity. But it is not without risk for negative experiences:

> *"It wasn't a roller-coaster, it was free falling from an airplane without a parachute … I don't see the point in doing this as education instead of just doing entrepreneurship outside of education." (Anthony)*

Links between strong emotions and entrepreneurial learning outcomes

After coding all interviews it was possible in the NVIVO software to construct an interaction matrix, capturing all instances of text where sources of emotions and entrepreneurial learning outcomes were discussed simultaneously. This analysis resulted in 80 such strings of text. The most common links are displayed in Table 5.

Table 5. Links between sources of emotions and entrepreneurial learning outcomes.

Coding based linkages in interviews		Number of occurences in total	Number of occurences Anthony	Number of occurences Barbara	Number of occurences Carol
Source of emotions	**Entrepreneurial learning outcome**				
Interacting with outside world	Self-efficacy	13	-	5	8
Uncertainty and confusion in learning environment	Uncertainty, ambiguity tolerance	10	4	2	4
Team-work experience	Self-insight	9	5	3	1
Interacting with outside world	Marketing skills	8	-	4	4
Overcoming competency gaps	Self-efficacy	7	2	-	5
Interacting with outside world	Uncertainty, ambiguity tolerance	7	-	3	4
Team-work experience	Entrepreneurial identity	7	2	4	1
Uncertainty and confusion in learning environment	Entrepreneurial identity	6	2	1	3
Interacting with outside world	Self-insight	6	-	4	2
Interacting with outside world	Entrepreneurial identity	5	-	3	2
Team-work experience	Self-efficacy	5	1	2	2
Theory versus practice	Self-insight	5	3	2	-
Team-work experience	Interpersonal skills	5	-	-	5
Getting feedback on own performance	Self-efficacy	5	-	3	2
Uncertainty and confusion in learning environment	Self-efficacy	5	2	-	3
Individual differences	Self-insight	5	4	-	1
Interacting with outside world	Entrepreneurial passion	4	-	1	3
Team-work experience	Entrepreneurial passion	4	-	2	2
Uncertainty and confusion in learning environment	Perseverance	4	-	2	2
Leadership and managing people	Interpersonal skills	4	-	-	4

The results of this table cannot be adequately interpreted without being aware of two quite different kinds of experience of the education for the three participants in the study. The data shows that Anthony did not engage in any substantial interation with the outside world that caused strong emotions (see table 5), while Barbara and Carol engaged to a very large extent in interaction with the outside world. Interviews with Anthony indicate that the reason for this is related to group dynamics. The group Anthony was part of did not function well for the entire fall of 2012, but was instead split up in December following a decision by the faculty. The groups Barbara and Carol were part of reached deep levels of collaboration and productivity, giving a distinctly different experience of the program. Still, Anthony reported some quite interesting learning outcomes related to entrepreneurship, such as increased uncertainty / ambiguity tolerance, increased self-insight, increased entrepreneurial self-efficacy and the formation of a distinctly personal entrepreneurial identity. In fact, after the program was finished, Anthony started up his own company together with some friends, which according to Anthony was a direct effect of his taking part in the education studied here. In this company Anthony was determined to practice his more "substance" or "technology" based view of entrepreneurship formed during the program and rooted in his background in electrical engineering:

> *"I'd like to … [practice] something you could call informed entrepreneurship, … when you actually know what you're doing, … something where I feel I am on top of everything needed in order to initiate a start-up. … [Take] for example a math book where you have a proof and every step must be justified, it is for me [a] completely opposite approach and … I can imagine that there are others who also think so. I think that when you apply social constructivism on technology*

> *development, … it summarizes what I think is wrong [in this education's approach to entrepreneurship]" (Anthony)*

The most common link between emotions and learning in this study is interaction with outside world being related to build-up of entrepreneurial self-efficacy:

> *"I guess it is the blend between the people you meet and the success stories you hear and things you do in the project as well as when you get confirmation that – hell, we could probably do this. (Barbara)*

> *"it had certainly not been the same if it were not for real. Then it would have been like any other school project that you have done, you might say. Yes, I would say it's a feeling that you - that you can - that you - yes, and that people trust you, that our idea partners can come to us with this idea and trust that we can do something good out of it – that they give you their trust and that - I do not know why it is so immensely motivating that it's real, but it really is." (Carol)*

In addition to this link the interview data also contains quotes indicating that interaction with outside world also can lead to build-up of marketing skills, increased uncertainty / ambiguity tolerance, increased self-insight and build-up of entrepreneurial identity and passion.

The second most common link between emotions and learning in this study is uncertainty and ambiguity in the learning environment leading to increased uncertainty and ambiguity tolerance:

> *"during that time in the fall [i.e. in the preparatory year, one year before this study started], I thought that yes, yes it was really a good simulation but in real life it can not be as uncertain as that. And I've noticed that [in reality] it is even as uncertain as it was there. … It was an interesting reflection. … it's almost a little ridiculously uncertain. ... If I had been trying to sell my stuff to someone who has no knowledge about [this] topic, I would just have needed to make up a bunch of bullshit and they would have swallowed that ... but that is nothing I can stand for ... I can imagine that in some areas it can work out very well that way. ..." (Anthony)*

> *"you get a task, and one would think like this: Oh God, we do not even know what it is, no one understands what we are doing, and [still] at the end you have something to submit. … It has built a little peace of mind that okay, it might be as stressful or as messy as anything, but it always turns out with something. I think it has been very much [a source of learning to me]." (Carol)*

Also in this case uncertainty and ambiguity in the learning environment seems to lead to other learning outcomes, such as build-up of entrepreneurial identity, increased self-efficacy and increased perseverance.

The third most common link in the data is between team-work experience and increased self-insight:

> *"I would say that the greatest source of learning then has … been largely myself and the situation the group has been in, … more self-awareness, perhaps, I feel I know myself better." (Anthony)*

> *"[Right] now [the major source of learning] is probably more the interaction between the three of us - that we have come quite far in … how well we know each other. So we have discussions on group climate and group norms, they are on a very deep level. … Those small things that can still create a bit like crisis and so then when you understand the different ways to deal with it so it will be like this - yes - we'll try to meet there." (Carol)*

Also team-work experience has been shown to lead to learning outcomes such as entrepreneurial identity, increased self-efficacy, increased interpersonal skills and increased entrepreneurial passion.

Discussion

This study has uncovered a large number of links between strong emotions and entrepreneurial learning outcomes, see Figure 4. The evidence for some links is stronger than for others. Three sources of emotions that seem to be particularly linked to entrepreneurial learning outcomes are interaction with outside world, uncertainty and ambiguity in learning environment and team-work experience. These sources of emotion seem to be linked to formation of entrepreneurial identity, increased self-efficacy, increased uncertainty and ambiguity tolerance and increased self-insight. A conclusion that can be drawn from this is that strong emotions induced by action-based entrepreneurial education seem to primarily impact attitudinal learning outcomes, rather than skill-based and knowledge based learning outcomes.

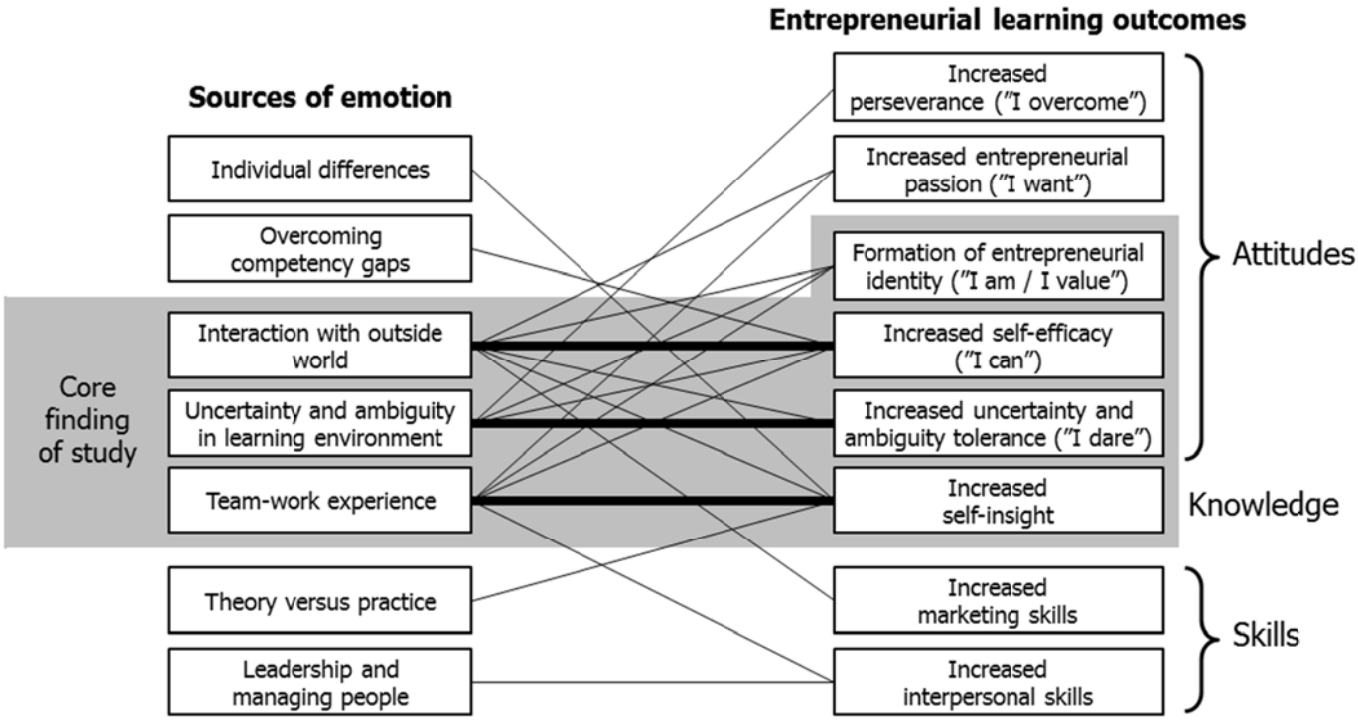

Figure 4. Links between sources of emotions and entrepreneurial learning outcomes uncovered / confirmed in this study.

Action-based entrepreneurship education and whole-person learning / competency

Adopting a whole-person view of learning and competency, as advocated by Jarvis (2006) and Man et al. (2002) respectively, has led this study to focus particularly on the emotional aspects of an action-based entrepreneurship education program. This approach has been capable to empirically confirm some aspects of Cope's framework for entrepreneurial learning stating that emotional learning events are central to how people become entrepreneurial (Pittaway and Thorpe, 2012). This study can also empirically confirm that disjunctural situations where a person's harmony is disturbed, the importance of which is emphasized by Jarvis (2006), can initiate profoundly personal and deep learning processes changing a person on attitudinal level, i.e. spurring new insights on issues such as "Who am I?", "What can I do?" and "What do I dare?".

Although it is outside of the scope of this article to extensively describe how the links between strong emotions and entrepreneurial learning outcomes play out in detail and why it is so, some basic mechanisms can be noted. Interaction with the outside world in the educational setting studied here at times seems to trigger very high levels of happiness and motivation among students, which in turn leads to a number of effects. They increase their level of energy put into the tasks and challenges constituting the action-based learning environment. They increase the willingness to overcome obstacles and tolerate uncertainty and ambiguity, leading to increased perseverance. It seems that when students get to present their work for people outside the educational environment, and when these external people give their honest feedback in a commited and interested way, the students feel highly acknowledged and appreciated. This feeling of being valued and valuable leads to increased self-efficacy and self-confidence. The students seem to develop an aptitude for these situations, which over time in turn leads to increased entrepreneurial passion ("I want more of this") and even a more entrepreneurial identity ("this is who I am"). This in turn correlates in time with the "tipping point" when students asssume emotional ownership of their projects, treating them as "theirs", especially if the positive feedback external people give them can be attributed to the students' unique contribution to the project, and if the external people devote time to the projects for other reasons than giving back to university, i.e. if they are motivated by the actual or perceived value created in the project.

This uncovering of basic mechanisms explaining links between emotions and learning only represent a first glimpse into the "black box" of entrepreneurial learning at this specific learning environment, and might well be contextual and not transferable to other environments. But they are still encouraging, and merit further research.

Implications for design of entrepreneurial education

Some of the methods for assessing entrepreneurial competency development advocated by Bird (1995) have been used in this study, such as "self-reflective diaries", "retrospective construction of events and behavior", "critical event interviewing" and "oral histories" (p. 61). This study can confirm this as a productive way to link educational intervention to entrepreneurial learning outcomes, provided that one agrees that the strong emotions reported in this study are indeed caused by educational design. Although a venture creation approach in education (Ollila and Williams-Middleton, 2011) is a very unusual educational design even on a global level (Lackéus and Williams Middleton, 2013), the underpinning principles of promoting interaction with the outside world, constructing a learning environment characterized by uncertainty and ambiguity and building on a strong team-work logic all

seem to be design principles worthy of emulating in other kinds of learning environments if the aim is to develop entrepreneurial competencies. Building a learning environment on these principles seems to be able to result in formation of entrepreneurial identities, increased self-efficacy, increased uncertainty and ambiguity tolerance and increased self-insight.

Implications for further research

This study set out to explore an alternative route to assessing entrepreneurial competency development, instead of the traditional pseudo-randomized experiments with pre- and post measurements on treatment and control groups using surveys based on psychological constructs (Martin et al., 2012). Although only based on three students, some rather strong patterns have been observable, opening up the "black box" of entrepreneurial learning. This is promising, and merits further research with similar methodological approaches. This study also confirms previous claims that venture creation programs constitute "clinical" laboratory environments allowing for focused studies on nascent entrepreneurial stages of venture creation (Lackéus and Williams Middleton, 2013). The utility of such research environments is probably not limited to entrepreneurial learning outcomes only, it can probably be expanded into other domains of entrepreneurship research as well.

Limitations of the study

This study has some important limitations that should not be overlooked. It is based on three students' views only, selected for inclusion based on availability rather than being representative entrepreneurship students. The transferability of the results from this particular learning and research environment is difficult to assess at this stage, given that this is exploratory research. The coding procedure has been performed by one researcher only. In future studies all interviews should be coded by multiple researchers in order to increase inter-coder reliability.

The two theoretical coding frameworks used is another limitation. Frameworks for sources of strong emotion in entrepreneurial education is an under-researched area, and there are no other frameworks that the author knows of in this specific domain. The availability of frameworks for entrepreneurial competencies in previous research is higher, but there is no consensus among scholars as to what constitutes entrepreneurial competencies, which means that the researcher has had to construct his own framework.

Conclusion

Through a longitudinal mixed methods approach, this study has investigated links between strong emotions and entrepreneurial learning outcomes in an action-based entrepreneurship education program applying a venture creation approach (Ollila and Williams-Middleton, 2011), i.e. requiring student teams to start a real-life venture. A large number of links between strong emotions and entrepreneurial learning outcomes has been uncovered and/or comfirmed. Three thematic sources of emotions that seem to be particularly linked to entrepreneurial learning outcomes are interaction with outside world, uncertainty and ambiguity in learning environment and team-work experience.

Interaction with the outside world has for the students in this study resulted in increased entrepreneurial self-efficacy. Uncertainty and ambiguity in the learning environment frequently resulted

in students increasing their tolerance for uncertainty and ambiguity. Team-work experience frequently resulted in increased self-insight among students. There were other frequent links between strong emotions and entrepreneurial learning outcomes in the data from this study.

The study also found that the educational design of the program studied at times induced an emotional roller-coaster that led to increased entrepreneurial self-efficacy, increased entrepreneurial passion and build-up of entrepreneurial identity. Another finding was that capability to envision and communicate an initial and vague idea was improved by the program studied, leading to improved marketing skills, resource acquisition skills and capacity to tolerate uncertainty and ambiguity.

These findings represent a novel approach to assessing learning outcomes within entrepreneurial education. They also represent early empirical evidence for three effective design principles of entrepreneurial education. Educators aiming to develop entrepreneurial competencies should try to design a learning environment ripe of uncertainty and ambiguity where students frequently are able and encouraged to interact with the outside world in a working environment emphasizing a team-based approach. This study also represents an attempt to open the “black box” of entrepreneurial learning, since it has been possible to uncover some mechanisms behind the links observed between emotions and learning.

Some important limitations of this study include a limited number of interviewees, unknown transferability of results to other contexts and learning environments, risk for individual bias in data coding procedures and a lack of suitable theoretical frameworks for strong emotions and learning outcomes within the domain of entrepreneurship education.

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