THESIS FOR THE DEGREE OF LICENTIATE OF ENGINEERING

Developing Entrepreneurial Competencies

An Action-Based Approach and Classification in Education

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Cover:
Three students at Chalmers School of Entrepreneurship presenting their real-life project Velit Biologics (project name at that time was SB101) to the teachers, their class and to external invited guests and experts. From left: David Henricson Briggs, Alexander Lagerman and Pille Pihlakas. Photo taken in December 2011 by Viktor Brunnegård.

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ABSTRACT

A question within entrepreneurial education that never seems to go out of fashion is "Can entrepreneurship be taught?". To address this question, this thesis adopts the view that becoming entrepreneurial requires direct experience, and explores how learning-by-doing can be put to use in entrepreneurial education through action-based approaches. Action-based approaches are frequently advocated for but more seldom used due to cost-based and systemic challenges. The field lacks a theoretically grounded definition and classification of action-based entrepreneurial education, and conceptual discussions on the topic of learning-by-doing-*what* in entrepreneurial education are rare. Challenges to assess entrepreneurial education have also contributed to a dominance of cognitive approaches in entrepreneurial education, despite their inability to develop entrepreneurial competencies.

The main purpose of this thesis has been to increase our understanding of how action-based entrepreneurial education can develop entrepreneurial competencies. An empirical setting suitable for this purpose was identified, qualified and described through extensive study of various educational environments in Europe and United States. A two-year entrepreneurial education program in Sweden was found to constitute a "paradigmatic case" of action-based entrepreneurial education, defining a "venture creation approach" and justifying a single case study approach. Thirteen students from this program were studied in their two-year process of developing entrepreneurial competencies. They were studied using an interpretation framework for entrepreneurial competencies developed for the purpose, an experience sampling based "mobile app" and through quarterly interviews.

The study is still on-going, but analysis of empirical data has so far revealed 17 different kinds of events that could be linked to the development of entrepreneurial competencies. According to preliminary findings, some links are stronger than others, such as interaction with outside world leading to build-up of entrepreneurial self-efficacy, marketing skills and uncertainty tolerance. Based on this, four classes of activities that trigger such events have been proposed, constituting an attempt to establish a classification and definition of action-based entrepreneurial education. These four classes could help practitioners in action-based entrepreneurial education to compare different pedagogical approaches and subsequently decide on which activity to opt for in any given teaching situation. They could also help researchers focus more on relevant aspects of action-based entrepreneurial education, removing differentiation that is irrelevant for the purpose.

In order to explain how these four classes of activities develop entrepreneurial competencies, a causal relationship has been proposed to exist between the four classes of activity, the emotional events they trigger and the resulting development of entrepreneurial competencies. If such a causal relationship exists, it opens up for a new approach to assessment in entrepreneurial education, focusing on the frequency, strength and variety of emotional events of certain kinds. These events could thus be viewed as indirect proxies for developed entrepreneurial competencies, which is an educational outcome difficult to assess directly. In addition to the assessment implications of these findings, an "actionable knowledge" approach has been proposed, where a focus on human action / activity bridges between traditional teacher-centric and progressive learner-centric approaches to education. It could contribute with new perspectives in a century-long debate in general education impacting the domain of entrepreneurial education.

Keywords: Entrepreneurship education; enterprise education; entrepreneurial competencies; learning; education; emotional events; longitudinal case study; venture creation; value creation

LIST OF PUBLICATIONS

This thesis is based on the following papers:

i. Lackéus, M., Lundqvist, M., Williams Middleton, K. 2013. How Can Entrepreneurship Bridge Between Traditional and Progressive Education? Presented at *ECSB Entrepreneurship Education Conference* in Århus, Denmark, 29-31 May 2013.

ii. Lackéus, M., Williams Middleton, K. 2012. Venture Creation Programs – Bridging Entrepreneurship Education and Technology Transfer. *Accepted for publication in Education + Training.*

iii. Lackéus, M. 2013. Links between Emotions and Learning Outcomes in Entrepreneurial Education. Presented at *Nordic Academy of Management* conference in Reykjavik, Iceland, 21-23 August 2013.

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Martin Lackéus

Göteborg, November 8, 2013

To my wife, Karin

&

To our children

CONTENTS

FIGURES

TABLES

1. Introduction

1.1 Entrepreneurial education

A question within entrepreneurial education that never seems to go out of fashion is "Can entrepreneurship be taught?". Many argue that there is enough evidence that entrepreneurship can be taught (Kuratko, 2005, Gorman et al., 1997, Pittaway and Cope, 2007a). Others argue that entrepreneurs are primarily born, not made (Nicolaou and Shane, 2009). Some opt for a middle way, claiming that certain aspects of entrepreneurship cannot be taught, such as self-confidence, persistence and energy levels (De Faoite et al., 2003). Others connect the question to assessment in education, stating that the difficulty lies primarily in measuring the effects of entrepreneurial education (Martin et al., 2013, Henry et al., 2005b).

In the domain of entrepreneurial learning there is no similar polarized discussion on the corresponding question "Can entrepreneurship be learned?". Instead a multitude of empirically grounded frameworks and models are proposed on how entrepreneurship is learned by individuals pursuing entrepreneurial endeavors (Rae and Carswell, 2001, Rae, 2005, Minniti and Bygrave, 2001, Cope, 2005, Politis, 2005, Pittaway and Thorpe, 2012). Consensus among entrepreneurial learning scholars is that the only way to become entrepreneurial is through direct experience, i.e. learning-by-doing or direct observation. The entrepreneurial learning domain is however largely disconnected from the educational arena, and primarily studies on-the-job learning; learning from the experience of operating a company.

1.2 Action-based entrepreneurial education

This thesis adopts the view that becoming entrepreneurial requires direct experience, and explores how learning-by-doing can be put to use in entrepreneurial education through action-based approaches, often labeled "learning *through* entrepreneurship" (O'Connor, 2012). If entrepreneurship can be informally learned it can also be formally taught (Lange et al., 2011, Drucker, 1985). Action-based approaches are frequently advocated for but more seldom used due to cost-based and systemic challenges (Mwasalwiba, 2010). The field of entrepreneurial education lacks a theoretically grounded definition and classification of action-based entrepreneurial education, instead often defining it through "laundry list" enumeration of a large amount of pedagogical approaches (See for example Mwasalwiba, 2010, Kuratko, 2005, Jones and Iredale, 2010). Conceptual discussions on the topic of learning-by-doing-*what* in entrepreneurial education are rare.

1.3 Developing entrepreneurial competencies

The ultimate goal of all entrepreneurial education is to develop some level of entrepreneurial competencies among learners in terms of knowledge, skills and/or attitudes. Entrepreneurial competencies are in this thesis defined as knowledge, skills and attitudes that affect the willingness and ability to perform the entrepreneurial job of new value creation; that can be measured directly or indirectly; and that can be improved through training and development, see Table 1. The definition of "entrepreneurial" used in this thesis is based on Bruyat and Julien (2001), proposing that entrepreneurship can be viewed as a dialogic system consisting of

the two entities *individual* (subject) and the *new value created* (object), where a *process* of interacting with the surrounding *environment* over time profoundly changes both of these entities. Some important challenges within action-based entrepreneurial education that I will focus on in this thesis are the lack of assessment tools for action- and emotion-based entrepreneurial competencies, and the vagueness of what activities to focus on in a learning-by-doing approach. I posit that these challenges have contributed to a dominance of cognitive approaches in entrepreneurial education, despite their inability to develop entrepreneurial competencies (Lautenschläger and Haase, 2011).

1.4 Research aim and contribution

The main purpose of this thesis is to increase our understanding of how entrepreneurial competencies can be developed through action-based entrepreneurial education. To focus the research, three Research Questions have been articulated: RQ1) How can entrepreneurial competencies be operationalized and measured? RQ2) What activities could contribute to development of entrepreneurial competencies in entrepreneurial education? and RQ3) How can these activities develop entrepreneurial competencies in entrepreneurial education?

A qualitative comparative case study approach has been applied, consisting of semi-structured individual interviews, focus group interviews, analysis of secondary sources and relating to various domains of literature. An abductive approach has been used, labeled as "systematic combining" by Dubois and Gadde (2002), stressing theory *development* rather than the theory *generation* approach proposed in the 'grounded theory' approach (Corbin and Strauss, 1990). Two major units of analysis have been selected, studying ten particularly action-based entrepreneurial education programs as well as thirteen individual students in one of the studied programs.

In this thesis I will propose a classification of action-based entrepreneurial education consisting of four activity classes of creation. The four classes could help practitioners in action-based entrepreneurial education to compare different pedagogical approaches and subsequently decide on which activity to opt for in any given teaching situation. I will also propose an explanation of how these four activity classes can develop entrepreneurial competencies. Based on this a new approach to assessing entrepreneurial education is proposed. A new approach to bridging between traditional and progressive education is also proposed, potentially alleviating a century-long debate leading to emphasis on pedagogical approaches that are easy to test (Löbler, 2006) and marginalizing entrepreneurial education.

1.5 Outline of the thesis

First the theoretical background of entrepreneurial education is described in Chapter 2, culminating in a framework for learning-by-doing and an instructional design example from literature. Chapter 3 outlines methodological considerations, and Chapter 4 describes the three appended papers. Chapter 5 proposes four activity classes of action-based entrepreneurial education along with a description of how these activities make people more entrepreneurial. In Chapter 6 additional propositions are presented and discussed. In chapter 7 conclusions from this thesis are made. Chapter 8 discusses future work.

2 Theory

In this chapter, I will present literature on general entrepreneurial education, on action-based entrepreneurial education and its theoretical roots, and on development of entrepreneurial competencies. Based on this I will outline a theoretical framework for learning-by-doing, as well as provide an illustrative example. To facilitate the discussion on these and related themes, a facilitating framework is outlined in Table 1. This framework will be elaborated on throughout the thesis to illustrate the contribution of this thesis. Relevant references will be given in subsequent versions of this table, as this first table is primarily presented to supply an overview.

Table 1. Facilitating framework used in this thesis.

Entrepreneurial…	What are they?	How to develop?	How to assess?
…knowledge / …thought / …know-what / …cognition	Mental models, declarative knowledge	Lectures Reading literature	Summative tests Reports – oral/text
…skills / …action / …know-how / …conation	Marketing, strategy, resource acquisition, opportunity identification, learning, interpersonal skills	Lectures Reading literature Case based teaching Learning-by-doing	Summative tests Reports – oral/text Jobs taken / done
…attitudes / …emotion / …know-why / …affect	Passion, self-efficacy, identity, proactiveness, perseverance, uncertainty tolerance	Learning-by-doing	Pre/post surveys

2.1 Entrepreneurial education

Entrepreneurial education is a term encompassing both enterprise education and entrepreneurship education, two terms that are often causing confusion (Erkkilä, 2000). In Europe, enterprise education has been defined as focusing more broadly on personal development, mind-set, skills and abilities, whereas entrepreneurship education has been defined to focus more on the specific context of setting up a venture and becoming self-employed (QAA, 2012, Mahieu, 2006). In United States, the only term used is entrepreneurship education (Erkkilä, 2000).

Erkkilä (2000) has defined United States and United Kingdom as leaders in the entrepreneurial education trend. In United States the first entrepreneurship class was held in 1947 (Katz, 2003). In United Kingdom Allan Gibb has been a key scholar leading the development in the field for decades. Entrepreneurial education has seen worldwide exponential growth in higher education institutions (Kuratko, 2005), and was in 2001 offered at around 1200 business schools only in United States (Katz, 2008). This growth is often explained by entrepreneurship being seen as a major engine for economic growth and job creation (Wong et al., 2005), and as a response to the increasingly globalized, uncertain and complex world we live in (Gibb, 2002). Today entrepreneurial education has become an important part of both industrial and educational policy in many countries (Hytti and O'Gorman, 2004). Besides the usual economical and job

growth related reasons to promote entrepreneurial education, there is also increasing emphasis on the effects it can have on learners' perceived relevancy and thus motivation to engage in educational activity, particularly among low achievers (Surlemont, 2007, Deuchar, 2007, Mahieu, 2006). Motivation is a key driver for learning in entrepreneurial education (Hytti et al., 2010, Kyrö, 2008) as well as in general education (Boekaerts, 2010) where entrepreneurial approaches could alleviate problems of student boredom causing high dropout rates (Fredricks et al., 2004, Mahieu, 2006).

With very few exceptions, focus of research in entrepreneurial education has been on post-secondary levels of education (Gorman et al., 1997), which is surprising given that childhood and adolescence is considered to be an ideal age for acquiring basic knowledge and positive attitudes towards entrepreneurship (Peterman and Kennedy, 2003). This lack of research is also surprising given the immense policy pressure on educational institutions to integrate entrepreneurial education in pre-university education (European Commission, 2012b). Following a rapidly developing trend starting as late as in 2003, most countries in the European Union now have launched national strategies for entrepreneurial education in general schooling (ibid). There is today very limited available empirical research outlining to what extent and with what results entrepreneurial education has been diffused in pre-university education.

2.1.1 Three approaches in entrepreneurial education

Entrepreneurial education is often categorized into three approaches (Johnson, 1988, O'Connor, 2013, Heinonen and Hytti, 2010, Scott et al., 1998). Teaching "about" entrepreneurship means a content-laden and theoretical approach aiming to give a general understanding of the phenomenon. Teaching "for" entrepreneurship means an occupationally oriented approach aiming at giving budding entrepreneurs the requisite knowledge and skills. Teaching "through" means a process based and often experiential approach where students go through an actual entrepreneurial learning process (Kyrö, 2005). This approach is often termed action-based entrepreneurial education, and will be discussed more in-depth in a separate part of this theory section, since it is the approach of primary interest in this thesis.

How entrepreneurial education is carried out in practice varies substantially, primarily depending on which definition is used (Mwasalwiba, 2010), but also depending on what underlying educational paradigm is applied (Ardalan, 2008). In general, the definitions used seem to get more and more narrow (i.e. business and start-up focused) the higher up in the educational system one looks (Johannisson et al., 1997, Mahieu, 2006). The actual coursework is often based on personal experience rather than systematic approaches (Fayolle and Gailly, 2008), and is often centered around letting students create a business plan (Honig, 2004).

2.1.2 Entrepreneurial education interacting with society

Entrepreneurial education at post-secondary levels is often expected to take part of the regional entrepreneurial ecosystem. (Mwasalwiba, 2010, Gorman et al., 1997). Common activities, often termed "outreach", include assisting local entrepreneurs, interacting with student clubs, inviting alumni and experts, visiting networking events, conducting student consulting and participating in business plan competitions (European Commission, 2008, Mwasalwiba, 2010, Rice et al., 2010). Less common activities include interaction with incubators and technology

transfer offices for university commercialization purposes (Moroz et al., 2010, Nelson and Byers, 2010). Hynes and Richardson (2007) outline several benefits of outreach arrangements for students, faculty, researchers and stakeholders outside university. Two terms frequently used in conjunction to outreach activities are "third mission" and "the entrepreneurial university" (Etzkowitz, 2003, Rothaermel et al., 2007, Etzkowitz and Leydesdorff, 2000).

Many outreach activities are extra-curricular due to difficulties in integrating them into formal courses and programs (Botham and Mason, 2007). A notable exception to this is a "venture creation approach" (Ollila and Williams-Middleton, 2011), i.e. when entrepreneurial education is formally integrated with commercialization entities at the university. This constitutes an exception from the prevailing norm that the formation of spinoffs based on university research is managed by technology transfer offices or similar entities, without integration to entrepreneurial education (Shane, 2004). Some programs applying a venture creation approach have shown interesting outputs in terms of both student learning and student-led venture creation (Barr et al., 2009, Hofer et al., 2010, Meyer et al., 2011, Thursby et al., 2009, Lundqvist and Williams Middleton, 2008). Two such programs that have yielded significant financial value and generated hundreds of new jobs are Chalmers School of Entrepreneurship at Chalmers University of Technology in Sweden (Lundqvist, in press) and the TEC program at North Carolina State University in United States (Barr et al., 2009). Research on this kind of integrated environments is in a nascent stage, but seems to be an environment well suited to study entrepreneurial competency development first-hand as ventures are started by inexperienced individuals (for an example, see Williams Middleton, 2013). This research opportunity is one of the basic tenets of this thesis.

At pre-university level interaction between entrepreneurial education and the surrounding society is not well researched. Some exceptions outline substantial benefits of external engagement in terms of increased motivation for learners, increased school attachment and strengthened self-confidence (Surlemont, 2007, Nakkula et al., 2003, Jamieson, 1984). A widespread model is Young Enterprise (Dwerryhouse, 2001) where adolescents run a company for 8 months, followed by voluntary liquidation.

2.1.3 Educational traditions impacting entrepreneurial education

Löbler (2006) has stated that "the constructivist paradigm serves as a theoretical base for entrepreneurship education" (p.31). This way of positioning entrepreneurial education in the progressivist and constructivist end of an educational philosophy continuum resonates with a century-long debate between traditional versus progressivist / constructivist education (Tynjälä, 1999, Labaree, 2005). The traditional approach to education has been positioned as emphasizing national curriculum, standardized tests, inert knowledge and a search for "what works" (Egan, 2008, Tynjälä, 1999, Biesta, 2007). The progressivist approach has been positioned as learner focused, process-based and socially situated (Tynjälä, 1999, Jeffrey and Woods, 1998). In general the traditional approach is preferred in education mainly due to its easiness to verify what has been learned through testing (Von Glasersfeld, 2001, Labaree, 2005, Löbler, 2006). For the learners this has resulted in an increased focus on measurable cognitive skills, at the expense of more behavioral and affective (i.e. non-cognitive) skills that

are more difficult to measure with standardized test scores but crucial on the labor market, such as entrepreneurial skills. This on-going narrowing of the curriculum in general education is an important challenge to the domain of entrepreneurial education. This unfortunate trend could be counterbalanced if assessing the development of non-cognitive skills were made easier, which is an aim of this thesis.

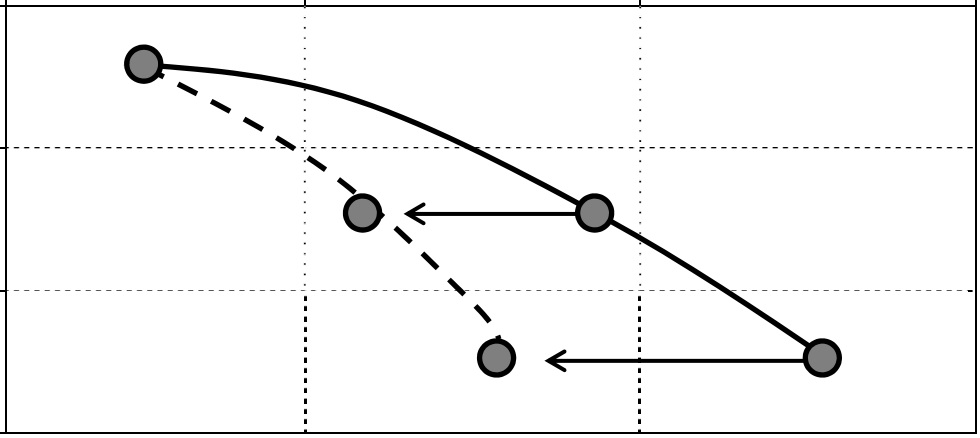
I posit that developing a classification of action-based entrepreneurial education requires a high level of awareness around these overarching issues in education, since entrepreneurial education always is delivered within an educational system. Much discussion around entrepreneurial education is being held without reference to the century-long debate in general education. Articles contrasting between a "traditional" and an "entrepreneurial" way of teaching are frequent in entrepreneurial education literature, but almost always without reference to the overarching debate in general education. Instead it is positioned as an entrepreneurial education specific problem. The usual way of illustrating the differences is by showing a table with two columns contrasting traditional teaching with entrepreneurial teaching, advocating for a paradigmatic change to entrepreneurial teaching (Gibb, 1993, Johnson, 1988, Ollila and Williams-Middleton, 2011, Cotton, 1991, Kyrö, 2005, Kirby, 2004). Standardized, content focused, passive and single-subject based curriculum in traditional education is contrasted with an individualized, active, process-based, collaborative and multidisciplinary approach in entrepreneurial education. In line with this, entrepreneurial education scholars often discredit traditional business schools for their silo structures and detachment from real life, stating that it is not a suitable place for entrepreneurial education or entrepreneurial extracurricular activities (Hindle, 2007, Binks et al., 2006, Wright et al., 2009, Tan and Ng, 2006). Some also claim that formal education in general suppresses entrepreneurial attitudes (Löbler, 2006, Gorman et al., 1997, Chamard, 1989), supported by studies showing for example that entrepreneurial characteristics were found at 25% of kindergarten children but only at 3% of high school students (Kourilsky, 1980).

The common solution to this debate has so far been to treat entrepreneurial education as a separate topic, giving a small amount of teachers some degree of autonomy over which pedagogical approaches to apply. But with increasing policy pressure on entrepreneurial education to become an integrated part of the entire educational system, this is not a long-term solution. On one side embedding entrepreneurial education is promoted by policymakers, on the other side the trend towards more standardized curriculum and test based educational systems is increasingly excluding entrepreneurial education. This paradox is evident in the Swedish school system today (Falk-Lundqvist et al., 2011).

Some scholars in education have recently proposed a "third way" bridging between traditional and progressive education (Egan, 2008, Hager, 2005), in the form of integrative approaches drawing from both dualist positions of traditionalism and progressivism. This strategy has not yet reached the domain of entrepreneurial education. This thesis can be viewed as an attempt to explore a "third way" strategy drawing both on traditional and entrepreneurial teaching by building on knowledge based value-creating activity as a foundation for both teaching and learning. Such an "actionable knowledge" approach could bridge between knowledge domains

and meaningful emotional action-taking, and form a more hands-on basis for assessing development of competencies by assessing concrete actions taken, see Table 2. It could for example lead to learners asking themselves "For whom is this knowledge valuable today?", and also lead to teachers assessing learners by asking "Who did you interact with?". Facilitating assessment of action-based approaches can also be a means to make such approaches more common in education, see Table 2. We will now turn to specific literature on action-based approaches in entrepreneurial education.

Table 2. Levels of difficulty in measuring competencies, and intention of this thesis to facilitate assessment (dotted line).

General… / Entrepreneurial…	**Easy to measure Common in education**		**Difficult to measure Less common in education**
…knowledge / …thought / …know-what / …cognition			
…skills / …action / …know-how / …conation			
…attitudes / …emotion / …know-why / …affect			

2.2 Action-based entrepreneurial education

The action-based approach has been given many different labels in entrepreneurial education literature. Rasmussen and Sörheim (2006) call it action-based entrepreneurship education, defining it as learning-by-doing. Others label it action learning (Leitch and Harrison, 1999), active approach (Henry et al., 2005a), experiential learning (Cooper et al., 2004, Kuratko, 2005), experiential education (Honig, 2004), learning-by-doing (Tan and Ng, 2006, Cope and Watts, 2000) or reflective practice (Neck and Greene, 2011). It would however be a mistake to assume that they are all equal synonyms. In fact, they have very different origins both in terms of theory and practice. They all illustrate the need for entrepreneurial education scholars to draw from the more general domain of learning. It is outside the scope of this thesis to describe various movements in the domain of experiential and action learning, but some important scholars that I discuss further in the papers appended to this thesis are John Dewey, Reg Revans, David Kolb and Peter Jarvis. As an example, a definition is given by Hoover and Whitehead (1975): "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).

When action-based entrepreneurial education is discussed it is often done by naming a myriad of different activities that can be undertaken in educational settings (See for example Mwasalwiba, 2010, Kuratko, 2005, Jones and Iredale, 2010). Activities typically include case studies, simulations, business plan creation, film and drama production, project work,

presentations / pitching, games, competitions, setting up real-life ventures, study visits, role plays, interviews with entrepreneurs, internships, mentoring, etcetera. There seems to be a lack of classification schemes within action-based entrepreneurial education, forcing scholars to define it through enumeration. A classification for such activities could thus prove to be useful in this domain.

Since many action-based approaches in entrepreneurial education draw on extra-curricular university-based entrepreneurial ecosystems (Rice et al., 2010, Mwasalwiba, 2010), it is important to emphasize that this thesis focuses on in-curricular action-based activities and approaches in credit giving entrepreneurial education, thus excluding purely extracurricular entrepreneurial activities. This thesis also focuses on the actual activities performed by the learners in an educational setting, since experience does not require learners to take action themselves apart from showing up. It could suffice to be present in a community of practice to experience events that one can learn from, for example being an observer participant in a study visit. The activity-based perspective of this thesis is in line with John Dewey's "learning-by-doing" approach[1], asking questions such as "learning-by-doing *what*?", or "teaching by letting learners do *what*?". Here I regard action and activity as a bridge between teaching and learning, since action-based entrepreneurial education always includes a teacher that designs, orchestrates, or triggers the activities that the learners then learn from doing.

2.2.1 Theoretical foundations of action and activity

Having outlined some perspectives in the rather weak literature base on action-based entrepreneurial education, I will now outline some theoretical and psychological approaches to human action / activity outside the domain of entrepreneurial education. These perspectives will later be used to build a theoretical model of learning-by-doing, as well as to propose a classification of action-based entrepreneurial education. Some key perspectives of these two sections are summarized in Table 3.

The study of human action has been labeled "praxeology" by von Mises (Mises, 1949), rooted in Greek philosophy where praxis means action. According to von Mises, praxeological principles are universally valid for all human actors and all actions (Callahan, 2005), since they are part of our mental structure. Von Mises (1949) defines human action as "purposeful behavior", or "the ego's meaningful response to stimuli and to the conditions of its environment" (p. 11). He states that all human action requires some degree of uneasiness as an incentive to reach a more desirable state, as well as an expectation that taking action will alleviate the felt uneasiness. The ultimate end of any human action is always the satisfaction of some desires of the acting person. The distinction between psychology and praxeology is that the latter does not "seek to identify the motivations, thoughts, and ends that give rise to particular purposes and choices" (Selgin, 1988, p. 23), but only asserts that "all acts of choice have meaning to the individual choosers in terms of *some* goal or purpose" (ibid). For the purpose of this thesis, praxeology puts focus on the mandatory coupling of meaning and action, implying that all activities in action-based entrepreneurial education need to have a purpose

[1] John Dewey did not label his approach to learning as "learning by doing", this widespread labeling has been done by interpreters of his work.

meaningful to the learner. According to Kyrö (2008), praxeology also leads to a very different view on learning and education more in line with social constructivism than with the currently prevailing educational paradigms of behaviorism and cognitivism. Kyrö (ibid) states that this implies that a competency based approach is the most appropriate type of structure for action-based entrepreneurial education. This approach has been chosen as a main tenet of this thesis, and I will elaborate on the competency approach further in a separate section.

Another theoretical framework for understanding human activity is activity theory (Jonassen and Rohrer-Murphy, 1999). This theory was pioneered by Russian researchers Vygotsky, Leont'ev and Luria in early 20:th century. In activity theory, human activity is broken down into subject, object and mediating tools. Subjects undertake activities using tools to achieve an objective, which is then transformed into a valuable outcome, see Figure 1. This is done in a socially situated context of rules, community and division of labor (Uden, 2007). In activity theory the learning that occurs when humans act is labeled "internalization" (Arievitch and Haenen, 2005, p.159). The valuable outcome, often termed "artifact creation", is labeled "externalization" (Miettinen, 2001, p.299). Here we view artifacts as anything created by human art and workmanship, in accordance with a definition by Hilpinen (2011). For the purpose of this thesis, activity theory connects human actions both to the learning they trigger and to the valuable artifacts they result in, see Table 3. The learning dimension of activity theory was the original focus of Vygotsky when he proposed a tool-mediated view on learning as a reaction to the predominant acquisition-based model of learning in solitude explored by Piaget and others, where prepackaged knowledge is transmitted to passive recipients (Kozulin, 2003, Kozulin and Presseisen, 1995). The artifact creation dimension was developed much later (See Engeström, 1999).

Activity theory emphasizes change, contradictions and development rather than stability (Haigh, 2007). These contradictions trigger learning and "are the driving force of change and development" (Engeström, 2009, p.55). Activities exploiting such contradictions can be labeled entrepreneurial activities (Murphy et al., 2006), and thus lead both to valuable outcomes and to learning. Further, activity theory and social constructivism are complementary approaches (Holman et al., 1997, Jones and Holt, 2008). According to some scholars, activity theory provides an appropriate framework for analyzing constructivist learning environments (Jonassen and Rohrer-Murphy, 1999, Uden, 2007), making it a theory also appropriate for the study of entrepreneurial education with its theoretical roots in constructivism (Löbler, 2006). Activity theory also has many similarities to Deweyian pragmatism with its focus on human action and interaction (Miettinen, 2001).

In the field of entrepreneurship a few scholars have used activity theory. Jones and Holt (2008) analyzed new venture creation and suggested that activity theory "provides more depth to the analysis of the sense-making activities undertaken by nascent entrepreneurs" (p. 69). In a study on entrepreneurial learning, Taylor and Thorpe (2004) claimed that "activity theory perspectives regard learning as taking place within the relationships or networks in which a person is engaged", and thus complement Kolb's (1984) "fundamentally cognitive theory of experiential learning" (p.203-204). Ardichvili (2003) used activity theory to study an

opportunity identification course, stating that it "makes it possible to overcome the dualism between individuals and their social environment" (p. 8). Deignan (2010) used activity theory to analyze potential tensions between enterprise education and the surrounding university context.

In this thesis, activity theory has served as an inspiration to consider various tools that can mediate entrepreneurial learning, i.e. mental models, tools and rules-of-thumb from the entrepreneurship literature as well as from the entrepreneurial community that learners get familiar with and then apply in their process of entrepreneurial learning-by-doing, ultimately making them develop entrepreneurial competencies.

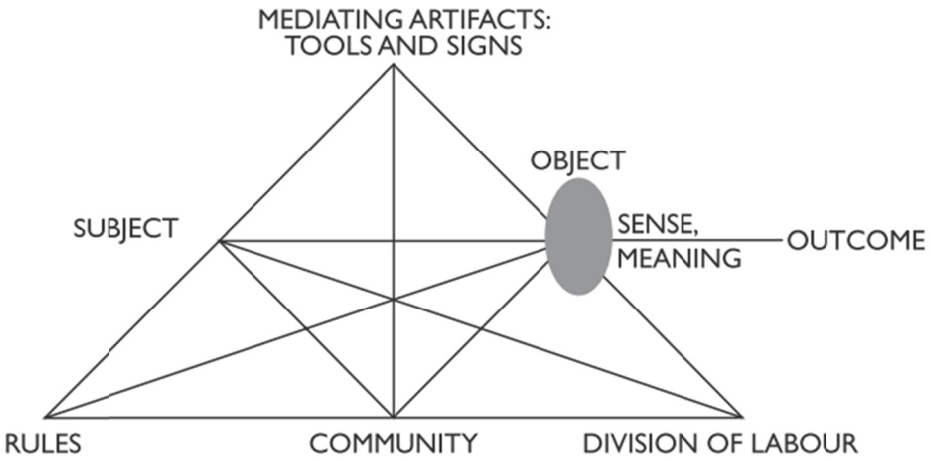


Figure 1. The structure of a human activity system (Engeström, 1987, p.78).

2.2.2 Psychological foundations of action and activity

The will and tendency to take action has been considered one of three faculties of the human mind, where the two other are thought / cognition and emotion (Hilgard, 1980). How these three faculties interplay is the subject of much research in psychology, studying antecedents to action as well as outcomes of action. According to Bandura (1989), people "act on their thoughts and later analyze how well their thoughts have served them in managing events" (ibid, p.1181). But recent research in cognitive neuroscience has shown that the formerly assumed primarily cognition based decision making processes of human action rather are as dependent on emotions as on cognitive thought processes (Lakomski and Evers, 2010). Morris et al (2002) showed in a study on advertisements that emotions even can dominate over thoughts in predicting action. On outcomes of action, Baumeister et al (2007) state that an action or event leads to an emotional reaction that stimulates reflective thought and in turn results in a revised prescription for future actions. Thus, psychology literature suggests that both cognition and emotion play important roles in connection to human action, and must therefore be considered also in action-based entrepreneurial education. The formerly neglected role of emotions has been pointed out by some entrepreneurial education scholars, suggesting that emotional events have "a prominent role to play in how entrepreneurs learn" (Cope, 2003, p.434), and that "the affective construct actually rare in entrepreneurship research, should take

a more explicit place in learning and teaching" (Kyrö, 2008, p.46). Dirkx (2001) states that emotions are key to attributing meaning to our learning experiences, thus making emotions a central part of action-based entrepreneurial education since praxeology links action to meaning. Studying students' experienced emotions has been chosen as a major perspective in this thesis in order to explore motives around entrepreneurial action and their impact on development of entrepreneurial competencies.

Schumpeter has outlined three main motives for entrepreneurial action; the will to found a private kingdom, the will to win and conquer, and the joy of creating (Goss, 2005). In terms of what can motivate students to act creatively, Pekrun's (2006) control-value theory of achievement emotions stipulates that student motivation and enjoyment is enhanced through actions that are perceived as both controllable and valuable. Thus, action-based entrepreneurial education where students get to create a valuable outcome through challenging yet manageable processes can increase students' levels of enjoyment and motivation, factors that are crucial in entrepreneurial education (Hytti et al., 2010).

Table 3. Summarizing key aspects of action and activity based on the tripartite division of mind (Hilgard, 1980)

Part of mind	Some key aspects
Cognitive / Thoughts	• Informs decisions to act and course of action (Bandura, 1989) • Primary focus of education and of learning outcomes assessment (Löbler, 2006) • Primary focus of Kolb's (1984) theory of experiential learning (Taylor and Thorpe, 2004)
Conative / Actions	• Triggers both learning and value creation (Arievitch and Haenen, 2005; Miettinen, 2001) • Triggers emotional reactions and reflective thoughts (Baumeister, 2007) • Leads to the creation of artifacts which in turn spurs motivation and learning (Goss, 2005)
Affective / Emotions	• Informs decisions to act and course of action (Lakomski and Evers, 2010; Morris et al., 2002) • Triggers action through a feeling of uneasiness (von Mises, 1949) • Links action with meaning (Dirkx, 2001) • Neglected in entrepreneurship research, plays a key role in learning (Cope, 2003; Kyrö, 2008)

2.3 Development of entrepreneurial competencies

Competence/y/ies is a set of terms with widespread use in the human resource development domain, where they are used in assessment of people's job performance (Moore et al., 2002). 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" (ibid, p.241). These terms also have regional variations in interpretation, with differences in emphasis between United Kingdom and United States (Mitchelmore and Rowley, 2010). To alleviate the confusion, Moore et al. (2002) have proposed *competence* to relate to an area of work, *competency* to relate to the behaviors supporting that area of work, and *competencies* to relate to the attributes underpinning these behaviors. They also relate behavior to both ability and willingness to act, leaning on Burgoyne (1989) who defines competency as "the willingness and ability to perform a task" (p. 57).

2.3.1 Entrepreneurial competencies

Combining the two terms *entrepreneurial* and *competencies*, we 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) see it as a higher-level characteristic that reflects the "total ability of the entrepreneur to perform a job role successfully" (ibid, p.124). Johannisson (1991) has proposed a framework consisting of five levels of learning; (1) Know-what, or knowledge; (2) Know-when, or insight; (3) Know-who, or social skills; (4) Know-how, or skills; (5) Know-why, or attitudes, values and motives. Based on this framework he calls for more contextual approaches in entrepreneurship teaching, involving qualified experience and social networks through action learning. Another influential scholar is Bird, who (1995) has explored various "laundry lists" of entrepreneurial competencies mainly derived from management theories.

For the purpose of this thesis, a knowledge, skills and attitudes (KSA) based framework for entrepreneurial competencies has been developed, see Table 4. This framework is a developed version of a framework for learning outcomes in entrepreneurship education proposed by Fisher et al. (2008), which in turn leans on a general training evaluation framework proposed by Kraiger et al. (1993) consisting of cognitive, skill-based and affective learning outcomes. Such a KSA approach is in line with the tripartite division of mind outlined earlier in Table 3, and is also in line with the definition of experiential learning outlined earlier (Hoover and Whitehead, 1975, p.25).

Table 4. Entrepreneurial competencies framework.

Main theme	Sub themes
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 (Fisher et al., 2008) • Self-efficacy (Fisher et al., 2008) • Entrepreneurial identity (Krueger, 2005, Krueger, 2007) • Proactiveness (Sánchez, 2011, Murnieks, 2007) • Uncertainty / ambiguity tolerance (Sánchez, 2011, Murnieks, 2007) • Innovativeness (Krueger, 2005, Murnieks, 2007) • Perseverance (Markman et al., 2005, Cotton, 1991)

2.3.2 Measuring entrepreneurial competencies

A specific aspect of a competencies approach 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., 2013). The measurement instruments are often survey-based and try to capture the prevalence of entrepreneurial knowledge, skills and attitudes before and after an educational treatment. This kind of approach has however been heavily criticized by scholars in education. 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). Biesta (2007) states that "education cannot be understood as an intervention or treatment because of the noncausal and normative nature of educational practice and because of the fact that the means and ends in education are internally related." (p. 20). This thesis represents an approach to outcome assessment that differs from these traditional randomized experiment approach, in that it explores what entrepreneurial competency development can be tied to emotionally laden experiences caused by an action-based entrepreneurial education program. Such an approach can lead to measuring the prevalence of emotional events as a valid proxy for developed entrepreneurial competencies, instead of trying to measure the competencies themselves, which has shown to be both subjective and questionable.

2.3.3 Developing entrepreneurial competencies through education

The ultimate goal of all entrepreneurial education is to develop entrepreneurial competencies among students / learners. Various initiatives have varying emphasis on knowledge, skills and attitudes respectively. There is also a variety in focus of initiatives in terms of educating about, for or through entrepreneurship as outlined previously. Many initiatives apply a narrow definition of entrepreneurship (QAA, 2012, Mahieu, 2006, Fayolle and Gailly, 2008) focusing primarily on opportunity identification, business development, self-employment, venture creation and growth, i.e. learning about or for becoming *an entrepreneur*. Fewer initiatives apply a broader definition focusing on personal development, creativity, self reliance, initiative taking, action orientation, i.e. becoming *entrepreneurial*. What definition and approach is used profoundly affects educational objectives, target audiences, course content design, teaching methods and student assessment procedures, leading to a wide diversity of approaches (Mwasalwiba, 2010). Nevertheless, many scholars state that there is only one way to learn to become entrepreneurial, and that is by learning through own experience. Cope leans on a variety of scholars (Minniti and Bygrave, 2001, Dalley and Hamilton, 2000, Young and Sexton, 1997, Gibb, 1997) when stating that there seem to be no shortcuts, it "can only be acquired through learning-by-doing or direct observation" (Cope, 2005, p.381). This is also the position adopted by this thesis, impacting study design and empirical data collection, focusing on environments that apply action-based approaches.

Research on what to let students do more explicitly in action-based entrepreneurial education is in a very early stage. Entrepreneurial education literature is full of "laundry lists" of action-based activities, but very few theorize or conceptualize beyond the division of activities into

about / for / through, or beyond dividing learning environment features into traditional or entrepreneurial as outlined previously, leaving educators wanting to adopt action-based approaches with primarily anecdotal information and general recommendations. Literature on entrepreneurial education is replete with single case studies outlining what one particular team of educators did and how it worked for them, but without a deeper decontextualization, categorization or contrasting to other relevant educational environments within or outside the entrepreneurial domain. One exception is found in a study by Pittaway and Cope (2007b), who propose that 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. Their recommendation is adopted by this thesis, exploring what emotional events lead to development of entrepreneurial competencies, and also exploring what could trigger these emotional events.

2.4 A theoretical framework for "learning-by-doing"

Given that learning-by-doing is so central to explaining how entrepreneurial competencies are developed, I will now outline a theoretical framework for learning-by-doing based on activity theory, see Figure 2. It will be used to point out some aspects of developing entrepreneurial competencies central to this thesis.

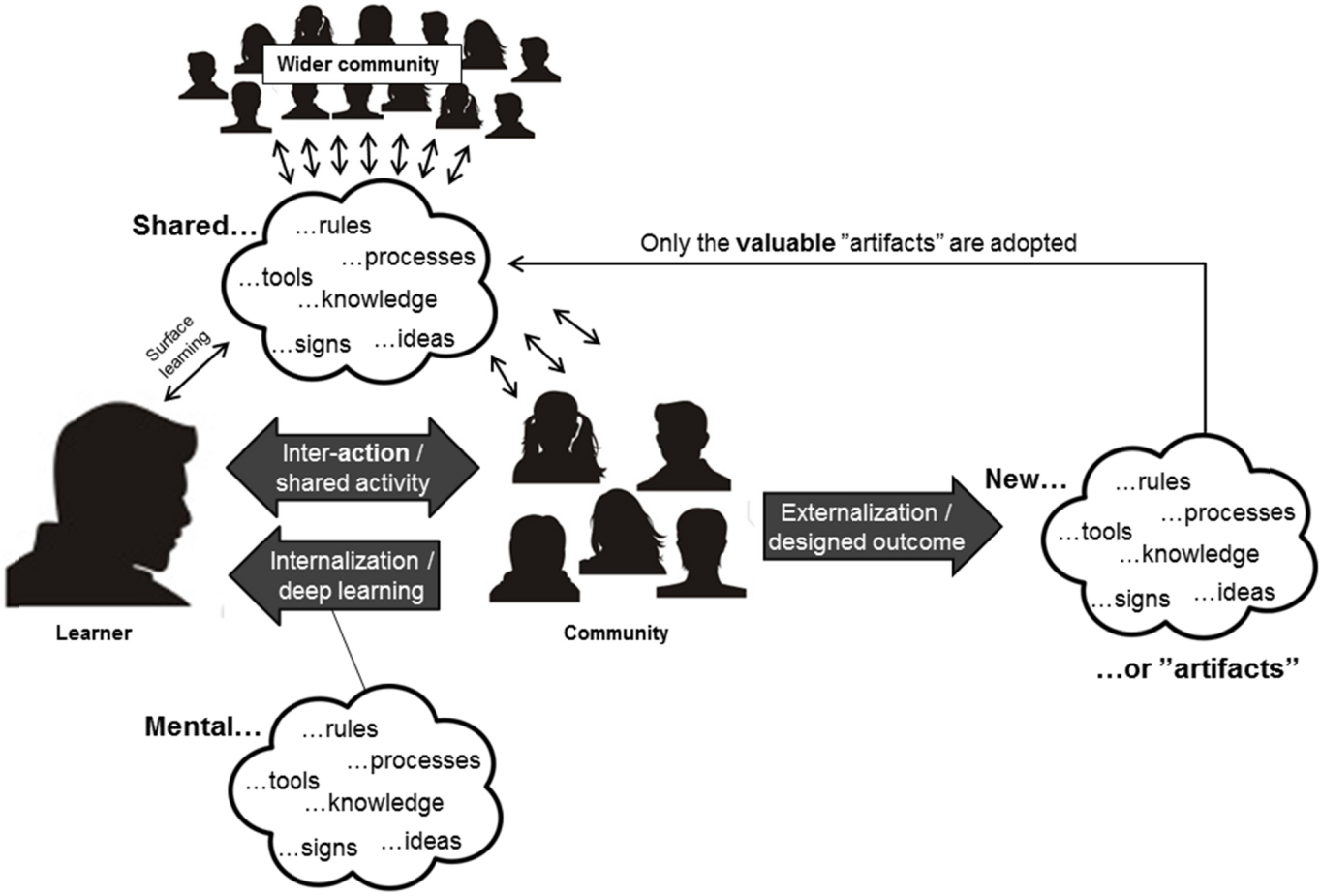


Figure 2. A theoretical framework for learning-by-doing based on activity theory.

Vygotsky has stated that all learning originates from social interaction (Vygotsky, 1978). According to activity theory, social interaction can be interpreted as the interaction between subject and object, see Figure 1. In learning-by-doing the subject is the learner taking action together with objects consisting of other humans, see Figure 2. This interaction is based on a shared set of mediating "artifacts", such as shared tools, rules, processes, knowledge, signs, ideas etcetera. The term "artifact" can be broadly defined as anything created by human art and workmanship (Hilpinen, 2011). Therefore, for the purpose of simplifying this framework, in the term "artifacts" I also include the community within which action takes place, its rules and its processes for division of labor as stipulated by activity theory, see Figure 1. Further, according to Vygotsky, shared human activity leads to meaningful outcomes, i.e. "externalization of activity into artifacts" (Miettinen, 2001, p.299). Creation of new artifacts is thus a natural outcome of human activity. In line with previously used definition of artifacts, this too can consist of tools, rules, processes, knowledge, signs and ideas etcetera. Finally, according to Vygotsky, human interaction also leads to construction of new mental abilities, defined as a learning process of "internalization of activity and gradual formation of mental actions" (Arievitch and Haenen, 2005, p.159). This too can be described as a process resulting in construction of mental tools, rules, processes, knowledge, signs and ideas, for future use in new activity. Also illustrated in Figure 2 are the concepts of surface and deep learning. Surface learning has been defined as memorization and acquisition of facts, whereas deep learning has been defined as abstraction of meaning and a process of interpreting experience (Jarvis, 2006).

Given that motivation, meaning and engagement are key factors in entrepreneurial education (Hytti et al., 2010, Kyrö, 2008, Surlemont, 2007, Deuchar, 2007), I will now point out three such aspects / processes of learning-by-doing visible in this framework. The first aspect is the process of (inter-)action, which according to praxeology is always connected to meaning. The second aspect is the process of internalization triggering deep learning. Deep learning is by definition meaningful to learners, which leads to increased motivation. This cannot always be said about surface learning approaches common in education also positioned in the framework. The third aspect triggering motivation is the process of producing valuable outcomes in terms of new artifacts generated through shared activity. Drawing on Pekrun's (2006) control-value theory outlined previously, these artifacts can lead to varying levels of motivation depending on to what extent they are being perceived as valuable to the creators and to external stakeholders in a wider community. In essence, learning-by-doing can be regarded as an emotional and motivation laden process, where motivational levels depend on (1) what actions are taken, (2) what learning occurs and (3) what value is created. I further hypothesize based on this theoretical framework for learning-by-doing that these three processes of motivational triggering can reinforce each other in certain circumstances, such as when the value creation process resonates with certain deep values, goals and beliefs held by the learner. An example is the process of becoming entrepreneurial studied by Williams Middleton (2013) in a venture creation program setting, where students assumed an entrepreneurial identity through social interaction with a community, acting "as if" they were already entrepreneurs and assigning meaning to themselves through the use of storytelling towards key internal and external stakeholders.

2.4.1 Connecting learning-by-doing to wide definitions of being entrepreneurial

This framework for learning-by-doing also allows us to connect wide definitions of being entrepreneurial to the process of learning-by-doing. Mahieu (2006) has described the entrepreneurial culture promoted by OECD since 1989 as consisting of qualities such as habits of "learning, curiosity, creativity, initiative, teamwork and personal responsibility" (ibid, p.63). I will now connect these habits to the framework outlined here. A learning-by-doing approach as framed above fosters habits of learning by default through its deep learning component. It also promotes initiative and responsibility, since it encourages people to take initiative to inter-*action* of the kind that leads to meaningful outcomes, sometimes even valuable to a wider community (i.e. taking responsibility). It is inherently teamwork based, and if the outcome is both novel and valuable to others it also fulfills what commonly is defined as creativity (Amabile and Khaire, 2008). From this I theoretically infer that learning-by-doing is a central approach to making people more entrepreneurial. The remainder of this thesis discusses if and how it can also be validated empirically.

2.4.2 An example: Galperin's framework for action-based teaching

An exception to the lack of robust advice for teachers in the domain of learning-by-doing is the "systemic-theoretical instruction" approach proposed by Piotr Galperin (Haenen, 1996), based on primarily activity theory and decades of research resulting in over 800 works (Arievitch and Haenen, 2005). The six-stage teaching approach contains the following steps (ibid, p.131):

1. **Motivational stage** – actions to be learned introduced, connected to relevant goals.
2. **Orienting stage** – a "cheat schema" outlining a complete framework for actions.
3. **Material stage** – learning by taking action in actual practice or through simulation.
4. **Overt speech stage** – Transferring actions taken into oral speech, linking action with thought and facilitating generalizing in a social setting of "communicated thinking".
5. **Covert speech stage** – Inner dialog reflecting on previous stages "in the head".
6. **Mental stage** – The action takes place in abbreviated form, has been transformed into a partly subconscious scheme or mental phenomenon, as a cognitive tool being "kept in mind".

This approach resonates with many teaching practices advocated in the domain of entrepreneurial education. It is also more explicit than many situated learning theories in its emphasis on cognitive tools such as "cheat sheets", in its emphasis on social and verbal interpretation of actions taken and in its final stages where internalization of actions into mental thought occurs. Rambusch (2006) considers Galperin's theory to be "a necessary and long missing link between sociocultural learning theories and traditional, more cognitivist approaches to learning." (ibid, p. 1998). I posit that Galperin's approach constitutes a rare and robust framework for action-based entrepreneurial education.

3 Methodology

Due to the perceived lack of systematic exploration into action-based entrepreneurial education, a qualitative and explorative multiple case-study approach was used (Yin, 2008), aligning with methodological recommendations (Edmondson et al., 2007). Two major methodological phases can be distinguished in this thesis. The first phase consisted in identifying a suitable empirical setting where action-based entrepreneurial education could be studied in detail. In this first phase, entrepreneurial education programs were chosen as the unit of analysis, aiming to qualify a small selection of programs relevant and worthwhile in terms of strong action orientation and consistent as well as significant development of entrepreneurial competencies. The second phase was conducted with individual students from one of these programs as the chosen unit of analysis, aiming at understanding their process of developing entrepreneurial competencies.

3.1 Phase 1: Qualifying the empirical environment: Venture creation programs

Employing an appropriate sampling strategy is key to any research design. The strategy applied in this thesis has been the extreme case sampling strategy (Flick, 2009, p.122), a strategy often applied when a certain phenomenon is rare enough to merit single case study research designs (Yin, 2009, p.47). Aiming to identify the extreme cases to study in this phase, a selection process was initiated by specifying an initial definition of a particularly action-oriented approach to entrepreneurial education. The most action-based approach to entrepreneurial education conceivable at the outset of this study was to study when students are required to create a real-life venture, a process that arguably requires more than a single course, i.e. focusing on entrepreneurial education *programs* rather than *courses*. The conception of a Venture Creation Program (VCP) was developed, allowing for a purposeful sample. The preliminary definition used for sampling purposes was:

> *Entrepreneurship or business educations at a higher education level with the on-going creation of a real-life venture as their primary learning vessel and thus part of formal curriculum, with intention to incorporate or in some other way indicate future operative status*

This resulted in a mere 18 VCPs having been identified so far, and more VCPs being discovered occasionally. The initial population was analyzed through email/telephone contact to determine a refined VCP population. Ten of these programs were then studied using ten sensitizing concepts developed by reviewing literature on VCPs. Key individuals at these programs were selected for interviews, which were recorded and transcribed. Documentation and public data found online or provided by the interviewees was used to supplement the interview data. A two-day focus-group of program directors/key colleagues was also held with 14 of the identified 18 programs in June 2012 (in Gothenburg, Sweden), providing additional in-depth data. Presentations were video recorded and participants produced written material during the meeting on key themes identified through the initial interviews, including: program objectives, background, key partners, achievements, challenges and funding. Written participant feedback from the meeting confirmed "venture creation programs" as a productive and surprisingly unusual common denominator.

This phase resulted in three conference papers, one of which was decided to be submitted for publication and is included in this thesis (appended paper 2). A general methodological outcome of this phase was that the empirical setting of Chalmers School of Entrepreneurship at Chalmers University of Technology (Gothenburg, Sweden) can be regarded as one of the most mature and comprehensive VCPs out of the 18 identified, thus justifying a single case study approach as employed in phase two of this thesis. The first phase thus qualified Chalmers School of Entrepreneurship as a "paradigmatic case", i.e. a case with metaphorical and prototypical value deemed to be central for human learning (Flyvbjerg, 2006, p.232):

> *No standard exists for the paradigmatic case because it sets the standard. Hubert Dreyfus and Stuart Dreyfus (1987) saw paradigmatic cases and case studies as central to human learning. In an interview with Hubert Dreyfus, I therefore asked what constitutes a paradigmatic case and how it can be identified. Dreyfus replied: "Heidegger says, you recognize a paradigm case because it shines, but I'm afraid that is not much help. You just have to be intuitive. We all can tell what is a better or worse case—of a Cézanne painting, for instance. But I can't think there could be any rules for deciding what makes Cézanne a paradigmatic modern painter. . . . In fact, nobody really can justify what their intuition is." "*

The Chalmers School of Entrepreneurship case has attracted significant interest previously among researchers and policymakers outside Gothenburg (See for example Berggren, 2011, Lindholm Dahlstrand and Berggren, 2010, Hofer et al., 2010, European Commission, 2012a, Rasmussen and Sørheim, 2006). Public data has also shown that it is the most effective university incubator in Sweden (Lundqvist, in press), having generated 27% of all revenue in 2010 among ventures started at 17 Swedish university incubators 1995-2005. These figures support the methodological choice of focusing on this case in the second phase of this study.

From a methodological standpoint it can be questionable when a researcher opts for studying the entrepreneurship program that he or she is deeply involved in, as is the case in phase two of this thesis. It is common in entrepreneurial education research that scholars apply a convenience based sampling strategy, studying their own environment. For these reasons the resource intensive first phase outlined above, resulting in qualifying Chalmers School of Entrepreneurship as a relevant object of study, is of particular importance in this thesis. Building on this, I posit that the three years spent getting to know the 18 identified VCPs worldwide were well spent, establishing the trustworthiness and wider relevancy of the next phase in this study outlined below. It has also been concluded (see paper 2) that VCPs in general, and Chalmers School of Entrepreneurship in particular, provide unique access to nascent stages of entrepreneurial processes, allowing for observation of entrepreneurial competence development as it is taking place, instead of through hindsight. This constitutes a rare "clinical" laboratory environment (Schein, 1993) of high relevancy in research on entrepreneurial competence development primarily, but also on related issues such as technology transfer, general entrepreneurship issues and general education / learning issues.

3.2 Phase 2: Exploring entrepreneurial competency development

In this still on-going phase, a longitudinal design has been applied, following 13 students since September 2012 and ongoing. These students are all following the action-based master

program at Chalmers School of Entrepreneurship, Chalmers University of Technology, Sweden. 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 applies and defines the "venture creation approach" outlined by Ollila and Williams Middleton (2011) and described previously in this thesis.

11 out of the 13 students in this study work with intellectual property developed by university researchers, corporate researchers or individual inventors outside university, aiming to commercialize it through starting a venture. The remaining two students follow a sister program studying early-stage commercialization but with a project work rather than venture creation based approach. Five of the students were included in the study when they initiated their second year of the master program, and eight of the students have been followed from the start of the two-year master program.

A mixed-methods approach has been applied, using both quantitative and qualitative research methods. A quantitative approach has been developed to capture emotions as they occur through a mobile survey in an experience sampling method (ESM) approach (Morris et al., 2012, p.266), and a qualitative approach has been used to reveal underlying mechanisms through semi-structured interviews, primarily searching for connections between strong emotions and learning outcomes.

3.2.1 Quantitative approach: mobile survey engine

In the quantitative part of this phase, students are equipped with a mobile app in their smartphones connected to a mobile survey engine, and are 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 (Russell, 1980, Posner et al., 2005), i.e. to rate valence and activation for each event deemed worthy of registering. They are asked to quantitatively rate the following two questions from 1-7 in a likert scale manner each time they make 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)". The students are also encouraged to write a sentence or two on why they feel like they do in each app report produced.

The mobile app also contains a possibility to report critical learning events, since this kind of events constitutes an important source of both emotions and learning according to Pittaway and Cope (2007b) as outlined in the theory section. The app probes for six different kinds of critical learning events. These critical learning event reports are also coupled with an opportunity for the students to write a sentence or two about the reason for the critical learning event occurring.

3.2.2 Qualitative approach: Semi-structured interviews

The app-based measurements are followed up with quarterly individual interviews aiming to uncover links between strong emotions and resulting entrepreneurial learning outcomes. A semi-structured approach has been applied, using an interview template with themes covering learning and themes covering emotions. In addition to the semi-structured parts, each interview

also includes 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 are recorded and some of them have been transcribed verbatim. To date 40 interviews have been conducted, and an additional 24 interviews are planned in the year to come.

3.2.3 Data analysis: Coding procedure

All data collected in this second phase will be 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. So far six interviews have been coded, resulting in appended paper 3 on links between strong emotions and developed entrepreneurial competencies. Each framework consists of 9 and 15 sub-themes respectively. The coding framework for sources of emotions is based on an article by Arpiainen et al. (2013), where the author of this thesis is a co-author (an article not appended to this thesis). This article outlines main sources of strong emotions in two entrepreneurship education programs in Finland and Namibia and one entrepreneurship education course in Estonia, see Table 5. The coding framework for entrepreneurial learning outcomes is based on the entrepreneurial competencies framework outlined in the theory section, see Table 4, and has been further developed for the purpose of this study, see Table 6, which also constitutes the operationalization part of the answer to RQ 1 of this thesis – "how can entrepreneurial competencies be operationalized and measured?".

During the coding process more codes are added when the coding frameworks do 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 are coded, a coding matrix is produced using functionality for this in the NVIVO software package. In the third appended paper this matrix has tentatively been used to identify salient connections between emotions and learning outcomes in the data. Although it is based on transcribed interviews with only three out of the 13 respondents in this study, interesting links between emotions and learning outcomes have already surfaced, outlined in Figure 3 and explained in detail in the appended paper. This is methodologically promising.

Table 5. 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 6. Elaborated framework for entrepreneurial competencies used as coding framework in NVIVO.

Main theme	Sub themes	Primary source	My interpretation when coding data
Knowledge	Mental models	(Kraiger et al., 1993)	How to get things done without resources, risk and probability models.
	Declarative knowledge	(Kraiger et al., 1993)	Basics of accounting, finance, technology, marketing, risk
	Self-insight	(Kraiger et al., 1993)	Knowledge of personal fit with entrepreneurship career
Skills	Marketing skills	(Fisher et al., 2008)	Conducting market research, assessing the marketplace, Marketing products and services, Persuasion, getting people excited about your ideas, Dealing with customers, Communicating a vision
	Opportunity skills	(Fisher et al., 2008)	Recognizing and acting on business opportunities, Product development skills
	Resource skills	(Fisher et al., 2008)	Creating a business plan, including a financial plan, Obtaining financing
	Interpersonal skills	(Fisher et al., 2008)	Leadership, motivating others, Managing people, Listening, Resolving conflict
	Learning skills	(Fisher et al., 2008)	Active learning, Adapting to new situations, coping with uncertainty
	Strategic skills	(Fisher et al., 2008)	Setting priorities (goal setting) and focusing on goals, Defining a vision, Developing a strategy, Identifying strategic partners, Risk management
Attitudes	Entrepreneurial passion	(Fisher et al., 2008)	”I want”. Need for achievement
	Self-efficacy	(Fisher et al., 2008)	”I can”
	Entrepreneurial identity	(Krueger, 2005, Krueger, 2007)	”I am / I value”. Deep beliefs, role identity, values, axiology
	Proactiveness	(Sánchez, 2011, Murnieks, 2007)	”I do”. Action-oriented, initiator, proactive
	Uncertainty / ambiguity tolerance	(Sánchez, 2011, Murnieks, 2007)	”I dare”. Comfortable with uncertainty and ambiguity, adaptable, open to surprises,
	Innovativeness	(Krueger, 2005, Murnieks, 2007)	”I create”. Novel thoughts / actions, unpredictable, radical change, innovative, visionary, creative, rule breaker
	Perseverance	(Markman et al., 2005, Cotton, 1991)	”I overcome”.

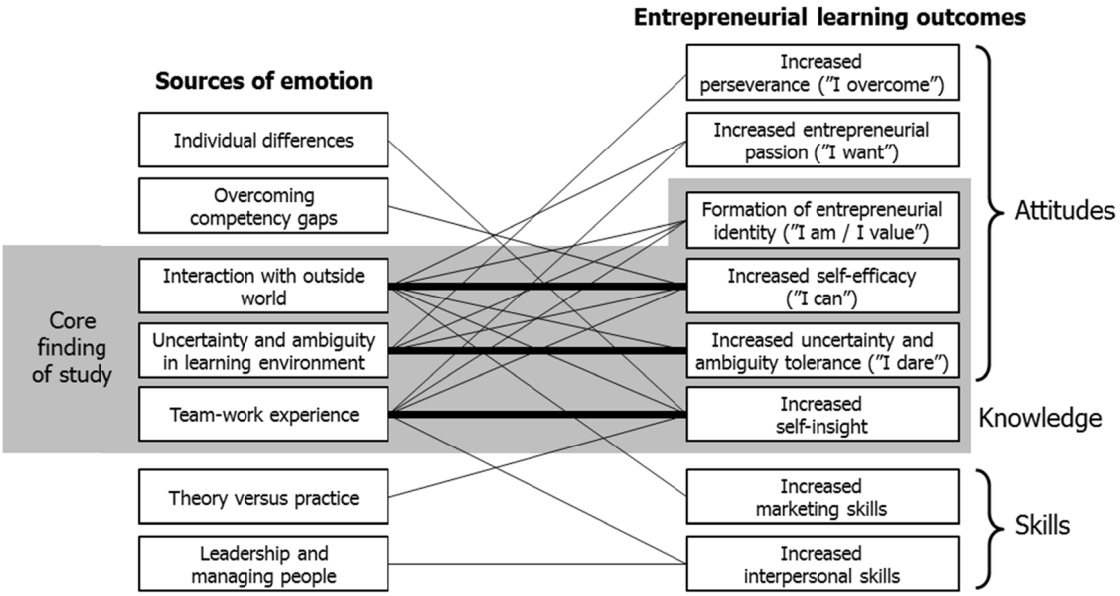


Figure 3. Links between emotions and learning outcomes based on coding matrix.

4 Summary of appended papers

No	Paper	Authors	Status	Subject / relevance	Method	My role
1	How can Entrepreneurship bridge between Traditional and Progressive Education?	Lackéus, M., Lundqvist, M., Williams Middleton, K.,	Presented at ECSB 3E, 2013	Develops main theoretical conceptions used in this thesis. Outlines a tools approach that was a precursor to the activity classification outlined in this thesis kappa. Thereby indirectly addresses RQ2 and RQ3.	Conceptual paper	First author, presen-tor.
2	Venture Creation Programs – bridging Entrepreneurship Education and Technology Transfer	Lackéus, M., Williams Middleton, K.	Accepted for publi-cation in Education + Training.	Outlines empirical setting. Explores venture creation programs as an instance of action-based entrepreneurial education. Uncovers what activities contribute to development of entrepreneurial competencies, thus addressing primarily RQ2	Empirical research paper. Multiple case study design.	Equal author.
3	Links between Emotions and Learning Outcomes in Entrepreneurial Education	Lackéus, M.	Presented at NFF 2013.	First test of developed methodology in second phase of this study. Uncovers how activities develop entrepreneurial competencies, thus addressing primarily RQ1 and RQ3.	Empirical research paper. Multiple case study design.	Sole contri-butor and presen-tor.

4.1 "How can Entrepreneurship bridge between Traditional and Progressive Education?"

In this paper we argue that the "fault line" between traditional and progressive education starts in the domain of philosophy of science, passing through general educational philosophy and its century-long battle for control over instructional design practices, and ends up in the entrepreneurial education domain. This paper then asks the question: How can entrepreneurship contribute with cognitive tools that bridge between traditionalist and progressivist educational perspectives? Cognitive tools are defined by Egan (2008) as "the things people think with, not the things they think about".

The analysis has yielded five dualisms that are described more in-depth. Attempting to bridge and balance between these dualisms we end up with five resulting questions: How can entrepreneurship contribute with cognitive tools that…

- ….simplify a complex, multidisciplinary and holistic constructivist learning environment?
- ….preserve the concrete and individual aspects in a social learning environment?
- ….inject more content and linearity into an iterative learning process?
- ….facilitate detached reflection in an emotional and action-oriented learning environment?
- ….absorb more theoretical knowledge into an experiential learning environment?

These five resulting questions are tested on two candidates for cognitive tools that can mediate learning; value creation and entrepreneurship as a method. Both of these candidates seem to be quite constructive means to balance between traditional and progressive education. For researchers this opens up for new opportunities to consider entrepreneurship theory and practice as pedagogical cognitive tools in general education. For practitioners this can serve as inspiration for trying out some of the vast array of tools, models and concepts from the entrepreneurship domain in general education. Further inquiry into the entrepreneurship domain can surface more cognitive tools of potential use.

Research that leverages profoundly on theory from both entrepreneurship and education is scarce. This specific attempt has potential to lead to a flexible yet criteria based "third way" between the rigidity of traditional education and the vagueness of progressivism. It also holds potential to bridge the gap between advocated and applied pedagogy in the field of education, where desired pedagogical approaches often are not used in practice due to the higher cost of such approaches and their misalignment to the conventional educational systems and paradigms.

4.2 "Venture Creation Programs – bridging Entrepreneurship Education and Technology Transfer"

The article explores how university-based entrepreneurship programs, incorporating real-life venture creation into educational design and delivery, can bridge the gap between entrepreneurship education and technology transfer within the university environment. Based on a literature review and snowball sampling over a two-year period, 18 entrepreneurship education programs were identified as applying a venture creation approach. Ten of these programs were selected for case study, including interviews and participatory observation during a two-day workshop. Empirical findings were iteratively related to theory within entrepreneurship education and technology transfer.

The article identifies the bridging capabilities of venture creation programs (VCPs) across five core themes, illustrating the potential benefits of closer collaboration between entrepreneurship education and technology transfer in a university environment. A definition for 'venture creation program' is tested empirically. These programs are shown to be sophisticated laboratory environments, allowing for clinical research towards the understanding of entrepreneurship and technology transfer processes. Findings identify practical benefits of combining entrepreneurship educators and technology transfer activities, such as increased value creation through not only new firms, but also an entrepreneurially equipped graduate population. VCPs allow for 'spin-through' of innovative ideas in the university environment, while simultaneously contributing to entrepreneurial learning.

This article presents findings from the first multiple case study into entrepreneurship educations specifically designed to develop real-life venture as part of the core curriculum. Findings provide basis for investigating the value of integrating entrepreneurship education and technology transfer at the university.

4.3 "Links between Emotions and Learning Outcomes in Entrepreneurial Education"

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. 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 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. 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. 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.

5 Towards a classification of action-based entrepreneurial education

Some common purposes of classifications are to improve the actions of practitioners (Lamp, 2011), to reduce cognitive load on individuals by removing differentiation that is irrelevant for the purpose (Jacob, 2004), and to establish stable and meaningful relations between classes (ibid). In this thesis, a proposed classification of approaches to action-based entrepreneurial education represents an answer to RQ2, in that it outlines four different classes of activity that can develop entrepreneurial competencies in entrepreneurial education, see Figure 4. This classification scheme can also be regarded as a tool for distinguishing between different activities in terms of degree of motivation for the learner as well as in terms of complexity for the teacher. This can help scaffolding educators' judgment of which class of activity to opt for in any given teaching situation depending on purpose, ability, resource access, interest and context. In this classification I posit that the further you get into the classification questionnaire (further down in Figure 4), the higher the potential student motivation and engagement, but unfortunately also the higher the teaching complexity.

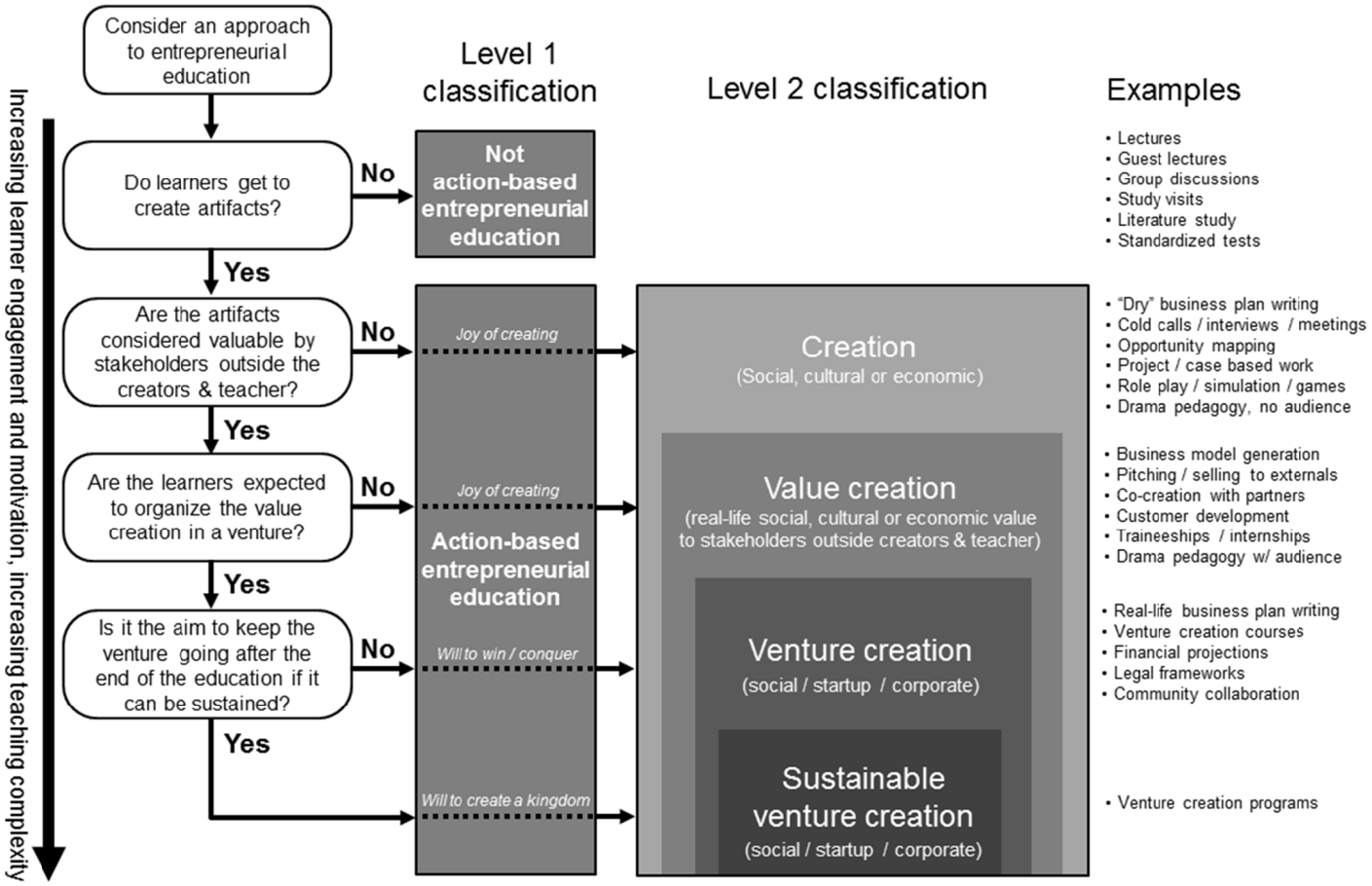


Figure 4. Classification of action-based entrepreneurial education in two levels.

This attempt to classify action-based entrepreneurial education activities is based on extensive study of venture creation programs, an educational format containing most of the example activities outlined in Figure 4. It is thus a classification that draws on all three appended papers as well as the empirical and theoretical perspectives outlined there. Although this study could

be argued to be well positioned to outline a classification of this kind, it remains to evaluate its usefulness and validity among practitioners and scholars. Below the different classes are outlined and connected to the appended papers.

5.1 The creation approach - defining action-based entrepreneurial education

The first level classification is an attempt to determine if any given approach to entrepreneurial education should be classified as action-based or not. Building on the previously outlined theoretical framework for learning-by-doing (see Figure 2), the creation of new human artifacts has been chosen as the differentiating factor in this classification scheme. As activity is always coupled with meaning, and frequently also with an outcome meaningful to the creator(s), this gives action-based approaches an inherently higher level of meaning and consequently motivation to the learner than non action-based approaches. This aligns with one of Schumpeter's three basic motives for entrepreneurial action – the joy of creating (Goss, 2005). Indeed, in the third paper appended to this thesis (see p.13 and 15), the joy of creating is vividly described by some respondents. This classification level thus results in a proposed definition for action-based entrepreneurial education; educational approaches where the learners get to create new artifacts through activity. As stated before, "artifact" can in turn be defined as anything created by human art and workmanship (Hilpinen, 2011).

Some examples of activities in a creation approach include opportunity mapping, project work in teams, case based teaching, role play, drama / film pedagogy without external audience, simulations, games, interviews / meetings with external stakeholders and business plan creation without external stakeholders involved. Some examples that are not regarded to be action-based approaches are lectures, guest lectures, group or class discussions, study visits, literature study and standardized tests.

5.2 The value creation approach

The first of three questions in the second level classification captures those approaches where the newly created artifacts are considered valuable by stakeholders outside the creators, i.e. people apart from the learners and the teacher. Here, the teacher is included as one of the creators, for two reasons. The first reason is to acknowledge that it is an educational activity triggering the creation of artifacts, orchestrated and thus co-created by a teacher. The second reason is that such a distinction excludes all activities where artifacts are created solely to please the teacher – a traditional model in education but one that arguably does not create as high levels of motivation and meaning for the learners as if their work is appreciated by "real world" stakeholders. Indeed, in the third appended paper (see p.13 and 15) respondents emphasize "making others think it is interesting" and "that [external] people trust you" as being a source of high levels of motivation. In Schumpeterian terms (Goss, 2005), a value creation approach could also be attributed primarily to the joy of creating, but on a higher level of meaningfulness. Also in the second appended paper the centrality of creating value to external stakeholders is identified as a key characteristic of VCPs (see table 4 in appended paper no 2).

Some examples of activities in a value creation approach include business model canvas generation (Osterwalder, 2004), pitching an idea to external stakeholders, co-creation with partners, traineeships / internships, drama / film pedagogy involving an external audience and customer development methodology (Blank, 2005).

5.3 The venture creation approach

The second question in level two classification captures approaches where learners are expected to organize the value creation activities into a social, corporate or start-up venture. As an example, Neck and Greene (2011) outline a real-world venture creation course at Babson College consisting of a "limited duration business start-up" (p.63), stating that such approaches are becoming more commonplace at business schools. A similar approach in secondary level education is Young Enterprise, where pupils create a company that runs for eight months, "after which it will go into voluntary liquidation." (Dwerryhouse, 2001, p.155). Integral to venture creation approaches are activities such as business planning, financial accounting, market analysis, marketing and human resource planning (ibid). Another approach that fits into this class is the "venture creation approach" presented in the theory section (2011). In this classification I would however put such an approach primarily in the next class of sustainable venture creation, see below.

In entrepreneurial education a focus on creating a business plan is a very common focus (Honig, 2004). All to often however, "most if not all business plans fail upon first contact with the assumed customers" (Jones and Penaluna, 2013). Most business plan courses consist primarily of desk-based guesswork (ibid), and are thus more in line with a creation approach than with a venture creation approach, since such work does not create value to external stakeholders. Instead the business plan becomes primarily a deliverable to the teacher.

In appended paper two, a respondent points out that it is the iterative doing around the business plan that is important (see page 9 of appended paper no 2). I posit that it is this very process of iteration with external stakeholders that creates the high levels of commitment and emotional ownership among learners possible to reach at this level of action-based entrepreneurial education and reported in the second appended paper. One reason that the doing around a business plan often is neglected is that it involves a relatively high degree of complexity compared to just producing a plain desk based business plan. This complexity has however quite recently been alleviated through some new practice-oriented tools, such as Customer Development (Blank, 2005), Business Model Generation (Osterwalder, 2004) and Lean Startup (Ries, 2010), tools that in this thesis are classified as value creation tools, i.e. as precursors to venture creation. From a Schumpeterian point of view, the venture creation approach can activate two of the three main motives for entrepreneurial action – both the joy of creating and the will to conquer and win (Goss, 2005), since a venture can be regarded as a vehicle for competing on a market rather than just creating one-off value for any random external person or organization.

To conclude this class, some examples of activities in a venture creation approach include business plan writing involving external stakeholders, the young enterprise approach

(Dwerryhouse, 2001), venture creation courses, entrepreneurial community collaboration (competitions, incubators, student clubs etc.), financial projections for a venture and applications of legal frameworks for venture creation.

5.4 The sustainable venture creation approach

A marginal but for this thesis relevant approach is the sustainable venture creation approach. It could be argued if the value of such a class merits its own class in this classification, but in the early stage of this study it was evident that many VCPs illustrated a magnitude of real-life content that very few entrepreneurial education programs have. In the second appended article the moment is described when students reach a "tipping point" (see p. 10), which is when students realize that the venture they are working on might actually become a real company. This transforms the venture from being a school project to feeling real. This moment has shown to have a dramatic positive impact on learners' motivation, engagement and effort. In the definition of a VCP this was captured through the phrase "with an intention to incorporate". Many examined potential VCPs were excluded based on this part of the definition of a VCP. I posit that real-life venture creation intention is crucial in spurring a particularly high level of motivation and engagement among learners. However, it also represents a teachability challenge in that it induces a wide variety of complexity and challenges that for many educational institutions are currently impossible to manage for legal or other reasons. This could contribute to explaining the scarcity of VCPs. From a Schumpeterian point of view the sustainable venture creation approach opens up for the third of the motives for entrepreneurial action, i.e. the will to create a kingdom. This aspect is touched upon in the third appended paper (see p.13), when students claim to be able to "take over the world".

There are very few examples of a sustainable venture creation approach. This study has revealed 18 programs worldwide that exemplify this approach to a varying extent. Ten of them are described in the second appended paper (see for example table 2 in paper two). The approach has also previously been outlined by Ollila and Williams Middleton (2011), but without the prefix "sustainable".

6 Discussion

It is no easy feat to linearly present a thesis resulting from an iterative process of systematic combining and matching between theory and empirical phenomena (Dubois and Gadde, 2002) as is the case here. The frameworks and propositions outlined in this thesis have not emerged through pure induction, nor through pure deduction, which poses challenges both in presenting the evidence base and in outlining a repeatable process for replicating the results. They have rather evolved following several years of in-depth immersion into action-based entrepreneurial education, where the author has assumed different roles, such as entrepreneurial education student (2000-2001), nascent entrepreneur (2001-2003), successful entrepreneur (2004-2008) and finally the role of nascent researcher (2009-2013). Still, this discussion will be presented in a semi-linear way partly constructed for the purpose of this thesis, to facilitate external evaluation of propositions made, see Table 7.

Table 7. Main propositions of this thesis and their connection to purpose, research questions and appended papers.

Proposition	How general understanding of development of entrepreneurial competencies could be increased	How it addresses the three research questions RQ1-3	Appended papers covering this proposition
P1: Entrepreneurial competencies can be operationalized through a tripartite framework (see Table 1, Table 4 and Table 6)	• Widens the scope of entrepreneurial competencies to include all three faculties of the human mind, in contrast to the traditionally cognitively biased perspective	• A direct response to RQ1 • Helps responding RQ2 and RQ3 by specifying the desirable outcome	The methodological foundation of paper 3. Was developed through the study reported in paper 2.
P2: Action-based entrepreneurial education can be classified into four classes (see Figure 4)	• Could help teachers comparing different pedagogical approaches • Could help researchers focus on more relevant aspects	• A direct response to RQ2. • Helps responding RQ3 by specifying classes of activities that trigger emotional events.	All three papers are precursors to this classification, covering different classes.
P3: There is a causal relationship between actions, triggered emotions and developed entrepreneurial competencies (see Figure 5)	• Emotional events can be regarded as a proxy between action-based activities and developed entrepreneurial competencies • Studying links between emotional events and learning can open up the "black box" of entrepreneurial learning	• A direct response to RQ3. • Was uncovered through the response to RQ1 given in the methodological development phase	The primary focus of paper 3.
P4: Assessing / evaluating entrepreneurial education can be done indirectly by measuring emotional events (see Table 2, Table 8 and Table 9)	• An event-based view on developing and assessing entrepreneurial competencies can evolve, which could be a more productive basis for further research as well as for practice (see Table 8)	• A consequence of the response to RQ3 given by P3.	Mentioned in paper 3 as a future possibility.
P5: An "actionable knowledge" approach can bridge traditional and progressive education (see Figure 6)	• Puts the development of entrepreneurial competencies into a wider context of general education.	• One of a few responses to RQ2 and RQ3, and is thus connected to P2.	The primary focus of paper 1.

A basic tenet in this endeavor to increase our understanding of how entrepreneurial competencies could be developed has been to study emotional events, following

recommendation from key scholars in the field of entrepreneurial education (Cope, 2005, Pittaway and Cope, 2007b, Kyrö, 2008) and supported by research in psychology (Baumeister et al., 2007, Dirkx, 2001). This first resulted in a framework for entrepreneurial competencies emphasizing emotions as well as actions in addition to the usual focus on cognition, see proposition 1 in Table 7. Empirical work outlined in appended papers 2 and 3 and theoretical work outlined in appended paper 1 subsequently resulted in articulating the previously proposed classification of activities that trigger emotional events, see proposition 2 in Table 7. Next step was to search for connections between emotional events and developed entrepreneurial competencies, outlined in appended paper 3 and resulting in proposition 3 in Table 7. This work then led to stating that actions, emotions and developed entrepreneurial competencies are causally linked, see proposition 4 in Table 7. Finally a need to bridge between traditional and progressive education through the developed frameworks and propositions was contemplated, resulting in proposition 5 in Table 7. I will now discuss these five main propositions.

6.1 P1: Entrepreneurial competencies can be operationalized through a tripartite framework

As outlined in the method section, an entrepreneurial competencies framework has been developed in this study. Coupled with an emotional events framework it has shown capable of interpreting large amounts of qualitative data into a limited number of categories of developed entrepreneurial competencies, thus allowing for measurement of developed entrepreneurial competencies. Appended paper 3 shows that the developed framework captures a high proportion of the situations discussed by the interviewees. Three open codes were added in the process; autonomy, self-esteem and other aspects. A future consideration needed is whether to add these open codes into a future version of theoretical coding framework. Autonomy has been discussed as an entrepreneurial competency in previous literature (See for example Shane, 2004, p.159, and Aouni and Surlemont, 2009, p.434). Self-esteem could be regarded as part of entrepreneurial identity (Markowska, 2011), but might still merit its own category in a future version of an entrepreneurial competencies framework. Revising and clarifying the entrepreneurial competencies framework developed through this study and presented in this thesis is a work that needs to continue, and will impact inter-rater reliability substantially in future work.

6.2 P2: Action-based entrepreneurial education can be classified into four classes

The classification framework proposed in Figure 4 is in fact a mixture between a classification and a categorization. Classification theory is a subject where librarians and information system designers are at the forefront of research. In this field there is a constant debate between proponents of subjective value-based flexible *categorization* and proponents of objective rule-based systematic *classification* (Mai, 2011). Categorization is argued to be a flexible process of context dependent grouping resulting in fuzzy boundaries where any entity can belong to multiple categories, whereas classification is a systematic and rigorous process resulting in mutually exclusive and non-overlapping classes (Jacob, 2004).

The classes proposed in Figure 4 are neither mutually exclusive nor non-overlapping. Even though the questions posed are designed to be yes/no questions, there is room for interpretation. One example is the venture creation approach proposed by Ollila and Williams Middleton (2011). It is an approach which contains aspects of creation, value creation, venture creation as well as sustainable venture creation. Another example is Young Enterprise (Dwerryhouse, 2001), which some could argue is a good example of a venture creation approach. Still, there are critics of this approach stating that it employs a too narrow approach to entrepreneurship, instilling a view of entrepreneurship in adolescents as being about financial reporting and making money (Otterborg, 2011, Smålandsposten, 2013). Here we then have an approach that is largely about venture creation, but allegedly with a too weak emphasis on creation and value creation. Should we then view Young Enterprise as an instance of "merely" creation, i.e. that the focus is primarily creation of artifacts that will please the teacher, or can we view it as venture creation albeit with some problematic issues attached to it? We can conclude that a classification might solve some confusion issues and help in making sense of action-based entrepreneurial education, but will probably spur new questions.

6.3 P3: Actions, triggered emotions and developed entrepreneurial competencies are causally linked

In an attempt to answer RQ3 concerning how the action-based activities outlined in Figure 4 develop entrepreneurial competencies we will now turn to the emotional events that they might trigger as well as the resulting development of entrepreneurial competencies. The first appended paper conceptually explores how value creation can foster learning, outlining for example that both success and failure to create value can trigger reflection (p. 9 in appended paper no 1). However, none of the appended papers specifically focuses empirically on triggers to emotional events. Therefore at this stage we need to explore conceptually how the four proposed classes of action-based activities can be seen as triggering emotional events. Further investigation needs to be conducted exploring this also empirically.

This study has revealed 17 emotional types of events that to varying extent can be linked to development of entrepreneurial competencies, see third appended paper (p. 12). Conceptually, I posit that the four classes of action-based activities in entrepreneurial education can trigger at least the emotional events shown in Figure 5. For example, creating value to external stakeholders must reasonably trigger events of interaction with outside world, which has shown to often be emotional as outlined in appended paper 3. Also, the frequency, strength and variety of emotional events will probably increase the further down we get in the classification model illustrated in Figure 4, as assumption based both on theory outlined previously and on empirical data in appended papers that supports this (see for example p.15 in third appended paper). Further, the third appended paper empirically outlines links between emotional events and developed entrepreneurial competencies. This means that emotional events can be regarded as a proxy between action-based activities and developed entrepreneurial competencies, see Figure 5. Thus, I posit that action-based activities trigger emotional events, which in their turn lead to development of entrepreneurial competencies.

The empirical exploration of this kind of linkages has not been done previously in entrepreneurial education to my knowledge. From a theoretical perspective the crucial role of emotions in learning has however been discussed previously. Kort et al. (2001) have proposed a model of how emotions impact learning. Pekrun et al. (2011) have developed a survey instrument to measure achievement emotions in order to explore how they impact learning in educational settings. Still it is a neglected field of educational research (Pekrun, 2005). Getting back to the proposed framework for learning-by-doing (see Figure 2), I posit that it is the internalization / deep learning process that is fuelled by strong emotions, and thus leads to build-up of an entrepreneurial cognitive toolbox which directs future actions taken. Dirkx (2001) states that emotions not only impede or motivate learning, but also play a central role in "our ways of knowing" and invite "a deeper understanding of ourselves" (p.64). Still, proposition 3 is based on early stage assumptions and hypotheses in need of further work, both theoretically and empirically. The measurement of emotions is also a field replete with methodological challenges (Pekrun et al., 2011, Ortony and Turner, 1990). Here, the experience sampling method used in this study, as well as its more recent variation labeled Ecological Momentary Assessment have been positioned as methods for avoiding "retrospective distortion of data" (Stone et al., 2003, p.28).

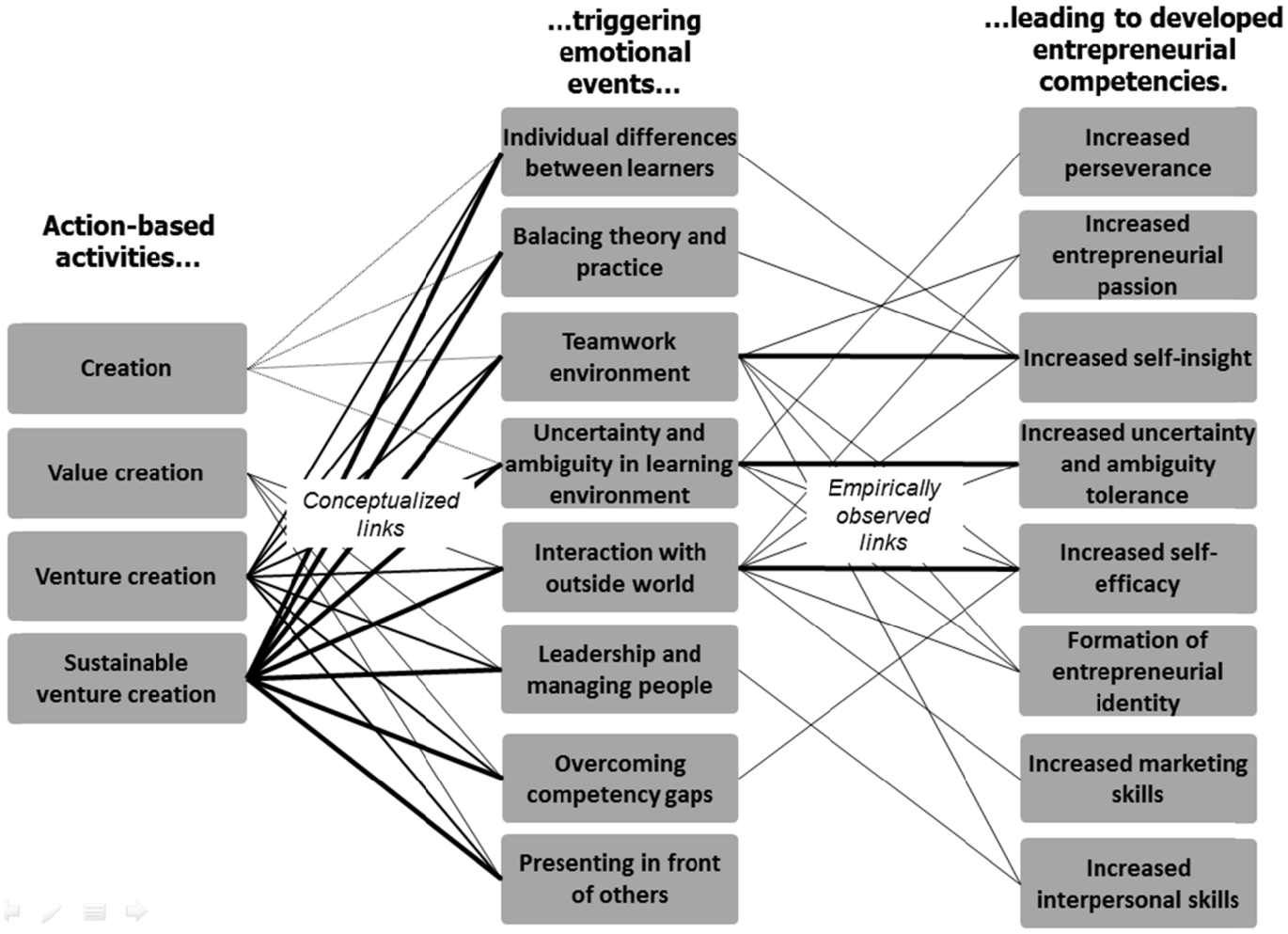


Figure 5. Emotional events as a proxy between action-based activities and developed entrepreneurial competencies

6.4 P4: Entrepreneurial education can be assessed by measuring emotional events

The causality proposed in Figure 5 opens up for new approaches to evaluation and assessment in entrepreneurial education, a topic of interest to policymakers, researchers and educators. Instead of trying to measure the evasive and subjective entrepreneurial competencies (Bird, 1995), I propose that we could measure emotional events, i.e. take advantage of the uncovered proxy between action-based educational activities and developed entrepreneurial competencies. We could for example measure the frequency, kind and magnitude of emotional events of the kinds uncovered in the third appended paper (see p. 12 in third appended paper). More frequent and stronger emotional events of certain kinds could then indicate a more effective entrepreneurial education intervention. This is illustrated in Table 8 together with the previously proposed activities to develop entrepreneurial competencies. In this table, entrepreneurial skills are split up in two parts, illustrating that some aspects of skills are more cognitive based and others are more non-cognitive based (action and emotion oriented) and thus more difficult to assess with traditional assessment methods.

Table 8. My contribution (in bold) to our understanding of how to develop and assess entrepreneurial competencies.

<table>
<tr><th>Entrepreneurial…</th><th>What are they?</th><th>How to develop?</th><th>How to assess?</th></tr>
<tr><td>…knowledge /
…thought /
…know-what /
…cognition</td><td>Mental models, declarative knowledge</td><td>• Lectures
• Reading literature</td><td>• Summative tests
• Reports – oral/text</td></tr>
<tr><td rowspan="2">…skills /
…action /
…know-how /
…conation</td><td>Marketing, strategy skills</td><td>• Lectures
• Reading literature
• Case based teaching</td><td>• Summative tests
• Reports – oral/text</td></tr>
<tr><td>Resource acquisition, Opportunity identification, learning, interpersonal skills</td><td rowspan="2">• Actionable knowledge approach
• Artifact creation
• Value creation
• Venture creation
• Sustainable venture creation
• Trigger emotional events
• Interaction with outside stakeholders
• Team-based work
• Uncertain setting</td><td rowspan="2">• Jobs taken / done
• Pre/post surveys
• Valuing artifacts
• Measuring (emotional) activity of specific kinds
• Measuring value created during/after
• Measuring value creation attempts
• Reports – oral/text</td></tr>
<tr><td>…attitudes /
…emotion /
…know-why /
…affect</td><td>Passion, self-efficacy, identity, proactiveness, perseverance, uncertainty tolerance</td></tr>
</table>

Given that measurability is what makes an educational approach viable on a wider scale (Löbler, 2006), a more robust approach to evaluation and assessment may allow for a stronger emphasis on action-based approaches in entrepreneurial education, and thus lead to a changed focus among entrepreneurial education providers towards more effective active approaches than the passive ones currently widely applied (Mwasalwiba, 2010). It could also provide progressive and constructivist educators with new measurement tools currently in short supply, thus increasing the possibility to bridge the debate in education outlined previously through an action-based approach coupled with new measurement instruments, see Table 2. After all, the

debate around educational traditions is to a large extent tied to the measurability of competence development (Labaree, 2005, Löbler, 2006), currently a huge advantage to passive behaviorist approaches. I posit that an action-based approach to not only development but also assessment of entrepreneurial competencies represents a new kind of "third way" in an educational system where an increasing number of educators are currently struggling to integrate entrepreneurial methods and tools, both across the curriculum and at primary, secondary and tertiary levels of education (Gibb, 2011, Smith, 2008, Mahieu, 2006). A detailed outline and examples of proposed assessment approaches is outlined in Table 9.

How promising the idea of measuring activity might seem, significant challenges remain before such an approach could be realized. New quantitative measurement instruments take many years to develop, validate and put to practical use. While Table 9 gives some rough ideas of what could be measured, the detailed craftwork to develop hypotheses to items and scales that can then be tested on hundreds or preferably thousands of participants in education is a daunting task. It should probably also be complemented by more traditional measurement employing a pre / post research design as outlined in the theory chapter, as well as benefit from drawing on previous work in assessment of creativity and divergent thinking (Plucker and Runco, 1998), which for example stipulates that "both quantity and quality of creative achievement should be included as outcome variables" (p. 37).

Table 9. Assessment approaches proposed in this thesis, some examples and value/validity.

Measurement approach	**Examples**	**Value / validity**
Valuing artifacts	• Portfolio assessment in art schools • Business plan evaluation	Artifact creation can develop entrepreneurial competencies.
Measuring emotional activity	• Measure number of interactions with outside world • Measure/assess perceived uncertainty in learning environment, through for example surveys • Measure/assess levels of trust reached in teamwork • Assess (number and kinds of) opportunities for applying theory in real-life situations • Measure/assess (number of) opportunities for managing other people in shared activity	Some emotional events have shown to lead to the development of entrepreneurial competencies
Measuring value creation (attempts)	• Measure number of external stakeholders contacted and/or met by the learner • Measure number of external stakeholders willing to engage above a certain threshold • Measure / assess tangible value learners created that was appreciated by external stakeholders	When value creation is attempted and/or achieved together with external stakeholders it leads to development of entrepreneurial competencies
Learner reports – oral / text	• Written reflection on action and / or emotion, individual / group • Oral reflection on action and / or emotion, one-on-one / group / plenum • Storytelling, where the learners' actions and emotions are used as the basis for a story told by the learner	When learners are asked to reflect on their action/activity and/or the emotions that are connected to them, it leads to internalization of tools, methods, knowledge, i.e. development of entrepreneurial competencies

6.5 P5: An "actionable knowledge" approach can bridge traditional and progressive education

This thesis has addressed the need to bridge between traditional and progressive education, both in general and entrepreneurial education. This theme was explored conceptually in appended paper 1, and has resulted in a set of questions that could guide further work, as well as in a framework outlining the similarities in dualistic challenges inherent in philosophy of science, educational philosophy, entrepreneurial education and entrepreneurship, see Figure 6. A general principle has been proposed in this thesis labeled "actionable knowledge", where action / activity bridges between these dualisms by letting learners find and act on the answer to the question "for whom is this knowledge valuable today?". By finding use for acquired knowledge immediately through interaction with external stakeholders as opposed to the usual teacher assertion "you will have use for this knowledge in 15 years from now", high levels of motivation could be triggered, fuelling the learning process. I propose labeling this an "altruistic paradox", stipulating that we get more motivated by creating value for others today than by creating value for ourselves in a distant future. Perhaps we are not as individualistic as we are being told to assume. In line with this, political writer George Gilder has proposed three entrepreneurial virtues; giving, humility and commitment (Spinosa et al., 1999), and has even proposed that profit is an index of the altruism of an investment (Gilder, 2013). Critics of Gilder have stated that labeling capitalism as altruism is nothing but a "subtle shuffling of words" (Himmelstein, 1981). Still, regarding entrepreneurship as a knowledge-based process of creating value to others could help bridging between traditional and progressive education.

Building on the "actionable knowledge" approach, the five questions from appended paper 1 could now be restated as: What *actions / activities* (instead of cognitive tools) in entrepreneurial education can…

- ….simplify a complex, multidisciplinary and holistic constructivist learning environment?
- ….preserve the concrete and individual aspects in a social learning environment?
- ….inject more content and linearity into an iterative learning process?
- ….facilitate detached reflection in an emotional and action-oriented learning environment?
- ….absorb more theoretical knowledge into an experiential learning environment?

This thesis has identified some candidate answers to these questions, such as reducing complexity through use of new kinds of value creation tools discussed in chapter 5, through Sarasvathy's effectuation logic capable of preserving individual aspects in a social learning environment as discussed in appended paper 1 (see p. 10), and in other ways outlined in appended paper 1. These different approaches could be seen as variations of an "actionable knowledge" approach. Still, significant work remains in exploring answers to these five questions grounded in the framework outlined in Figure 6, as well as defining and empirically testing such an "actionable knowledge" approach more precisely. For now, the mere existence of an "actionable knowledge" approach, leaning on altruistic value creation acts but still to be defined properly, is a proposition with bridging implications but as of now not explored to any significant extent. There might also exist other frameworks and propositions of similar kinds not yet identified in this study.

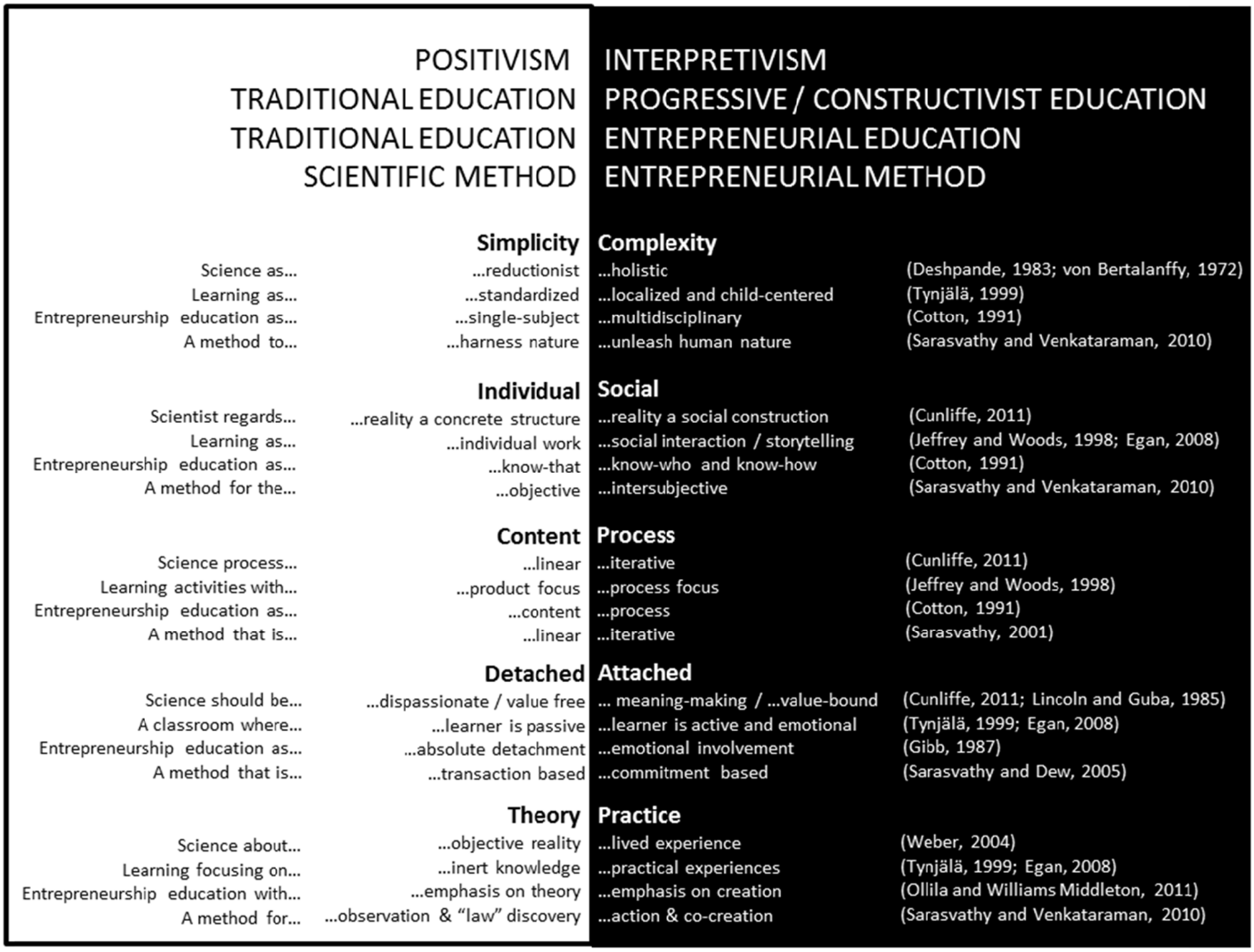


Figure 6. Five different dualisms cutting across four different literature domains.

7 Conclusions

The main purpose of this thesis has been to increase our understanding of how action-based entrepreneurial education can develop entrepreneurial competencies. Initially, an empirical setting suitable for this purpose was identified, qualified and described through extensive study of various educational environments in Europe and United States. A two-year entrepreneurial education program in Sweden was found to constitute a "paradigmatic case" of action-based entrepreneurial education, defining a "venture creation approach" and justifying a single case study approach. Thirteen students from this program were studied in their two-year process of developing entrepreneurial competencies. They were studied using an interpretation framework for entrepreneurial competencies developed for the purpose, an experience sampling based "mobile app" and through quarterly interviews.

The study is still on-going, but analysis of empirical data has so far revealed 17 different kinds of events that could be linked to the development of entrepreneurial competencies. According to preliminary findings, some links are stronger than others, such as interaction with outside world leading to build-up of entrepreneurial self-efficacy, marketing skills and uncertainty tolerance. Based on this, four classes of activities that trigger such events have been proposed, constituting an attempt to establish a classification and definition of action-based entrepreneurial education. These four classes could help practitioners in action-based entrepreneurial education to compare different pedagogical approaches and subsequently decide on which activity to opt for in any given teaching situation. They could also help researchers focus more on relevant aspects of action-based entrepreneurial education, removing differentiation that is irrelevant for the purpose.

In order to explain how these four classes of activities develop entrepreneurial competencies, a causal relationship has been proposed to exist between the four classes of activity, the emotional events they trigger and the resulting development of entrepreneurial competencies. If such a causal relationship exists, it opens up for a new approach to assessment in entrepreneurial education, focusing on the frequency, strength and variety of emotional events of certain kinds. These events could thus be viewed as indirect proxies for developed entrepreneurial competencies, which is an educational outcome difficult to assess directly. In addition to the assessment implications of these findings, an "actionable knowledge" approach has been proposed, where a focus on human action / activity bridges between traditional teacher-centric and progressive learner-centric approaches to education. It could contribute with new perspectives in a century-long debate in general education impacting the domain of entrepreneurial education.

Some important limitations of this thesis include a limited number of student interviewee data transcribed so far, 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. There is also a need for establishing stronger empirical linkage between educational activities and emotional events. Finally, the value of the proposed classification needs to be verified externally through extensive peer and practitioner review.

8 Future work

This thesis has proposed an operationalization of entrepreneurial competencies, four classes of action-based entrepreneurial education, a causal linkage explaining how learners become entrepreneurial through experiencing emotional events, a new perspective on assessing entrepreneurial education and an "actionable knowledge" approach to bridging between traditional and progressive education. These propositions now need to be tested further empirically as well as through attempts to publish the remaining appended papers and future papers outlining classes, linkages, assessment perspectives and bridging approach.

Interest from practitioners and other researchers to engage has been raised during the course of this study, and will be addressed in further work. One replication study has been initiated on primary level education in Sweden, and two more replication studies in Sweden are under discussion on secondary and tertiary level education. The app-based experience sampling methodology developed in this thesis has also been replicated in an ongoing Danish study on university students, and will be followed up as it progresses.

Empirical work remaining includes transcribing some additional 30 interviews waiting for transcription and subsequent data analysis, in order to corroborate findings presented in this thesis. Further interview waves with the 13 students that are followed longitudinally also need to be conducted, five of whom have now graduated. Three of the five "graduated" student ventures are still up and running, two of which are managed by the former students taking part in this study. These two former students are now "proper" entrepreneurs running their own ventures in a still very early and uncertain stage, allowing for transformation of this part of the study from the domain of entrepreneurial education to entrepreneurial learning should it be deemed interesting. The data analysis toolbox also needs to be developed further, consisting of primarily coding frameworks but also other procedures for analyzing data.

The study on venture creation programs reported in the second appended paper has resulted in an emerging global network of likeminded educators occasionally interacting at conferences and electronically. This represents another opportunity for collaborative research projects where cross-cultural studies and comparison studies can be conducted. This is however not the primary focus of my work as planned at the moment, since the coming years primarily need to be focused on corroborating the findings from this thesis based on data already or soon collected but not yet sufficiently analyzed.

An interesting link to explore in future work is the link between the development of entrepreneurial competencies and its assessment, drawing on and potentially also developing the domain of formative assessment. Formative assessment has been defined as a teacher- or learner-directed feedback process that establishes where learners are in their learning, where they are going and what needs to be done to get them there (Black and Wiliam, 2009).

To summarize future work, it will need to be focused on corroborating the findings presented in this study, rather than expanding into new kinds of findings and studies.

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