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# The interplay between cognitive, conative, and affective constructs along the entrepreneurial learning process

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## Abstract

**Purpose** – Although the role of reflections in entrepreneurship education is undeniable, the research has focused mainly on their advantages and consequences for learning process, whereas their dynamics and interrelations with other mental processes remain unexplored. The purpose of this paper is to better understand how personality and intelligence constructs: cognition, conation, and affection evolve and change along the learning process during entrepreneurship education.

**Design/methodology/approach** – To better understand reflective processes in entrepreneurial learning this paper adopts the tripartite constructs of personality and intelligence. By employing longitudinal explorative research approach and self-organizing map (SOM) algorithm, the authors follow students' reflections during their two-year learning processes. First, the authors try to identify how the interplay between the cognitive, conative, and affective aspects emerges in students' reflections. Then, the authors investigate how this interplay evolves during the individual learning process and finally, by looking for similarities in these learning pathways, the authors aim to identify patterns of students' reflective learning process.

**Findings** – All constructs are present during the learning process and all are prone to change. The individual constructs alone shed no light on the interplay between different constructs, but rather that the interplay between sub-constructs should be taken into consideration as well. This seems to be particularly true for cognition, as procedural and declarative knowledge have very different profiles. Procedural knowledge emerges together with emotions, motivation, and volition, whereas the profile of declarative knowledge is individual. The unique profile of declarative knowledge in students' reflections is an important finding as declarative knowledge is regarded as the center of current pedagogic practices.

**Research limitations/implications** – The study broadens the understanding of reflective practices in the entrepreneurial learning process and the interplay between affective, cognitive, and conative sub-constructs and reflective practices in entrepreneurship education. The findings clearly indicate the need for further research on the interplay between sub-constructs and students' reflection profiles. The authors see the study as an attempt to apply an exploratory statistical method for the problem in question.

**Practical implications** – The results are able to advise pedagogy. Practical implications concern the need to develop reflective practises in entrepreneurial learning interventions to enhance all three meta-competencies, even though there are so far no irrefutable findings to indicate that some types of reflection may be better than others.

**Originality/value** – The results of the analysis indicate that it is possible to study the complex and dynamic interplay between sub-constructs of cognitive, conative and affective constructs. Moreover, the research succeeded in identifying both individual variations and general reflection patterns and changes in these during the learning process. This was possible by adopting a longitudinal explorative research approach with SOM analyses.

**Keywords** Entrepreneurship education, Affection, Conation, Cognition, Reflections, Learning profiles

**Paper type** Research paper

## Introduction

Recent entrepreneurship education research underscores the need for a better understanding of the complexity and dynamics of the entrepreneurial learning process. This stream of research argues that, in addition to understanding cognitive processes, the interplay between affective and conative constructs is essential in learning entrepreneurial behavior (Collins *et al.*, 2006; Gibb, 2002; Krueger, 2007; Mitchell *et al.*, 2007; Pittaway and Cope, 2007; Rae, 2000). Also reflective practices have recently attracted research in entrepreneurial learning, as they are found to be key in enhancing entrepreneurial learning and help to uncover and communicate more about the learning process (Cope, 2003, 2005; Lumpkin and Lichtenstein, 2005). Research has not yet succeeded in defining the interplay between the cognitive, conative, and affective aspects of mental activity, or their conjunction with reflective practices along the entrepreneurial learning process. Furthermore, there is a lack of longitudinal research into how these three different mental processes and their interplays evolve during the reflection-based learning process and what kind of individual differences emerge along learning pathways.

Currently, not all of the personality and intelligence constructs have been brought into the entrepreneurship discussion. Entrepreneurship literature has mainly focused on the cognition school, which has been present in entrepreneurship research for about twenty years (Neck and Greene, 2011). Emotions have received much less attention from researchers (Cardon *et al.*, 2005; Foo, 2011; Cardon *et al.*, 2012). However, as many entrepreneurs act in accordance with their emotions (Cardon *et al.*, 2012) and emotions interact with entrepreneurial decisions and actions, the research has recently started to consider how individuals "feel" complimentary to how or what they "think" (Shepherd, 2004; Baron, 2008; Hayton and Cholakova, 2012; Mitchell *et al.*, 2007). The previous research claimed that affective processes of entrepreneurial behavior likely influence a variety of entrepreneurial cognitions; however many of the papers on this interplay are conceptual, so there is a lack of evidence approving this claim. Evidence supporting the interplay between conation and affection is also scarce. What is basically claimed is that motivation goes with affection (Cardon *et al.*, 2009; Seo *et al.*, 2004); however, we still do not know much about the dynamics of that interplay. Therefore, our main area of investigation is the interplay between different constructs of personality and intelligence along the entrepreneurial learning process.

To organize the understanding of cognition, conation, and affection we adopt the tripartite constructs of personality and intelligence originally introduced by Snow *et al.* (1996), which were further applied to entrepreneurship education by Ruohotie and Koiranen (2000). This model helps to differentiate the cognitive, conative and affective aspects of learning and organizes these often confusingly used concepts for learning interventions and research settings. Understanding how all three constructs evolve and interact during the learning process assumes an access to reflection, as reflecting is a process that mediates knowledge, experience, and action, involving both cognition and feelings (Gray, 2007). Our research question is:

*RQ1.* How does the interplay between cognitive, conative, and affective constructs emerge and change along reflection-based entrepreneurial learning?

By examining how different personality and intelligence constructs evolve along individual learning processes, we aim to identify patterns in reflective entrepreneurial learning. By following these pathways we can learn how to improve reflective practice among students.

To answer the research question, we examine students' reflections during a two-year learning process in entrepreneurship at one of several Finnish universities. We employ a longitudinal, explorative research approach and the SOM method. More specifically, based on personality and intelligence tripartite constructs complemented with meta-level,

we first identify how the interplay between the cognitive, conative and affective aspects emerges in students' reflections. Then, we investigate how this interplay evolves during the individual learning processes, we identify some regularities, and finally we compile different reflection profiles of the students. We expect to add knowledge about reflective practices in the entrepreneurial learning process and thus contribute to a better understanding of the interplay between affective, cognitive, and conative constructs, and reflective practices in entrepreneurship education.

## The cognitive, conative, and affective constructs in entrepreneurship research

As Snow *et al.* (1996) argue, affective, conative, and cognitive modes of mental functioning have been historically distinguished but are still regarded as interactive elements in human intelligence and personality. Personality refers to all those factors which distinguish a person as an individual human being. It includes the ability to undertake activities which are difficult, complex, abstract, demanding, goal-oriented, socially prestigious and original, as well as the ability to accomplish these activities in situations that demand concentration and control of one's emotions (Ruohotie and Koiranen, 2000). These two abilities concern the qualities identified as specific to the holistic, integrative, and synergistic experiential, and action-oriented view of entrepreneurial learning expressed, for example, by Collins *et al.* (2006), Pittaway and Cope (2007), as well as Rae (2000).

Cognition is a term for the process of acquiring awareness through which individuals recognize and obtain information. It relates to perceiving, recognizing, conceiving, judging, and reasoning. The cognitive construct contains declarative and procedural knowledge. The distinction between these two is that the first refers to the way we link concepts together and the second to our abilities to apply this knowledge.

The conative construct includes impulse, desire, and purposive striving. It relates to the mental process, which supports an organism in developing (Ruohotie, 2000). Conation is subdivided into motivation and volition. As Ruohotie and Koiranen (2000) describe it, motivation includes, among other things, internal and external goal-orientation, fear of failure, need for achievement, self-esteem, and belief in one's own abilities and prospects. Volition entails, among other things, perseverance, the will to learn, endeavor or effort, mindfulness in learning, intrinsic regulation and evaluation processes, as well as different control strategies. Motivation precedes volitional processes that formulate the goals, but volition guides the setting of clear goals, as well as the enactment and realization of decisions related to these goals. The conative construct also contains orientation toward others and ourselves.

Affection relates to feeling, emotion, mood, and temperament. It is the emotional response to a certain object. Affection is divided into temperament and emotion. Temperament is longer lasting and not dependent on individual situational factors, while an emotion may be strongly linked to a situation.

### Affection and cognition in entrepreneurial processes

The need to understand the role of affection in the entrepreneurial process is described by many authors, including Cardon *et al.* (2005, 2009); however, there is much confusion around the concepts of affection and emotions in the entrepreneurship literature. Cardon *et al.* (2012) regard affection as a subjective concept concerning both dispositional affect (personality that is more stable), specific emotion (intense and short-term), and mood (low intensity but lasting, resulting from stimuli). They find emotion and affect to be semantically equal. Baron (2008) distinguishes between state affect and dispositional (trait) affect. The former is connected to changes in current moods as a result of external events; the latter refers to stable tendencies to experience specific affective reactions, both producing parallel effects in

many situations. This interpretation corresponds more to Snow *et al.* (1996) division of affection into temperament and emotion.

Recent research has shown that emotions play a significant role in the opportunity identification process (Welpe *et al.*, 2011; Foo, 2011; Grichnik *et al.*, 2010). These studies are based on the assumption of interplay between cognition and affection. For example Hayton and Cholakova (2012) claim that affect and cognition are interwoven in an iterative process and through that process entrepreneurs feel, think, and finally act. Affective and cognitive processes are associated with the arousal of different parts of the brain (Cohen, 2005; Hayton and Cholakova, 2012), but, as Baron (2008) indicates, their interaction is continuous. For Baron (2008), affection may influence cognition through its impact on perceptions of the external world, creativity, the tendency to engage in heuristic processing, memory, the cognitive strategies individuals use in coping with intense and persistent stress, and interpretations of others' motives; however, none of the authors considers the role of conation in the interplay between affection and cognition.

### Conation in entrepreneurial processes
Motivation in entrepreneurship research is regarded as one of the basic characteristics of entrepreneurs and investigated mainly in terms of being a "push or pull" factor (Vanevenhoven, 2013). What we know about motivation is that it may influence entrepreneurial process through risk-taking, locus of control, self-efficacy, goal setting (Shane *et al.*, 2012), and it usually accompanies affection. As Seo *et al.* (2004) state, understandings of motivation fails if we do not consider human emotions. This interplay has been studied in regard to motivational effect of passion (Cardon *et al.*, 2009) or in the context of self-regulation providing linkage through which motivation and emotions integrate (Seo *et al.*, 2004). Despite that entrepreneurship might be regarded as an act of individual volition, the role of the volition construct in the entrepreneurial process remains unexplored, although the need for exploration has been noted for example by Bygrave and Minniti (2000). What may be guessed is that motivation seems to influence the volition (Snow *et al.*, 1996).

### Confusions about the constructs
Entrepreneurship research, drawing from the conceptual understanding of cognitive psychology (Kickul *et al.*, 2009; Palich and Bagby, 1995), often underestimates the differences between conation and affection (as does the meta-analysis of Sitzmann *et al.*, 2010) or leaves affection outside of the conceptual discussion (as does Liu *et al.*, 2011). For example, in their meta-analysis of the self-assessment of knowledge, Sitzmann *et al.* (2010) regard learner motivation and self-efficacy as affective learning outcomes. This indicates that either affection is used as a synonym for conation or it subsumes both conation and affection.

Not all streams of research follow the conceptual understanding of tripartite personality and intelligence or do not differentiate enough between them. Most of the studies assume and concentrate only on the interplay between affection and cognition, ignoring conation, and more specifically the role of volition in entrepreneurial processes. Drawing from limited previous research on the interplay between personality and intelligence constructs, we might expect to find some relationships between particular sub-constructs of personality and intelligence, namely:

(1) interplay between cognition and affection;

(2) interplay between motivation and affection; and

(3) motivation influencing volition.

However, this is a very general level of understanding of the interplay between constructs and their sub-constructs, which calls for more clarification of these relationships.

**The cognitive, conative, and affective constructs in entrepreneurial learning**
The cognitive, conative, and affective constructs are present during the learning process and are all valuable as they guide our willingness and interest to learn (Kyrö, 2008); however, they are not often studied simultaneously. The affection construct is especially ignored in learning models. Ruohotie (2000) claims that in entrepreneurial education, be it formally planned or taking place in everyday life, the key processes concern motivation and volition, that is, the conative aspects of learning. However, as already argued by Dewey (1946), emotions are essential factors of learning. Dewey saw man as a living being in interaction with the world and in a confrontation with things. This is how meaning, emotions and interests are born. Gibb (2002) likewise underlines how the affective aspects relating to our values and attitudes should take on a more explicit place in learning practices. Pittaway and Cope (2007) found that emotional exposure plays a major role in creating an environment for effective entrepreneurial learning. For Feys *et al.* (2011) cognitive and affective processes are needed in self-regulation. Likewise, Shrivastava (2010) calls for a more holistic pedagogy that integrates emotional and cognitive learning to change human behavior.

As affection is embedded in all situations and each individual has his/her own temperament, we may assume that there are individual differences in the interplay between cognitive, conative and affective aspects in the learning process. This approach follows a stream of research emphasizing on students' differences in entrepreneurship education, as identified by Béchard and Grégoire (2005) in their meta-analyses of entrepreneurship education research or by Kyrö *et al.* (2011) concerning students' different approaches to the opportunity process. This assumption also gains empirical support from recent research by Kickul *et al.* (2009) on differential models of cognitive style on entrepreneurial self-efficacy and the new venture creation process. Thus, we can assume that affective, conative and cognitive processes interact in the entrepreneurial learning process, yet there is little evidence of how this interplay takes place. To better understand this interplay, we need to identify how these three constructs evolve in the learning process.

*The role of reflections in learning*
Understanding the interplay between personality and intelligence constructs requires that we follow the meta-level, reflective competencies, since learning depends on the learner's ability to manage meta-level abilities of self-regulation. Sometimes reflective practices are also referred to as self-awareness practices as they create commitment to learning (Feys *et al.*, 2011). As Krueger (2007) or Krueger *et al.* (2011) argue we need to identify the deep beliefs that anchor and shape meta-level knowledge structures which, in turn, influence knowledge content. Ruohotie (2003) has modeled this dynamic of meta-processes between conative and cognitive constructs. The meta-cognitive component of self-regulation includes awareness of one's own knowledge structures, processes, and cognitive and affective states, and both facilitates and is a precondition for the self-regulation process. An individual learns if the range of its behaviors is changed (Huber, 1991) or as Ruohotie and Koiranen (2000, p. 13) argue, "when a person learns entrepreneurship, changes take place not only in her/his knowledge constructs, but also in meta-cognitive skills, motivation, belief, self-esteem, etc." Limón-Lugue (2003) uses the terms "meta-motivation" and "meta-emotion" to refer to knowledge and regulation of one's motivation and emotions. However, we can also expect that value- and attitude-based feelings are embedded in this interplay. Thus, affective meta-aspects are interwoven into this dynamic. This assumes that, besides meta-cognition, meta-affection and meta-conation are needed to complete our theoretical understanding of the interplay between cognitive, conative, and affective aspects in the reflection-based entrepreneurial learning process.

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Accordingly, each construct has its own meta-level counterpart, that is, the concepts of meta-cognition, meta-conation and meta-affection. Constructs and their meta-level counterparts are presented in Figure 1.

The three meta-constructs represent a learner's competencies to reflect his/her learning and consequently change or improve it. Thus, reflection refers to examining and making meaning of the learning experience on the basis of these three constructs. It is an aspect of an individual's development that reaches a higher level than understanding. Accordingly, we should be able to find a way to differentiate the meta-level reflective competencies of each of the constructs and investigate their development during the learning process Figure 2.

## Longitudinal explorative research approach and the SOM method

### Longitudinal explorative research approach

We adopt an explorative research approach and investigate students' reflections during their learning process. Research into the dynamics of learning often adopts an explorative approach. However, the explicit use of explorative methodology is more common in other fields of science than in entrepreneurship research (Beall, 2002). Explorative research in the social sciences, as Schutt (2006, p. 16) argues, "seeks to find out how people get along in the setting under question, what meanings they give to their actions and what issues concern them." According to Stebbins (2001, p. 9), it aims to explore, reveal, and generate ideas emerging from the data to discover new patterns and relationships. In this study we are interested in still not explored interplay between different constructs and sub-constructs of personality and intelligence along entrepreneurial learning.

We integrate two ideas of exploration. As a methodology of discovery, the idea of exploration has been opened up simultaneously in two different directions: in Canada, by Stebbins (2001), who is especially known for his research in art and leisure, and by Kleining and Witt (2001), representing the Hamburg Group of psychologists and sociologists. Integration of these two approaches offers a methodology to analyze the interplay between
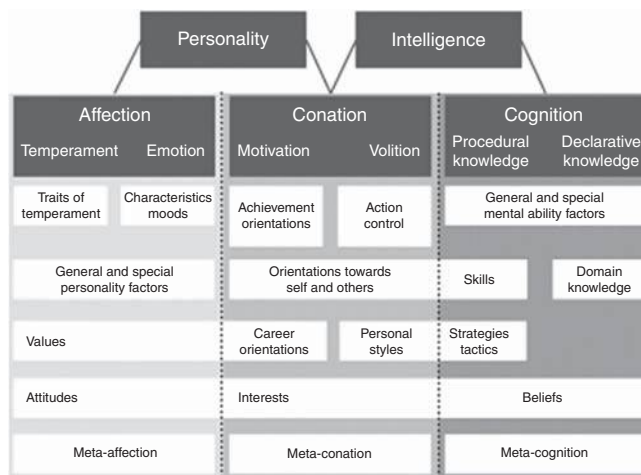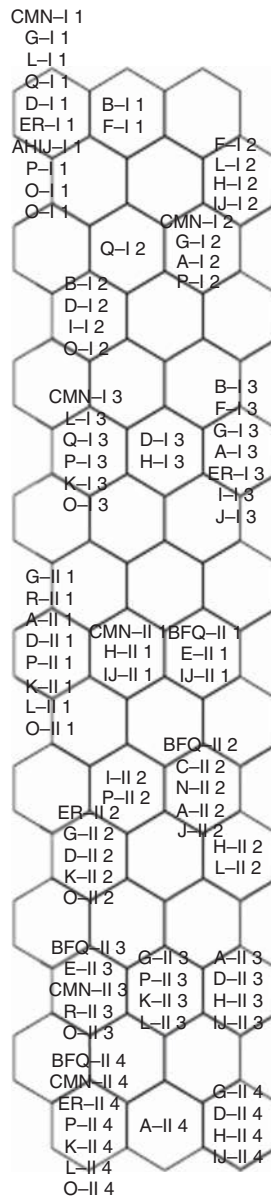


**Figure 1.**
Constructs and meta-constructs of personality and intelligence

Notes: Combined: Snow *et al*. (1996, p. 247); Koiranen and Ruohotie (2001, p. 104) and complemented with meta-level construction Kyrö (2006)

CMN–I 1
G–I 1
L–I 1
Q–I 1
D–I 1     B–I 1
ER–I 1    F–I 1
AHIJ–I 1              F–I 2
P–I 1                 L–I 2
O–I 1                 H–I 2
O–I 1                 IJ–I 2
            CMN–I 2
        Q–I 2    G–I 2
                 A–I 2
                 P–I 2
        B–I 2
        D–I 2
        I–I 2
        O–I 2

                      B–I 3
                      F–I 3
   CMN–I 3            G–I 3
     L–I 3           A–I 3
     Q–I 3   D–I 3   ER–I 3
     P–I 3   H–I 3   I–I 3
     K–I 3           J–I 3
     O– 3

G–II 1
R–II 1
A–II 1
D–II 1   CMN–II 1 BFQ–II 1
P–II 1    H–II 1   E–II 1
K–II 1    IJ–II 1  IJ–II 1
L–II 1
O–II 1
                BFQ–II 2
                 C–II 2
         I–II 2  N–II 2
         P–II 2  A–II 2
ER–II 2          J–II 2
  G–II 2              H–II 2
  D–II 2              L–II 2
  K–II 2
  O–II 2

BFQ–II 3
  E–II 3    G–II 3   A–II 3
CMN–II 3    P–II 3   D–II 3
  R–II 3    K–II 3   H–II 3
  O–II 3    L–II 3   IJ–II 3

BFQ–II 4
CMN–II 4             G–II 4
ER–II 4              D–II 4
  P–II 4    A–II 4   H–II 4
  K–II 4             IJ–II 4
  L–II 4
  O–II 4

**Notes:** The documents have been labeled with the letters corresponding
to students who authored the reflection. The letters are followed by the
module number and the course number

**Figure 2.**
Student
reflections on the
self-organizing map

the cognitive, conative, and affective aspects and the changes between them in the students'
reflective experiences during their learning process. From Stebbins' (2001) different forms of
exploration, we employ limited exploration, in which the explorer knows what to look for
and examines an idea for diagnostic purposes to scrutinize it systematically.

*Learning interventions*

Learning interventions offer a naturalistic, experiential setting for the research and, more specifically, by following Tesch's (1995) division of reflexive forms of phenomenology, offers its heuristic alternative. Heuristic form is taken to make a distinction between the discovery process, verification, and corroboration. It focuses on searching for a pattern or meaning from the data, as Kleining and Witt (2001) suggested. According to them, the analysis should aim at the discovery of similarities, analogies, or homologies within the varied set of data, and through integration of data end up discovering its patterns or structures. In this study we proceed in three phases. First, we try to identify how the interplay between the cognitive, conative, and affective aspects emerges in students' reflections. Then, we investigate how this interplay evolves during the individual learning process and finally, by looking for similarities in these learning pathways, we aim to identify patterns of students' reflective learning process.

The data consist of the two-year follow-up reflections of 90 Finnish university students taking bachelor's (25 ECT, three modules) and master's (30 ECT, four modules) level degree studies in entrepreneurship education in years 2003-2006. Finland is among the first countries to adopt entrepreneurship education by mainstreaming it throughout the education system and for long has been at the top of the PISA rankings which indicates the high quality of its education (OECD, 2009). This offers a fruitful context for investigating changes in the learning process. However, it should be underlined that the data may contain cultural bias because of the specifics of Finnish working culture, especially the Lutheran work ethic, which is deeply embedded in Finnish culture, and the more introvert style of behavior of Finns.

Both investigated programs adopted entrepreneurial and enterprising pedagogy to enhance entrepreneurial behavior and were available to all university students in Finland. The reflection instructions based on action research studies were the same in all program modules. The aims of the first 25 ECTS bachelor's level program were: to learn the basic competencies of entrepreneurship education and different dimensions of entrepreneurial pedagogy from the perspectives of society, individual, small business and other organizations, to introduce participants to the newest international aspects of entrepreneurship concepts and theory-building, and to support participants' competencies for applying and advancing entrepreneurial pedagogy in their own working contexts. It contained three modules: Orientation to entrepreneurship education and its pedagogy, Small business management and ownership, and Intrapreneurship and learning organization, special themes on entrepreneurship. The master's level 30 ECTS program was aimed to provide the students with an advanced level overview of international research on entrepreneurship education, familiarize them with scientific discussion in the entrepreneurship education field, and provide them with means to conduct research in the field. The focus was on conceptualizing entrepreneurship education, the dynamics of growing into entrepreneurship and the methodology of their research. It contained four modules: orientation to entrepreneurship education, international research into learning and the conceptualization of entrepreneurship, methodological approach to research into entrepreneurship education and its dynamics, and design and analysis of an entrepreneurship education research process.

Both bachelor's and master's programs were process oriented and were virtually supported with three days of face-to-face interventions per module. The students came from different academic disciplines. The responsibility for learning and the freedom to do so was left to the learners, who were encouraged to proactively create their goals, the means to achieve them, and their own concepts and ideas about phenomena. Students were encouraged to start working individually and collaboratively. The assignments actively supported students' own knowledge creation, action and interaction with surrounding firms and organizations. The assignments consisted of real-life cases, their peer evaluation, and presentations. They contained concept mapping examinations, group works, peer evaluations,

and reflections. Students were also instructed to reach meta-level reflections. Data were collected after each module when students were expected to write a reflection essay. Altogether, 263 reflections were gathered from 90 students, and among them 18 students from seven modules were identified to have finished both programs.

*The SOM method*
Students' reflections were analyzed with the SOM algorithm (Kohonen, 2001), a method widely used for data analysis and visualization (Lagus *et al.*, 2013). The SOMSOM is a neural network method that can be utilized for organizing complex data sets onto a two-dimensional ordered map display (Kohonen, 2001). In general, nearby locations on the map display contain similar data items and properties of the data item change gradually when moving over the map. In this paper we utilized the SOM to explore how written reflections in students' own words can be interactively analyzed and displayed as trails on a map to allow interpretations about their developmental paths during the course of their studies. Adopting the SOM method offered us a solution to follow the key ideas of the explorative approach in the analyses. As Stebbins (2001) argues, the main goal of explorative research is to make generalizations about the group, process, activity or situation under study. These generalizations are derived inductively from the data.

The top-down dimension of the map is dominated by the time aspect. The right-left axis refers to differences in the data in some direction in the multidimensional space that the SOM has deemed interesting (mainly, having a large variance). The SOM automatically groups the students by similarity at a particular point in time. The nodes in the SOM can then be thought of as the mean-values of the group assigned to that node. The right-left dimension corresponds to a grouping based on similarities in the five underlying variables.

For each reflection we created a "fingerprint," a vector which encodes information about the usage of words and various types of expressions related to the object of study. The basic approach was to encode the reflections as document vectors, using the WEBSOM document map set-up as a baseline. Then, with a theory-driven approach, we examined specifically the constructs that students utilize with respect to the affective, conative and cognitive processes active during their learning. The vocabulary utilized by the students was labeled according to these categories (and their subcategories). As a consequence, for each reflection we had a fingerprint that tells us how many times the student utilized a word referring to conative, cognitive or affective processes. The fingerprints were then projected onto the map display. By looking at the progress of a student on the map display in the form of a developmental path, and, in the context of the other students and their individual paths, we are able to observe both typical patterns, as well as individual variation in the students' use of cognitive, conative, and affective processes during their learning processes.

When interpreting the visualizations one must consider that the sample size is small, and the fingerprints contain an unknown amount of noise, as the students' vocabulary is only an indication of the true sub-construct activity. Since the reflection, by definition, is free form, the student reflections also contain a statistical structure not directly related to the sub-constructs, for example, the topic of the reflection assignment. Thus, the findings should be taken as hypotheses that need to be evaluated by future research, and the focus needs be on the larger variations shown on the map, as they are less susceptible to noise.

*Analysis of the data set and pre-processing*
To focus on the longitudinal aspect we studied the subset of the data for the 18 students that participated in the whole program, and for which reflections from up to seven modules were available. The data set consisted of 93 student reflections, out of which 18 were group documents with a varying number of authors (2-4). The reflections were written in Finnish and varied from 146 words to 3,074 words in length, with a median length of 655 words.

As Finnish has a highly productive morphology, many related word forms occur in separate inflected forms. We replaced each word form by its grammatical base form using the software tool FDG produced by Connexor. Word forms occurring fewer than ten times in the full data set were discarded, likewise, a list of stop words containing the most frequent non-content words and words considered to be noise (e.g. single letters and proper names). After pre-processing, the vocabulary contained 847 unique word types.

All words in the created vocabulary were labeled based on whether or not they were related to a sub-construct. We then formed a vector for each student reflection that contained the count of each word in the vocabulary in the student reflection. To emphasize content words over frequent words, we calculated TF-IDF weights for the student reflection vectors and finally normalized the weight vector to unit length, to control for varying reflection length. Then for each of the sub-constructs (affection, motivation, volition, declarative knowledge, and procedural knowledge), we calculated, for each student reflection, the sum of the normalized TF-IDF weights for each word in the sub-construct word list. This gave the final five-dimensional fingerprint for each student reflection.

We trained the SOM on the fingerprint vectors, using the SOM Toolbox software package (Alhoniemi *et al.*, 1997). We chose to add extra structure in the training procedure as our data set is quite small compared to the large text document collections usually analyzed in this fashion (e.g. WEBSOM Kaski *et al.*, 1998; Lagus *et al.*, 2004). We added an extra input dimension encoding the module number with a large enough variance that it dominates the organization of the map, taking over one dimension of the map completely. This is equivalent to training a separate mini-map for each module, but allowing it to visualize all modules on the same map. The resulting map enabled us to identify both differences between students within modules, and trends in how student reflections change between modules. We normalized the variances of the fingerprint dimensions to 1, such that each sub-construct has an equally large contribution to the organization of the map. We let the map size be chosen by the default method of the Toolbox, and we get a $16 \times 3$ map (48 nodes).

## Results

The reporting of the results and their interpretation is divided into two stages. At the first stage, by looking at all 48 nodes of SOM map and following how students' reflections change, we get some ideas of interplays between constructs. Thus, we answer how the interplay between the cognitive, conative, and affective aspects emerges and changes in students' reflections. The results are summarized according to each aspect of the constructs with respect to the position of the node in the map and then with respect to other constructs and finally characterized according to their potential specifics. We also can see how students are located in the SOM map during the learning process as they precisely enter 22 of 48 nodes.

Next, to understand how the interplay between the cognitive, conative, and affective aspects evolves during the individual reflection-based learning processes, we identify each individual learning path. By visualizing the similarities of the reflections with the SOM, we examine how the reflections of a student are positioned on the map, and we look for similarities in students' learning pathways. In this way we follow the individual development paths of students. From the individual paths in the map, by identifying their similarities, we compile different reflection profiles according to the combinations of the interplay between the sub-constructs.

### *The interplay between constructs and sub-constructs, and their evolution*
Activity of five sub-constructs is illustrated in Figure 3.

*Affective construct*. Looking at the SOM map, affection reaches the highest intensity in left side nodes, and the weakest on the right side nodes. Affection usually correlates with motivation but also interacts, however less intensely, with volition and procedural knowledge.
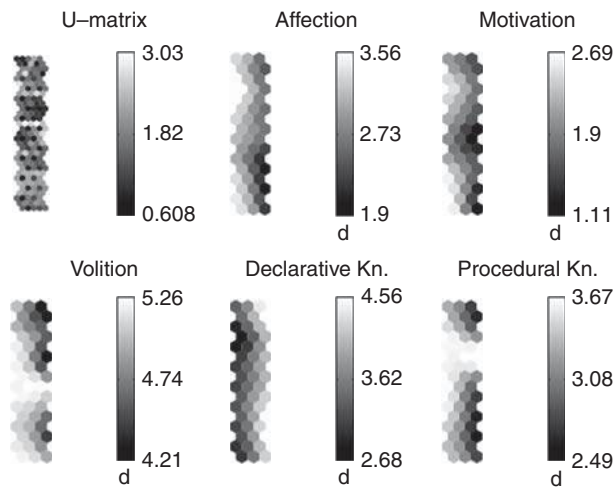
**Figure 3.**
Activity of the five
sub-constructions in
different map nodes

It has to be noted that at the beginning of the learning process all students (except B, P, Q) start with a high level of affection, and then during the learning process some of them stay with high affection, but some stop to rely on affection while reflecting.

The suggested earlier relation between affection and motivation (e.g. by Cardon *et al.*, 2009) has been confirmed. Affection is identified in students' reflections. Its role is significant as it matches with all sub-constructs except declarative knowledge. Therefore, as earlier emphasized, affection cannot be ignored if we want to understand the learning process.

*Conative constructs.* Motivation. In general, the highest degree of motivation may be found in left side nodes of the SOM map with the lowest on the right one. Motivation emerges together with affection, volition and with procedural knowledge. In the middle of the learning process (row 8-10), motivation for most of the students (except A, L P, R) goes down but often then goes up. So they face some motivation decrease in the middle of the learning process when moving from basic to advanced studies.

Volition. Volition emerges together with all sub-constructs except declarative knowledge. The highest volition degree is in left side nodes of SOM map, whereas the weakest are in right side nodes, except for rows 8-11, where it is high in all nodes. Interestingly, in these rows motivation is weak. This means that motivation is replaced with the will to learn.

Previous research suggests that motivation influences and precedes volition (Snow *et al.*, 1996). According to our findings, motivation and volition interplay. They change during the learning process but the conative construct has to be present all along. However, we cannot say anything about the order of the emergence of motivation and volition.

*Cognitive constructs.* Declarative knowledge. The highest degree of declarative knowledge can be found in nodes on the right side of the map, with the lowest in nodes on the left side. Declarative knowledge has a very unique profile comparing to other sub-constructs. The position of the declarative knowledge nodes draws a structure in the map indicating its difference from a high degree of affection, motivation, volition and procedural knowledge.

Procedural knowledge. The highest degree of procedural knowledge is seen in left side nodes on the map, with the lowest in right side nodes, except for rows 5-7 where all nodes are characterized by high procedural knowledge. Characteristically procedural knowledge emerges together with emotions, motivation, and volition. The current trend to underline the need to adopt action-oriented pedagogy seems to be valid, as it was in the investigated programs.

The analysis of the map shows differences between declarative and procedural knowledge. Thus, we can say that declarative knowledge and procedural knowledge have very different profiles. They do not emerge together and in most of nodes are opposite in intensity. Declarative knowledge hardly accompanies other sub-constructs. Procedural knowledge on the other hand interplays with all other sub-constructs, which indicates action-oriented learning. Surprisingly, procedural knowledge precedes volition. Despite the aims of the course, procedural knowledge, or learning by doing, seems to be the guiding principle for students. High intensity of procedural knowledge in rows 5-7 (when the scientific course takes place) could indicate that learning scientific declarative knowledge starts with adopting it in practice.

Thus, the cognitive construct alone does not shed light on the interplay between different constructs, but requires further analyzing each connection between substructures. In light of our research, a commonly stated interplay between affection and cognition (Baron, 2008; Hayton and Cholakova, 2012) should be specified to interplay only between procedural knowledge and affection, as affection and declarative knowledge have opposite profiles.

In conclusion, the interplay between sub-constructs has many combinations. However, by analyzing the position and evolution of all nodes we can identify some typical or common combinations. As identified by previous research, there is interplay between affection and motivation. However, we cannot confirm the suggested interplay between cognition and affection. Our study shows that more attention should be put on the interplay of sub-constructs because the interplay between constructs alone may be misleading, as in the case of the different profiles of procedural and declarative knowledge. Thus, in light of our research we are able to better describe how particular sub-constructs interact:

- affection and motivation emerge together with volition and procedural knowledge;

- there is an interplay between volition and procedural knowledge; however, procedural knowledge precedes volition; and

- declarative knowledge does not correlate with any other sub-construct, and it has a reverse profile to that of affection.

*From individual pathways to four different reflection profiles*
By identifying similarities in individual reflection pathways we compiled four reflection profiles (see Figure 4) that indicate that students adopt different combinations of interplay between the sub-constructs of personality and intelligence.

*"Towards declarative knowledge" learning profile (right side location in SOM map), Students: H, I, J, D.* Students start reflecting with low declarative knowledge, but during the learning process it increases gradually. They start with high affection, which shortly decreases (which could be the sign of emotions rather than temperament). Procedural knowledge, volition, and motivation fluctuate intensively throughout learning process. Students end up with low affection, motivation, and volition, and an average level of procedural knowledge. Only declarative knowledge is high in their reflections. Volition weakens during the learning process (with some minor jumps). Education changed students' reflections from affection driven into ones based on declarative knowledge. They started to conceptually understand entrepreneurship as a domain of knowledge, but as more declarative knowledge was used, the less affection was involved.

*"Affection-motivation circle" learning profile (left side location in SOM map), Students: K, O, M, R, E.* Students start and end the learning process with high affection and motivation. During the learning process, sub-constructs fluctuate. Thus, students use different combinations of sub-constructs while reflecting but finally come back to the starting point.
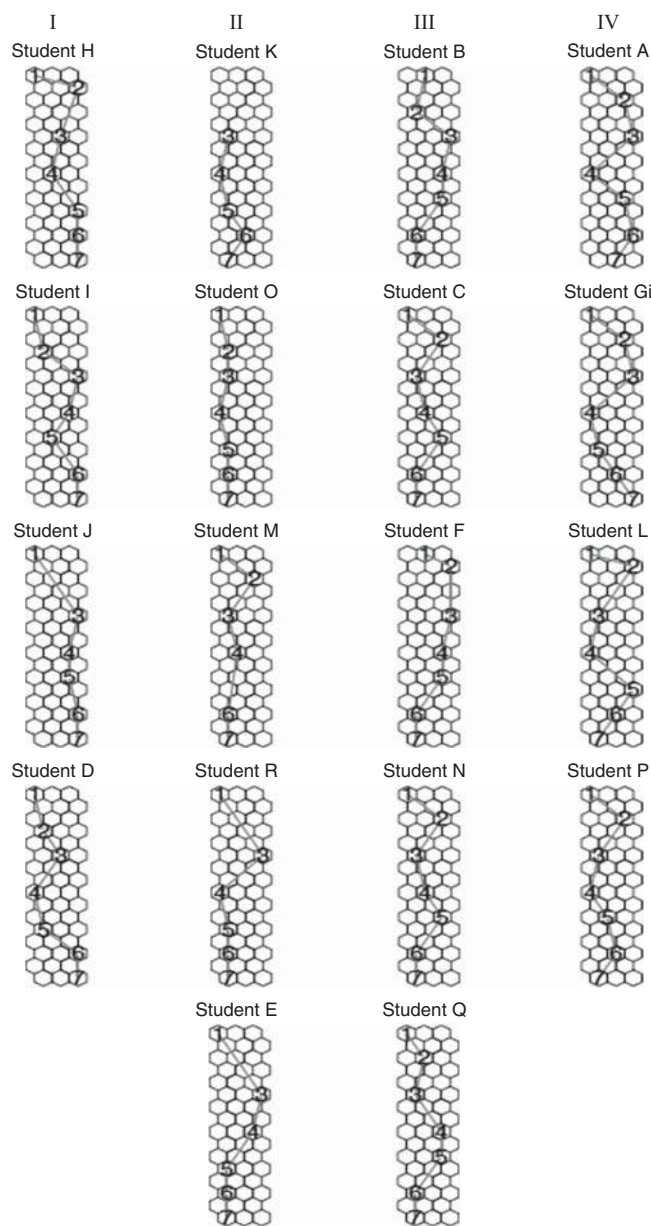
**Notes:** I , "Towards declarative knowledge"; II, "Affection-motivation
circle"; III, "Volition oriented"; IV, Chaotic learning profile

**Figure 4.**
Paths of individual
students' development
during their education

Declarative knowledge achieves different levels but at the end of the learning process stays
at an average or low level. For E and R, volition stays weak, but for K, O, and M, it stays or
becomes strong. So, the intensity of volition does not influence the appearance of other
sub-constructs. Also, procedural knowledge intensity does not form any regularity.

Entrepreneurship education influenced students' learning pathways, but in a limited way. Although students started with high affection levels in the "towards declarative knowledge" learning profile, the education did not decrease their affection and did not increase their declarative knowledge. Affection and motivation seem to be their natural sub-constructs through which they reflect on world. Thus, affection is probably more connected with temperament than with emotions. Declarative knowledge seems to be less important in reflections and less natural for them, making education more challenging.

*"Volition oriented" learning profile (zigzagging 1), Students: B, C, F, N, Q.* Students start reflecting with different profiles, but during the learning process volition gets stronger and declarative knowledge decreases. Affection, motivation, and procedural knowledge fluctuate but interact (achieve similar intensity). Students end up reflecting with high affection, motivation, and procedural knowledge, average volition, but low declarative knowledge. These students do not reflect through declarative knowledge. They seem to have high aspirations, they are determined to complete the course but according to them they do not achieve this by increasing their declarative knowledge.

*Chaotic learning profile (zigzagging 2), students: A, G, L, P.* In this profile the learning process is dynamic. Students "jump" and switch between different sub-constructs while reflecting. So, during the learning process they enhanced their reflection profile by entering different combination of sub-constructs. For these students learning pathways are characterized by dynamic interplay; however, they still look for a way to define them.

## Discussion

The purpose of our research was to gain more understanding of how the interplay between cognitive, conative, and affective constructs emerges and changes along reflection-based entrepreneurial learning. Looking at different interactions between sub-constructs and different learning pathways, we may conclude that learning is a dynamic process, but it is not possible to identify its universal dynamics. Students are different and outcomes of pedagogy are different, so entrepreneurship education influences students in diverse ways. However, all sub-constructs are present during the learning process and all are prone to change. Our research shows that the individual constructs alone shed no light on the interplay between different constructs, but rather that the interplay between sub-constructs should be taken into consideration as well. This seems to be particularly true for cognition, as procedural and declarative knowledge have very different profiles. Procedural knowledge emerges together with emotions, motivation, and volition, whereas the profile of declarative knowledge is individual, and its role is different. The unique profile of declarative knowledge in students' reflections is an important finding as declarative knowledge is regarded as the center of higher education and current pedagogic practices.

For educational practice, our finding of a high intensity of procedural knowledge during the scientific course is interesting, and it may be interpreted to mean that learning scientific declarative knowledge starts with adopting it in practice. In this sense, learning by doing might have a broader meaning in whatever type of teaching intervention we decide to implement.

Interestingly, we found that emotions play significant role in learning. Emotions interact with all sub-constructs except declarative knowledge. Thus, emotions cannot be ignored if we want to understand the learning process and their roles in making evaluations and judgments. Emotions have to be included as a part of pedagogy. It may mean that in teaching endeavors we should create more emotional experiences for students and pay attention to their values, beliefs, and attitudes (and their changes).

We found that declarative knowledge and affection have quite opposite profiles, and that there is a group of students who, in order to understand entrepreneurship as a domain

of knowledge, start to reflect through declarative knowledge and use affection less. However, we have to be conscious that this result might be biased, as it may be the consequence of reaching more abstract understanding.

We also found that that individual changes matter in the learning process. Uniqueness and sophistication of students' learning pathways and profiles during entrepreneurship education probably inhibit creation of universal teaching and learning methods, but in the context of entrepreneurship they are important to experience, as the dynamics of the learning process correspond to the essence of entrepreneurial processes. It has to be noted that we could not use course grading as an indicator of how well students succeeded in their performance. Students could constantly improve their grading during the learning process; also some of the evaluated assignments were the result of team work. As a criterion to evaluate the contribution of our study, we lean on Stebbins' (2001) definition of the aim of explorative research and limited exploration. Thus, we should have succeeded to explore, reveal, and generate ideas emerging from the data to discover new patterns and relationships focusing on the interplay between cognitive, conative, and affective constructs. The results of this analysis indicate that it is possible to study the complex and dynamic interplay between sub-constructs of cognitive, conative, and affective constructs. Moreover, we succeeded in identifying both individual variations and general reflection patterns and changes in these during the learning process. This was possible by adopting a longitudinal explorative research approach with SOM analyses.

## Implications and suggestions for future research

The implications for entrepreneurial learning research are threefold: for theory, further research, and the practice of teaching entrepreneurship. First, our study broadens the understanding of reflective practices in the entrepreneurial learning process and the interplay between affective, cognitive, and conative sub-constructs and reflective practices in entrepreneurship education.

Our findings clearly indicate the need for further research on the interplay between sub-constructs and students' reflection profiles. Also, promising exploration with SOM encourages us to develop its adaptation further in the future. We see the study as an attempt to apply an exploratory statistical method for the problem in question and evaluate if such an approach can yield interesting hypotheses for further study. Results of our study raise several questions for future research. For example, the question remains whether these different profiles lead to differences in the grading, whether some are more successful than others. Thus, future research could be to confront identified profiles with students' performance during courses. However, in this particular group of students under study there are no essential differences in grading due to the fact that after submitting their first versions of the assignments they were coached to improve them if needed or wanted and usually students were more than eager to improve their work. This process reduced the variation in grading. Thus, differences rather indicate the genuine differences in students' reflections and thus their learning, rather than differences in modules and their ability to reflect on their learning.

Finally, the results are able to advise pedagogy. Practical implications concern the need to develop reflective practices in entrepreneurial learning interventions to enhance all three meta-competencies, even though there are so far no irrefutable findings to indicate that some types of reflection may be better than others.

Our results support the most recent stream of research that highlights the need for a better understanding of the interplay between cognitive, affective, and conative constructs, and reflective practices in entrepreneurship education. Thus, our results add to our knowledge of the complexity of these processes with some suggestions for further research on these interactions.

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