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Assessment of Entrepreneurship Education: Design, Learning and Objectives

Doctoral Thesis

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Summary

This thesis explores the assessment of entrepreneurship education at the university level. The development of entrepreneurship education has led to the introduction of new and progressive designs in which action-based learning, experienced-focused activities and real-life involvement are central. Moreover, since entrepreneurial competencies have been accepted as useful and applicable for many disciplines and in a number of situations, entrepreneurship has expanded out of business schools and into many other university departments worldwide. However, while there have been significant developments in entrepreneurship education itself, its assessment methods have seen less development during the same period.

Therefore, the purpose of this thesis is to explore the assessment of entrepreneurship education. The focus is especially placed on educational design, where student involvement, in addition to real-world interaction, stand central because both factors are expected to influence student learning. These factors and influences are also expected to affect the assessment of entrepreneurship education, depending on the specific objectives of various educational programmes and the assessment methods applied.

The aims of this thesis are investigated through four articles, three of which are empirically based and where one is a literature review. In the theoretical framework of the cover essay, experiential learning and situated learning theories are central and are applied in the analysis of the findings obtained from the studies conducted in these four different papers. The results of the analysis and the revised conceptual framework are used to discuss the assessment literature of entrepreneurship education. Furthermore, the thesis' uses mixed methods to answer the research questions, including both qualitative and quantitative methods.

The first paper presents an entrepreneurship education literature review. The purpose of this paper is to systematise entrepreneurship education so that future assessment research could compare and use the results of different studies more easily. A total of 122 articles were included in the review, resulting in an investigation of 42 educational programmes presented in 41 articles. The results of this paper show a typology of entrepreneurship education, discriminating on the learning approach, but also on the outcome impact of an

educational programme—whether it is influencing the students only or whether the context is also influenced.

The second paper builds on the findings of the first one and investigates the designs of various entrepreneurship-education programmes through empirical case studies. In total, 10 Nordic universities were visited and 32 interviews with faculty members were conducted. The interviews, together with information from the universities' web sites, provided insights into and knowledge about the education offered by different institutions, which was the basis for a taxonomy of entrepreneurship education. The analysis identified two axes in the taxonomy—the first labelled educational approaches. This span—from teacher-directed through participatory to self-directed learning—is semi-hierarchically organised, meaning that it is necessary to achieve a balance of different approaches in an educational setting. Additionally, regarding the second axis, the education is here classified with respect to its action realness, which indicates to what extent it is imitating or interacting with the real world.

The third paper investigates a specific venture creation programme during which students develop their own start-ups. Here, the primary focus is on the learning process of those students working in their own start-ups in comparison to those who do not. By applying the Zaltman Metaphor Elicitation Technique (ZMET) as a method, this paper is able to dig deep into the different students' perceptions about their education and to create mind-maps that illustrate differences between the two groups of students. The main finding of this paper is that the students' learning process is influenced by their start-up activities, regardless of whether they have a start-up or not. The social milieu and culture are shaped by the start-up activities and, whereas the milieu and culture are viewed as facilitating the start-up activities of those students in start-ups, the start-ups are viewed as facilitating the milieu and culture for the students without start-ups. Thus, the social milieu and culture create a complex learning situation and influence students differently.

The fourth and last paper investigates the outcomes of the same venture creation programme that is discussed in the third paper. The focus here is placed on the influence of the programme on its alumni's entrepreneurial careers. By collecting information about 178 students (108 programme graduates and 70 non-programme graduates) using

LinkedIn, telephone interviews and survey responses, their entrepreneurial careers were mapped. The potential-outcome models of these graduates, in terms of multiplicity, duration and emergence, were explored and the programme enrolment process was controlled for by applying 'Wooldridge's double-robust' estimator to the model. The findings show that graduates from the programme, on average, involved themselves in several simultaneous entrepreneurial activities (multiplicity) and were engaged in their start-ups for a longer duration. The investigation of graduates' reasons for entering into entrepreneurship gave inconclusive results.

This thesis contributes to entrepreneurship education assessment literature with knowledge about the potential influences of educational design and contextual influences on the assessment results. It also contributes with knowledge and insights on how education in entrepreneurship and its assessment should be designed with respect to student involvement and real-world interaction. Regarding student involvement, the thesis argues for a balance in educational design and discusses the influence of the timing of the different educational approaches in light of assessment. Furthermore, the thesis finds that uncertainty resulting from interaction with the real world is a source for authentic and real experiences, important for student learning; however, the inherent uncertainty might inhibit student learning, as well as influence the students' emotional characteristics, both of which pose issues for assessment practices. Finally, in terms of educational programmes that are more student-driven, with student-centred designs and much real-world interaction, such open-endedness makes the assessment of these educational programmes more challenging.

Furthermore, the thesis has implication for entrepreneurship education design, where the question of time is central and a balance between educational approaches and action realness is required. The thesis has also implications for researchers, stressing the importance of a balance in assessment methods and outcome measures with respect to the design and objective of the educational programmes being assessed. Regarding policy is the thesis clear that assessment of educational programmes based on single outcome measures might fail to grasp the actual situation of programmes. As education in entrepreneurship become more open-ended, policymakers should support and seek new assessment methods and approaches to obtain insights in the educational effects.

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x

Table of Contents

Figures and Tables

List of Figures

List of Tables

Part 1: Cover Essay

1. Introduction

This thesis explores assessment of entrepreneurship education and how educational designs, in terms of student involvement and real-world interaction, influence assessment results. Entrepreneurship education has been increasingly supported by policymakers and other stakeholders (Mwasalwiba, 2010) and a growing number of entrepreneurship education programmes has been established in recent decades (Katz, 2003; Kuratko, 2005). Along with this trend, new types of entrepreneurship education have also emerged in which more action-based, progressive, discipline-spanning or novel educational types are being tested and occur in growing numbers (Mwasalwiba, 2010; Neck and Corbett, 2018; Neck and Greene, 2011). However, the exploration of and increase in programmes in entrepreneurship demands resources, with a recurring question from funders about their effectiveness (Fayolle et al., 2006; Mwasalwiba, 2010). Hence, with the increase of entrepreneurship education programmes, regarding types, amounts, and disciplines in which they are introduced, the number of and need for assessments have also increased (Longva and Foss, 2018). Educational assessment is defined here as a systematic collection, review and use of information, which is 'required for external accreditation and accountability [and] provides data that are used internally for quality assurance and improvement purposes' (Duval-Couetil, 2013: 395). However, while the literature on entrepreneurship education assessment has seen a prominent increase in the number of publications, the development of new assessment methods or approaches that are adapted to new educational designs nevertheless somewhat stand still (Longva and Foss, 2018; Nabi et al., 2017; Rideout and Gray, 2013). Thus, with the developments in entrepreneurship education, the assessment methods in this field also deserve to be developed to fit the new approaches.

In the literature on the assessment of entrepreneurship education, previous attempts have been made, aiming at exploring the direct effects of an education programme. For instance, some studies have explored the number of self-employed (Premand et al., 2016) or start-ups created by recent graduates (Åstebro et al., 2012; Dahlstrand and Berggren, 2010). However, as there is an assessment challenge presented by the time lag between graduation and potential entrepreneurial action, there are for the most studies that try to cope with this issue by applying alternative assessment methods (Duval-Couetil, 2013).

Examples here include investigations of students' opportunity recognition knowledge (DeTienne and Chandler, 2004) and entrepreneurial intentions (Bae et al., 2014). In addition, some scholars have used methods by which the courses or programmes are assessed through investigations of the programmes' features, e.g. matching of curricula to the expectations of markets (Miller et al., 2012). As such, the field has introduced and implemented different ways to assess entrepreneurship education in certain situations.

When looking at historical development and contemporary situation of entrepreneurship education, some of the current educational designs also present assessment challenges. Initially, the focus of entrepreneurship education was on new venture creation and small business growth (Gartner and Vesper, 1994; McMullan and Long, 1987) and the relevant courses and programmes were mostly found at business departments of universities (Gartner and Vesper, 1994). However, since entrepreneurship education could be relied on for its ability to foster entrepreneurial skills and competences applicable to different situations and disciplines (Blenker et al., 2011), several other departments at various universities have introduced entrepreneurship education programmes to their students. In addition, recently, more action-based entrepreneurship education programmes have emerged (Rasmussen and Sørheim, 2006), focusing on simulation (Pittaway and Cope, 2007b) and real venture creation (Lackéus and Williams Middleton, 2015). Moreover, there has also been an increase in collaboration with actors outside the educational setting. While Lackéus and Williams Middleton (2015) give an example of collaboration using a technology transfer office, others collaborate with local industries (Stone et al., 2005) or allow students to work as entrepreneurial interns in local firms (Creed et al., 2002). Through such approaches, students now have an active role and their education is more student-centred than teacher-led (Robinson et al., 2016), with an additional focus on reflection and life-long learning (Hägg and Kurczewska, 2016; Neck and Greene, 2011). However, these various designs and real-life experiences could also make students learn differently (Kassean et al., 2015; Robinson et al., 2016); nevertheless, assessment methods are applied and compared uncritically between various educational programmes.

Hence, with the expansion of entrepreneurship education into new disciplines that have different focuses and designs, as well as additional goals and objectives, several challenges arise regarding assessment. Prior research has already identified some issues

with entrepreneurship education assessment—for instance, when it comes to the quality of studies (Longva and Foss, 2018; Rideout and Gray, 2013). Other issues are more specific, dealing with different approaches and methods—e.g. the problem with the self-reporting of self-efficacy measures (Koellinger et al., 2007) or the difficulty with the selection process of study participants (Westhead et al., 2001). Nevertheless, perhaps the greatest challenge lies in the fact that there are conflicting results from similar studies in the field—e.g. when investigating students' entrepreneurial intentions (Bae et al., 2014). This might have a basis in the heterogeneity that is found among the students, faculty and institutions in the field (Duval-Couetil, 2013). For instance, the conflicting results could be due to inherent differences between students in different disciplines (Nabi et al., 2010); however, the challenge presented by varying contextual influences is also a question that has received calls for more attention (Nabi et al., 2017).

Therefore, with the broad development of educational approaches, as well as the differences in objectives, foundational ideas and students who are offered entrepreneurship education, scholars have also called for developments in the assessment literature (Duval-Couetil, 2013; Nabi et al., 2017; Rideout and Gray, 2013). The exploration of educational programmes is especially central in these calls because their design influences student learning. For instance, the students' action level is of interest because different educational approaches generate different learning (Robinson et al., 2016). Moreover, the educational programme's interaction with real-world actors is also expected to give the students experiences that enhance their learning (Kassean et al., 2015). However, the level of interaction with the real world could also influence the experiences and student learning (Kassean et al., 2015; Nab et al., 2010) but this is less explored in the literature. On the other hand, the objectives of different educational programmes also need a central place in assessment. Since results from assessments are used by the public and policymakers to make different decisions (Vesper and Gartner, 1997), it is important that the educational programme's objectives and the assessment measures or approaches are a good fit (Duval-Couetil, 2013).

Thus, an educational programme's design, in terms of real-world connection in addition to students' place within it, is of particular interest when it comes to the assessment of entrepreneurship education. These two topics have seen an increase in interest and

development in both practice and literature. However, an educational programme's design is also central concerning the objectives that are aimed to be achieved. Hence, the overarching research question of this thesis is split into three parts, with one main question followed by two sub-questions:

> *How does an educational programme's design influence the results of the assessment of entrepreneurship education?*

> > *How does an educational programme's interaction with real-world actors influence the results of the assessment of entrepreneurship education?*

> > *How does the students' action level influence the results of the assessment of entrepreneurship education?*

Educational programme here refers to 'a collection of educational activities which are organised to accomplish a predetermined objective or the completion of a specified set of educational tasks… Educational activities can be courses … organised into programmes or free-standing courses. They can also include a variety of components … for example periods of work experience in enterprises, research projects and the preparation of dissertations' (OECD, 2017: 69). In addition, the *entrepreneurship education* here are limited to higher education. Moreover, the term *design* here has two focuses. One places educational programmes on a continuum between traditional and action-oriented education (Mwasalwiba, 2010) and, thus, between teacher-led and student-centred education (Robinson et al., 2016)—i.e. the *students' action level*. The other looks at whether they have an in-class design or are designed more towards engaging with external factors and the real world (Kassean et al., 2015; Macht and Ball, 2016)—i.e. the *interaction with real-world actors*. The term *influencing* here indicates the factors or consequences of various educational designs, which could be of importance and unintentionally alter outcomes when using different, specific assessment approaches. Culture is one example that is 'likely to exhibit interaction effects with other impact factors' (Nabi et al., 2017: 291).

The research questions are addressed through studies presented in four research papers—one of which is a literature review while the other three are empirically founded. The overall results and findings provide three core contributions. First, educational design, in

terms of being teacher-led vs student-centred, influences assessment in two ways. In student-centred education, the faculty relinquishes control over the activities that students conduct. In addition, there should also be a balance between teacher-led vs student-centred educational approaches; however, this would also have an effect on the time spent on the different approaches and, furthermore, on what can be expected from different educational programmes. Second, the collaboration and interaction with the real world increases uncertainty in an educational programme and students might miss opportunities and be inhibited in their educational activities. Consequently, their experiences will differ and influence their individual learning. Third, by striving for educational programmes that have more student-driven, with student-centred designs and focus on collaboration and interaction with the real world, the more open-ended the education becomes. This means that the assessment methods applied today struggle in analysing the results and cannot definitively ascertain what factors are actually influencing the results.

Hence, this thesis has several implications for entrepreneurship education, research and policymakers. First, in terms of entrepreneurship education design, faculty should strive for a balance in the design—different approaches on the student-teacher-centred continuum should be combined and real-world interaction should be complemented with more in-class activities. Second, in connection to the first, different designs should be assessed with combinations of different methods and measures. More research on different methods and their interconnectedness in different educational approaches should also be conducted. Third, when assessing entrepreneurship education, policymakers should combine a few different outcome measures on which they base their conclusions.

The thesis is organised in the following manner. The second chapter presents the findings of a literature review on assessment in entrepreneurship education. The third chapter introduces the theoretical framework applied in the thesis. The fourth chapter focuses on the methodology used in this thesis and its different papers. The fifth chapter presents the four research papers, which is followed by a section that analyses their results in light of the theoretical framework. These findings and implications for theory are then discussed against a backdrop of current literature on entrepreneurship education assessment in chapter seven, before the eight chapter concludes the work and presents its implications.

2. Assessment in Entrepreneurship Education

The following chapter presents an entrepreneurship education assessment literature review, with a special focus on the outcome measures applied. The amount of literature on the assessment of entrepreneurship education has been increasing recently and different measures of or focuses on assessment have developed in this period (Duval-Couetil, 2013; Nabi et al., 2017). A central point in this development are the increasing variations of objectives that different educational programmes aim towards and which of these objectives the assessment literature tries to measure. Fayolle and Gailly (2008) propose that evaluation criteria and methods should be aligned with the objectives of the educational programmes assessed but also indicate that this should be defined for *each* educational programme in order to have a correct and effective measurement. The result of this is a massive body of literature with a variety of outcome measures (Nabi et al., 2017), where the 'evaluation criteria can be related to specific knowledge, specific skills and tools, level of interest, awareness or intention, degree of participation in the classroom or motivation, etc., based on what the programs' organizers want and are able to measure' (Fayolle and Gailly, 2008: 577). Thus, the outcome measures here are dependent variables that are used as main assessment measures for different educational programmes. As mentioned, the outcome measures are central in providing results for the public and policymakers on which they can base their opinions (Vesper and Gartner, 1997) and, therefore, the outcome measure-objective-fit is central and important in the literature on assessment of entrepreneurship education.

Consequently, the following literature review focuses on the outcome measures of assessment literature, exploring what the studies applying these different measures have contributed to the body of literature and how they assessed specific objectives. As the question in this thesis revolves around student learning and their learning situation, different measures need to be organised to obtain a clear overview of how they fit into an educational programme's design, learning situation and objectives. However, as stated by Nabi et al. (2017), there is no single assessment measure in entrepreneurship education

and the timing of the different measures applied might vary[1]—thus, several different classifications of measures applied are also found. The different classifications could be based on cognitive, skill-based, affective, conative or behavioural outcomes (Longva and Foss, 2018), on different operational levels (Nabi et al., 2017) or on courses, programmes or focused instruments (Duval-Couetil, 2013). In the following, Longva and Foss' (2018) classification of outcome measures is adopted in order to separate the various studies and articles in the review. However, while Longva and Foss (2018) explored different methodological approaches in different studies, this review focuses on the contribution and fit between the outcome measures and the objectives in different articles.

Table 1 shows the outcome measures and their constituents, which are used to organise the literature review in addition to the number of articles in the review that apply to the different outcome measures. While some of the articles used several different measures in the same study, they are still placed in only one of the outcome measure categories below. The focus of the article and the stress it placed on different outcome-measure findings are the factors used for deciding into which group each article is placed.

Table 1 - Number of articles in the literature review that applied different outcome measures. Outcome measures are adopted from Longva and Foss (2018).

Outcome measure categories	Outcome measures' constituent	Number of articles
Cognitive	Comprehension about entrepreneurship; business basics; need for achievement; proactiveness; self-esteem; risk propensity.	18
Skill-based	Business modelling; opportunity recognition; creative thinking; teamwork.	16
Affective	Passion/inspiration; attitude to entrepreneurship; subjective norm.	6
Conative	Entrepreneurial intentions; entrepreneurial self-efficacy.	21
Behavioural	Nascency; venture creation; intrapreneurship; social entrepreneurship; employability.	4

To be able to compare different articles in these groups, the information about different educational programmes and studies is systematised based on: either the education's or article's objective, the education explored, the specific outcome measures applied and the

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[1] A central issue in researching and reviewing assessment in entrepreneurship education has been that some actions and results of an entrepreneurial character often occur after a significant time lag or can only be measured during the educational process (Fayolle and Gailly, 2008; Nabi et al., 2017).

article's main findings. This information is summarised in several tables found in upcoming sections, which present and explore different outcome measures, and these tables have a format similar to Table 2—which also presents different criteria used to sort the articles. The tables summarising the articles are presented following the review of different outcome measures.

Table 2 - Article focus and education characteristics explored in the literature review.

Article	Education/Article Objective	Description of Education	Outcome Measure	Main Findings
Author(s), publication year	Based on Mwasalwiba's (2010) classification of objectives: 1. Start-up and job creation. 2. Stimulate entrepreneurial skills. 3. Increasing entrepreneurial spirit/culture/attitude.	The five points used in the description and in the following format: - Whether the educational programme is 'about', 'for' or 'through' entrepreneurship, using Pittaway and Cope's (2007b) definition. - The educational programme's duration. - Students' background(s). - Context/nation. - Short qualitative description of the educational programme.	What outcome measures are applied, from Longva and Foss (2018), presented in Table 1 above.	As stated in the articles' abstract, conclusion or main findings.

In the next sections, different groups of articles in different outcome-measure categories are elaborated upon in terms of their focus, findings, objectives and assessment assumptions, which lay a foundation for assessing an educational objective through different outcome measures. The first group of articles consists of articles that applied cognitive outcome measures.

Cognitive Outcome Measures

Table 3 presents articles that applied cognitive outcome measures, including student comprehension of entrepreneurship, business basics, need for achievement, proactiveness, self-esteem and risk propensity. The first observation from the literature identified in Table 3 is that there are some studies that applied 'entrepreneurial orientation' as a measure, which is not clearly presented in Longva and Foss' (2018) original classification. However, as the articles that apply this measure (i.e. Marques et al., 2018; Nshimiyimana et al., 2018) defined it as being aligned with cognitive measures (e.g. risk propensity), it is included in this section.

Furthermore, in terms of objectives presented in different articles, the majority focused on either start-up creation or stimulation of entrepreneurial skills among students. However, while four different articles' entrepreneurship education programme could be classified as aiming towards increasing their students' entrepreneurial spirit, cultures or attitudes, two of these four articles included this objective in addition to the objectives of start-up creation and stimulation of entrepreneurial skills. Hence, entrepreneurial action and utilising entrepreneurial skills are the objectives identified in the majority of articles that apply cognitive outcome measures.

Regarding educational programmes assessed in different studies, it is clear that most are of a rather short duration—in those programmes in which the duration could be identified both in terms of their time span or accumulated time. The two longest and most extensive educational programmes spanned from five months (Saukkonen et al., 2016) to several years (Stone et al., 2005) but, at the same time, they consisted of several modules or courses in a specialisation track. Hence, the majority of the educational programmes examined in these articles were modules or courses and no full master or bachelor programmes were identified. Moreover, few of the educational programmes could be identified as 'through' courses, but rather as approaches using the educational designs 'about' or 'for'. The courses that applied the 'through' approach appear to have a somewhat longer duration compared to the 'about' or 'for' ones. Thus, for the literature on assessment, this means that there is little knowledge about cognitive outcomes for educational programmes 'through' entrepreneurship as well as for those with a longer duration.

Students who participated in various educational programmes came from different backgrounds, although most studies focused on business or science/engineering students (i.e. in 11 of 15 articles in which student disciplines could be identified). In the studies, students were often limited to one group in terms of disciplines, with few exceptions, and only a few articles that applied cognitive outcome measures compared different groups of students.

When it comes to the educational approaches and designs, this is to a lesser degree elaborated on in the articles. The majority appeared to use traditional approaches, as

identified by Mwasalwiba (2010), although this is hard to verify due to a lack of course descriptions. However, there are some exceptions—for instance, the educational programme described by Verzat et al. (2017) in which students were 'self-directed' in the different teams, giving the students freedom and control over their learning situation. Another is presented by Saukkonen et al. (2016), where students worked together with entrepreneurs on the entrepreneurs' issues, as well as by Stone et al.'s (2005) study of a programme in which students worked in 'enterprises' to help and collaborate with local industries. Hence, some educational programmes offered more action-based educational designs (Mwasalwiba, 2010; Rasmussen and Sørheim, 2006) but the literature is rather limited when it comes to exploring the more action-oriented designs' influence on students' cognition.

In terms of results in these articles, the majority aimed at assessing specific pedagogical methods and their effect on students using cognitive outcome measures (e.g. Faherty, 2015; Kenny, 2015). However, differing results and conclusions were drawn from different studies. Some articles concluded about whether entrepreneurship could be learned and how it should be learned by students from faculties other than business schools (Dube et al., 2015; Marques et al., 2018; Morselli, 2018) and some indicated that certain approaches influenced certain qualities more than others (Harms, 2015; Stone et al., 2005; Venesaar et al., 2011). Other studies found that some educational approaches were preferred in comparison to others (Verzat et al., 2017) and a few articles tested new measures or research methods for future assessment (Welsh and Tullar, 2014). In addition, several articles focused on entrepreneurship education in general or did not describe the educational programme they assessed—thus concluding for entrepreneurship education in general. Therefore, in terms of assessment literature in general, the group of articles dealing with cognitive outcome measures contributed prominently with direct effects on students' cognition from different pedagogical approaches.

The studies used surveys to a high degree and were quantitative in their approach when exploring different educational programme's outcome measures. While some used a mixed method approach, only Kenny (2015) and Schilling and Klamma (2010) approached assessment in a purely qualitative matter. Thus, the majority of the studies explored their questions through questionnaires or similar tools, with students self-

assessing their own knowledge or capabilities after completing the courses. Moreover, with some of the studies presenting interesting and what appear to be solid methods, the methodological rigour of the studies was of a varying degree, especially in terms of pre- and post-test and control groups, a trend that was found in other previous reviews (Longva and Foss, 2018; Rideout and Gray, 2013).

In terms of the objectives that different educational programmes and articles present and how the results and applied measures justified them, it is proper to view different objectives independently. Regarding start-ups and job creation, the articles often argued that certain knowledge is necessary to be able to operate a start-up and that certain capabilities should be developed. For instance, Venesaar et al. (2011) argued that certain cognitive approaches and thinking among entrepreneurs influences their performance and their chances of being an entrepreneur to begin with. Hence, cognition should be changed through entrepreneurship education to enable development of new start-ups and create jobs. Thus, receiving positive feedback from students upon the end of a course would imply that they obtained necessary knowledge or developed their traits (e.g. Othman and Nasrudin, 2016)—or perhaps the students themselves would directly report that their knowledge or traits have changed (e.g. Saukkonen et al., 2016)—so that future entrepreneurial activities would manage to create new start-ups or jobs.

On the other hand, for articles that focused on the stimulation and development of entrepreneurial skill, the idea is that certain cognitive processes and knowledge should be developed because these are antecedents for skill development. For instance, Faherty (2015) states that entrepreneurial skills are developed through a process and that personal development and life-long learning is central to it—with self-esteem influencing the stimulation of entrepreneurial skills. Hence, students need to develop their traits and knowledge of how to apply their developing skills to be able to develop and stimulate their entrepreneurial skills. Furthermore, it is also clear that, in the studies in which the objective of entrepreneurship education was the stimulation of entrepreneurial skills alone, the educational programmes explored had students from disciplines not commonly associated with entrepreneurship, such as publishing and medical and educational sciences (Dube et al., 2015; Faherty, 2015; Morselli, 2018), or the programme focused on social entrepreneurship (Miller et al., 2012). These also appeared to focus more on

education 'about' entrepreneurship rather than on educating 'for' or 'through' entrepreneurship. Hence, the stimulation of these skills occurred through traditional educational approaches and the argument here was that, with this stimulation, students would develop their entrepreneurial skills and utilise them in various professions that they enter upon graduation.

Hence, regarding cognitive outcome measures, the articles applying them illustrated that entrepreneurship education has an influence on students' cognitive capabilities and that these capabilities are meant to be applied in future venturing activities and as a basis for further skill development. However, the measures are often explored through self-assessment and with varying methodological standards.

Table 3 - Articles applying cognitive outcome measures in entrepreneurship education assessment.

Article	Education/Article Objective	Description of Education	Outcome Measure	Main Findings
Marques et al. (2018)	Start-up and job creation	- N/A - N/A - Business, social sciences and engineering - Portugal - N/A	Entrepreneurial orientation	'The two most striking findings of this study are: (1) females reveal more proactivity; and (2) EE has no impact on engineering students, in contrast to the findings of other studies ...' (p. 66)
Morselli (2018)	Stimulate entrepreneurial skills	- About - Three months, seven lessons, each two hours in length - Educational sciences - Finland - 'The teaching methods I used in class were lectures, group work and peer review.' (p.127) Homework tasks.	Need for achievement; Proactiveness; Risk propensity	'This paper shows how a course on entrepreneurial education can be taught at tertiary level in faculties other than economics or business schools... Building on research on constructive alignment, this paper has concentrated on the effect of the course in terms of learning outcomes related to a sense of initiative and entrepreneurship' (p. 131)
Nshimiyimana et al. (2018)	Start-up and job creation	- For - Seven days - Science major students - Rwanda - 'As the module was new to non-business major students, theoretical approaches focusing on business planning and class discussions and case studies alone were not sufficient. Other approaches were needed for developing their entrepreneurial thinking and learning including but not limited to action-learning which is similar to approaches science students are used to.' (p. 152)	Entrepreneurial orientation	'Research findings of this study have contributed to the exploration of the influence EE can exercise on students' EO... Students fear to be autonomous (partially explained by a lack of exposure to market) but are eager to innovate and compete ... The experiment of the module at three distinct departments provided good signs of progress in students' creative thinking, personality assessment and development and, finally, entrepreneurial learning.' (p. 158)
Dzisi and Odoom (2017)	Start-up and job creation; Stimulate entrepreneurial skills; Increasing entrepreneurial spirit/culture/attitude	- About - N/A - N/A - Ghana - N/A	Comprehension about entrepreneurship	'The content of entrepreneurship education and the pedagogy as used in the polytechnics and other higher educational institutions need to be revised periodically, to ensure that entrepreneurship courses, materials, and research are of high quality to include more of practical skill development in students and be more adaptive to their local ecosystem.' (p. 450)

13

Article	Education/Article Objective	Description of Education	Outcome Measure	Main Findings
Verzat et al. (2017)	Stimulate entrepreneurial skills; Increasing entrepreneurial spirit/culture/attitude	- About/for - Seminar of 15 hours distributed over five sessions - Business students - France - 'The aim of the seminar is to instil entrepreneurial attitudes and behaviours in students.' (p. 986) Using self-directed learning approach as treatment, and applying a teacher-directed learning approach for the control group.	Proactiveness	'In this empirical study we have demonstrated that proactivity can be developed thanks to a specific teaching approach (Self Directed Learning), which gives freedom and control of the learning process to student groups working together in a creative mode.' (p. 1008)
Othman and Nasrudin (2016)	Start-up and job creation	- N/A - N/A - Business students (50 percent), and other students - Malaysia - N/A	Comprehension about entrepreneurship; Business basic; Passion/inspiration; Self-esteem	'This paper analyzed the results of a survey to answer the question, "How do students evaluate the four instructional dimensions of content, method, facilities/infrastructure, and time organization?" The analysis revealed that students were satisfied with the program's content and delivery methods.' (p. 895)
Saukkonen et al. (2016)	Start-up and job creation	- Through - Semester - Business students - Finland - A special module where students are working together with entrepreneurs on the entrepreneur's business, and they get guidance from coaches. Several courses in the module.	Self-esteem	'[E]ntrepreneurial skills critical to start-up success can be disseminated in a collaborative mode, in which normally distinct categories of learners – science and technology-based entrepreneurs and undergraduate business students – are trained in a collaborative, team based and facilitated learning environment.' (p. 236)

14

Article	Education/Article Objective	Description of Education	Outcome Measure	Main Findings
Dube et al. (2015)	Stimulate entrepreneurial skills	- About - Two week module - Medical students - UK - 'Enterprise skills development, including time management, communication, leadership, and presentation, was explicitly included as a common requirement across all topics. The supervisors received specific training and support on how to embed and teach enterprise skills within this specific course component. Assessment includes a reflective diary in addition to a written report or presentation reflecting the topic area. The written work explicitly requires the consideration of skills acquired around enterprise learning and is included within explicitly articulated assessment criteria, provided before choosing the topic, and within course information documentation.' (p. 64)	Comprehension about entrepreneurship; Business basic; Self-esteem	'Immediately after course completion, students gave positive feedback, identifying the development of independent learning, creativity, and reflection, as these enterprise skills were most valued. However, in subsequent reflection one year later, they were unable to transfer the acquired knowledge and identify the examples of enterprise around them in their later experiences and had mixed beliefs about its value in medicine.' (p. 63)
Faherty (2015)	Stimulate entrepreneurial skills	- About/for - Semester - Publishing students - UK - 'The course exhibits many generic characteristics of creative programmes, as identified by Carey and Matlay (2010), such as experiential, project-based and work-based learning, peer critiques and instructors who are also practitioners. Module assessments include a market analysis report, written business proposal and a critical reflection on the business planning process. A peer-assessed oral presentation was designed in order to assess the specific enterprise learning outcome: "to deliver persuasive presentations to win support for a business proposal within an organisational context".' (p. 294)	Self-esteem	'From an analysis of student views in a specific context, the implementation of summative peer assessment and feedback has been shown to aid development of a key enterprise skill useful in the workplace. Study participants valued the experience and considered that it enabled them to learn from the successes and failures of others, while enhancing their ability to present to and influence colleagues.' (p. 299)

15

Article	Education/Article Objective	Description of Education	Outcome Measure	Main Findings
Harms (2015)	Start-up and job creation	- For - N/A - Business and administration students - The Netherlands - 'The key activity of this project-based course was to execute a project following a lean startup-based course outline. The project assignments were given by entrepreneurs who were seeking assistance in customer problem validation, solution development, and solution validation (Maurya, 2012). While the content of the projects differ by group, the deliverables were clearly specified in a course guide. This creates a basis for comparability of the group performance.' (p. 24)	Teamwork; Comprehension about entrepreneurship; Business basic	'This paper has added to the literature on EE in that it shows that self-regulated learning has a positive impact on students' exam scores, but not on other individual and group-based aspects of an entrepreneurship classroom. This seems to indicate limits to the effectiveness of self-regulated learning in entrepreneurship. Another addition to the EE literature is that team learning, psychological safety, and their interaction positively affect group performance.' (p. 27)
Kenny (2015)	Start-up and job creation	- For - 30-week - Rugby athletes - Ireland - 'The CEP's modules were delivered by college lecturing staff and invited guest lectures on specialised topics on a flexible part-time basis (three hours per week)... The programme content focused on the practical application of the concepts and theory in each of the modules. This practical nature allowed the participants to develop their own individual skills and to understand their own strengths in relation to entrepreneurship.' (p. 184)	Comprehension about entrepreneurship; Teamwork	'The findings provide evidence of the entrepreneurial learning needs of professional athletes in career transition and identifies the key elements to be considered when designing an entrepreneurship programme to meet these needs. The findings are presented under the headings context, objectives and outcomes, audience, content, pedagogy, assessment and evaluation.' (p. 175)
Pardede (2015)	Start-up and job creation	- For - Lectures run over 12 weeks - IT students - Australia - 'We emphasise that traditional lecture sessions are still necessary, particularly to teach the theoretical knowledge of entrepreneurship. In addition to lectures by teaching staff, we practise learning by experience by having several entrepreneurship practitioners as guest lecturers.' (p. 643)	Comprehension about entrepreneurship; Business basic; Self-esteem	'In this paper, we have reported our experience of designing the TLAs for a subject that requires students to demonstrate high levels of functioning knowledge. The constraint is that the students have very little prior knowledge of the theoretical components upon which they are required to build further applied knowledge. The subject is an entrepreneurship subject offered for IT students.' (p. 648-649)

Article	Education/Article Objective	Description of Education	Outcome Measure	Main Findings
Welsh and Tullar (2014)	Start-up and job creation	- N/A - N/A - N/A - US - N/A	Need for achievement; Proactiveness; Risk propensity; Passion/inspiration; Entrepreneurial intentions	'We propose and test a measure of entrepreneurial propensity across the curriculum in a successful cross-disciplinary entrepreneurship program at a public state university. Six of the nine entrepreneurship constructs showed statistically significant gains from pre- to post-test scores. Implications for further research and application are discussed.' (p. 95)
Miller et al. (2012)	Stimulate entrepreneurial skills	- N/A - N/A - N/A - US - N/A	Comprehension about entrepreneurship	'[O]ur research contributes to social entrepreneurship literature by exploring differences in how competencies are valued by position and organization types.' (p. 367)
Venesaar et al. (2011)	Start-up and job creation	- About/for - Semester (i.e. total 16 weeks and 48 hours) - Engineering students - Estonia - 'The purpose of the courses was to introduce participants with the concept of an entrepreneurial mindset and widen the horizon of the respective knowledge among students. The content of the course in entrepreneurship and business planning included lectures and exercises, solving teaching cases and writing business plans.' (p. 381)	Need for achievement; Self-esteem	'The analysis of changes among different components of the thinking process (goal orientation, metacognitive knowledge, metacognitive experience, metacognitive choice, monitoring) showed that the thinking process under each component became more systematic after the course.' (p. 387)
Schilling and Klamma (2010)	Increasing entrepreneurial spirit/culture/attitude	- For - Semester (approximately 200 hours) - Computer sciences - Germany - 'During the first meeting, the students were introduced to the basic concept of the course. They selected one of the presented project tasks and formed corresponding project teams (with seven and eight members, respectively). [...] At the end of the term, the students presented an alpha prototype as a feasibility study. The successful development of the prototype was the precondition for the students to pass the course.' (p. 368–369)	Teamwork; Comprehension about entrepreneurship	'Only the goal of giving the students an understanding of entrepreneurship was clearly not reached. Important lectures in the course were missing. The remaining ones obviously were not linked closely enough to the task of the project teams.' (p. 378)

17

Article	Education/Article Objective	Description of Education	Outcome Measure	Main Findings
Del-Palacio et al. (2008)	Increasing entrepreneurial spirit/culture/attitude	- For - Semester - Engineering students - Spain - 'The methodology used for the course is based on the basics of the flexible education system defined by Gibb (1993) which involves 'learning by doing', experience-based learning, the multidisciplinary viewpoint, and encourages the creation of networks and contacts among others. This active methodology used for the training enables the students to not only acquire a global knowledge of business, traditionally linked to rationality, predictability and to tried and tested methods (Garavan & O'Cinneide, 1994), but also develop entrepreneurial, creative and proactive skills.' (p. 943)	Comprehension about entrepreneurship	'The results proved that students perceive both the courses and the professors of the Innova Programmes' educational courses to be of high quality compared with other courses at the university. The items related with the dynamism and enthusiasm of the professors, and also with the frequent interaction possibilities, were the most highly rated.' (p. 949)
Stone et al. (2005)	Start-up and job creation; Stimulate entrepreneurial skills;	- Through - Three-year experience - Engineering students - US - 'The curriculum is two-pronged and consists of (1) participation in the operation of a business (project work) and (2) completion of concentrated course material (instructional modules) designed to provide key information, processes and skills required for effective management of a viable business.' (p. 214)	Comprehension about entrepreneurship; Business basic; Teamwork	'By working together in a business-like setting, teams of students from every part of campus are not only enhancing their technical skills through the application of engineering concepts and practices, but are also developing a working understanding of the issues surrounding start-up and operation of a business, including the social, environmental, and economical concerns. Working in this environment, they see the value of communication skills, teamwork, and life-log learning.' (p. 220)

Skill-based Outcome Measures

Studies that focused on skill-based outcome measures (business modelling, opportunity recognition, creative thinking and teamwork) are presented in Table 4. The first important feature of this group of studies is that none of the articles nor the educational programmes they discussed focused on increasing entrepreneurial spirit, culture or attitude. Half of the articles' objectives were start-ups and job creation and the other half focused on stimulating entrepreneurial skills, with some focusing on both. Thus, in terms of students' entrepreneurial skills and measures of changes in these skills, the assessment literature has few articles whose objective was to influence students' attitude, spirit or culture.

Regarding the educational programmes explored in these articles, few looked at educating 'about' or 'through' entrepreneurship, the majority focusing on educational programmes 'for' entrepreneurship instead. The majority of the educational programmes discussed lasted for one semester or more, with few exceptions of shorter duration. The shorter-duration programmes aimed at stimulating students' entrepreneurial skills rather than at creating start-ups or new jobs.

In terms of student backgrounds in various educational programmes, where this information could be identified in the articles, the majority of students in the studies were from engineering or business and management fields, however, there were also students from disciplines like ceramics and textiles. In addition, many of the programmes were interfaculty or multi-disciplinary.

When it comes to the educational design, many programmes appear to have somewhat traditional approaches, with a few being more action-oriented. The latter have students work in teams or groups using more hands-on activities. For example, some focused on self-directed learning (Lindberg, Bohman and Hulten, 2017; Lindberg, Bohman, Hulten, et al., 2017) and others on simulations (Eggers et al., 2017; Pittaway and Cope, 2007b), while some aimed at giving students some sort of action-oriented education (Chau, 2005; Lassen and Nielsen, 2011; Ohland et al., 2004). Some of the educational programmes also included external individuals in the work assigned, for instance entrepreneurs in an active role (Collins et al., 2006), and where these external individuals were customers, problem-owners or consultants and mentors (Chau, 2005). Thus, the educational programmes

assessed through skill-based outcome measures were somewhat similar to those assessed by cognitive outcome measures. The former group of articles gives insights into both traditional and action-oriented education 'for' entrepreneurship. However, while 'about' entrepreneurship might be less present in this group—for perhaps obvious reasons—little knowledge is obtained about the effect from education 'through' entrepreneurship on students' entrepreneurial skill development.

Exploring the findings and results from the included studies and articles, it is found that almost all explored an approach or pedagogy and its effect on students' different entrepreneurial skills. An exception is Baggen et al. (2018), who focused on developing a test for the future assessment of entrepreneurship education. Moreover, out of the four measures in the skill-based group, all but two studies applied either creative thinking and/or opportunity recognition as an outcome measure. As such, business modelling was less in focus and, to some degree, teamwork as well, although the literature does not, by any means, ignore these skills or value them less—rather, they are simply not the main outcome measures. However, the articles in this group give insights regarding the most effective pedagogical approaches for learning, especially opportunity recognition skills and creative thinking.

In terms of methods, different studies used quantitative measures in most cases, as well as interviews (Collins et al., 2006; Okudan and Rzasa, 2006), and course hand-ins were also used and analysed (Oswald Beiler, 2015; Pittaway and Cope, 2007b). In the quantitative studies, a variation of quasi-experimental and pre/post designs were applied, with some using mixed methods in their approaches, combining both handed-in reflection notes and observations (Gunzel-Jensen and Robinson, 2017). Thus, while most applied the students' own self-evaluation of different skills, some investigated the actual work conducted by the students and, as such, could investigate the skills through course outcomes.

By applying these methods, different articles would assume that the entrepreneurial skills, evaluated either by the students themselves or through the researchers' exploration of student work, would be stimulated by the courses. Furthermore, they would assume that these skills would be utilised somewhere later on or be central and valuable in the

development of students with respect to start-ups or job creation. For instance, Gunzel-Jensen and Robinson (2017) stated that effectuation is central in understanding entrepreneurial decision-making and resource allocation and, as such, is valuable for an entrepreneurial individual. Moreover, Costa et al. (2018) focused on opportunity recognition skills in their assessment because the development of entrepreneurial skills is found important for the entrepreneurial mind-set, for which opportunity recognition is central in terms of new business development. Hence, without these skills, it is implied that the creation of start-ups and job creation would stall as opportunities would not be recognised to the same extent if individuals are untrained.

In addition, when most studies used opportunity recognition or creative thinking in their assessment, this was because these skills are considered to be of importance regardless of whether one starts a new venture or uses the skills in business development in bigger and more established corporations. In other words, as Baggen et al. (2018) stated, students with entrepreneurial competencies will be prepared for complex jobs and careers consisting of uncertainties and risks, innovations and different projects for which opportunity recognition is of high importance. Thus, by exploring whether different educational approaches influence students' entrepreneurial skills, these different studies assume that they are central to and of necessary quality for future work in both start-ups and other workplaces.

Through the findings for this group of outcome measures, the literature has been provided with evidence that entrepreneurship education could influence students' entrepreneurial skills, especially those regarding opportunity recognition and creativity. Moreover, while most of the studies used self-assessment, some of them also, unlike the articles in the prior outcome measure group, presented results based on empirical data collected as a part of the students' educational activities. In addition, most of the studies that investigated education 'for' entrepreneurship showed that such programmes often have traditional designs—with, for instance, teaching theory, business plan writing and guest lectures (Mwasalwiba, 2010)—rather than more action-based design.

Table 4 - Articles applying skill-based outcome measures in entrepreneurship education assessment.

Article	Education/Article Objective	Description of Education	Outcome Measure	Main Findings
Baggen et al. (2018)	Start-up and job creation; Stimulate entrepreneurial skills;	- About - Semester - Natural science, social science - Netherlands - 'The students took a course on career development and planning or a course on entrepreneurship in which they could orient themselves to an entrepreneurial career by actively exploring the first steps of the entrepreneurial process.' (p. 737)	Opportunity recognition	'The results suggest that the OICAT is successful in tracking individual differences in OIC. The OICAT could be used as a learning-oriented assessment, helping students find out both what they already can do and what they need for further improvement.' (p. 735)
Costa et al. (2018)	Start-up and job creation	- For - Semester - Social sciences and humanities - Portugal/Germany - 'The program's main goal was to inform participants in a uniform way about the entrepreneurial process, what entrepreneurial business opportunities are, and how to actively recognize business opportunities using information from an environment.' (p. 59)	Opportunity recognition	'The results demonstrate that the training has positive significant effects on the accurate identification of business opportunities' prototypical viability. Intense positive feelings about entrepreneur- ship moderate the learning process.' (p. 51)
Eggers et al. (2017)	Start-up and job creation; Stimulate entrepreneurial skills;	- For - Semester - Business students - N/A - '[T]eams of three to four students each participated in a web-based business strategy simulation by Market- place Live [...] In the simulation, students/participants start and grow companies that compete in the microcomputer industry. Participants compete in industries of five to six teams/companies for a total of five different industries/simulations [...] The simulation is played through-out an entire semester in eight decision rounds, where each round represents one quarter of the business year. Participants spend about two to three hours per simulation round.' (p. 269)	Creative thinking	'[T]eam-based business start-up simulations can be an effective teaching tool, especially for millennial learners for fostering the creativity that is necessary for entrepreneurial behaviours.' (p. 273)

Article	Education/Article Objective	Description of Education	Outcome Measure	Main Findings
Gunzel-Jensen and Robinson (2017)	Stimulate entrepreneurial skills	- For - Semester - Interfaculty - Denmark - 'The course was offered as an introduction to entrepreneurial processes and combined theoretical background knowledge (effectuation; Sarasvathy, 2001) with hands-on tools (design process; Liedtka and Ogilvie, 2011) to stimulate active participation by the students in such processes. The combination of effectuation and design thinking elements was constructed to ease the progress of the students through their project development.' (p. 783)	Creative thinking	'The authors find that students experience three barriers to using effectuation. These are: noviceness, regarding the project as a "school project," perceived lack of legitimacy of both the instructors and the process.' (p. 780)
Lindberg, Bohman, Hulten, et al. (2017)	Stimulate entrepreneurial skills	- For - Five weeks - Business students - Sweden - 'Having the self-directed learning pedagogy [...] The course introduction was followed by four workshops. The aim of the workshops was to stimulate the students' creativity by using exercises that made them practice divergent and convergent thinking. [... The course] focus on the early stages of the idea development process, but not on the commercialization process. [...] The instructor was a facilitator allowing the students to think and act independently; the students were encouraged to experiment and learn from their mistakes and to engage in active problem solving.' (p. 772)	Opportunity recognition; Entrepreneurial orientation	'This study contributes to the current debate on how EE can strengthen student's attitudes toward business opportunism. Pre- and post-evaluations on OR and IEO were carried out in a required course with a self-directed atmosphere. Clearly, a better understanding of the relationship between pedagogical interventions and the enterprise-oriented pedagogy that allow students to develop their self-directed learning skills makes it possible to foster graduates who are prepared for the global competition. The participants appreciated the applied methods and there was statistical support for the intervention's positive impact on their OR and IEO capabilities.' (p. 776)
Lindberg, Bohman and Hulten (2017)	Stimulate entrepreneurial skills	- For - N/A - N/A - Sweden - 'The model includes five components: creativity exercises, opportunity identification assignments, problem-based learning sessions, self-directed learning tasks and supervision (COPSS) aimed at helping the students reflect over their choices, actions and the factors that had influenced their decisions.' (p. 454)	Opportunity recognition; Creative thinking; Risk propensity	'Our study contributes to the current debate on intervention methods in EE programs and courses aimed at creating an entrepreneurial mindset among the participants. While earlier studies demonstrate that entrepreneurship can be taught (Kuratko, 2005), our findings provide insights about how EE can be taught to have a positive impact on the participants' OIC [opportunity identification capability], ECR [entrepreneurial creativity] and partly also RMC [risk management capabilities].' (p. 462)

Article	Education/Article Objective	Description of Education	Outcome Measure	Main Findings
Kazakeviciute et al. (2016)	Start-up and job creation	- For - N/A - Science, health, engineering, design, information technologies and other related fields - Lithuania - '[U]ndergraduate technology entrepreneurship (TE) curriculum and extends the idea of entrepreneurship education programme development to embrace the cross-disciplinary and cross-cultural approach.' (p. 203)	Comprehension about entrepreneurship; Teamwork; Business modelling; Creative thinking; Opportunity recognition	'The empirical research results show a positive and in many cases significant change in the development of student knowledge, skills and abilities in TE after experiencing the course. Not surprisingly, the most significant advancement is achieved at the accumulated competence level; that is, the capability to develop a business model while using the appropriate sets of skills and abilities. However, this could not have been achieved without the concurrent development of individual and team-based skills.' (p. 213)
Oswald Beiler (2015)	Stimulate entrepreneurial skills	- About/for - Semester - Engineering students - US - '[I]t is still instructional-based, meaning the lectures are focused on teaching new material (project management and engineering economics) while the labs are exploratory-based. The labs are devoted toward topics such as communication (written and oral), investigation of a feasibility study, preparation for their senior design projects (implemented in spring semester), and an analysis of global challenges.' (p. 4)	Creative thinking; Teamwork	'KEEN (Kern Entrepreneurship Education Network) Student Outcomes (KSO) are comprehensive in that they cover the key components of the growth mindset, however, they still provide a broad view that addresses all disciplines within engineering. Civil engineering capstone courses provide the opportunity to integrate many of the KSOs, which include: enterprising attitude, multidimensional problem solving, productive collaboration, illuminating communication, and resolute integrity. The assessment results indicate that there are existing strengths as well as future opportunities to enhance student performance of innovative thinking and open-ended problem solving—skills that are essential to promoting sustainable design and development.' (p. 7)

Article	Education/Article Objective	Description of Education	Outcome Measure	Main Findings
Lassen and Nielsen (2011)	Stimulate entrepreneurial skills	- For - Three days - Engineering and business students - Denmark - 'Being based on the framework of experiential learning, the success of the camp was highly dependent on the students' active participation. It was not a camp in which students were taught creativity; it was a camp about doing, reflecting, abstracting and experimenting. In addition to going through the four phases, the students were offered a number of competences from sessions in creative thinking; 'brain-shopping' (students map own knowledge and shop for other students' knowledge); panel sessions with experts; sup- port of information searching at the university library; sessions of effective communication; and graphic and visual support to communicate the final concept.' (p. 283)	Opportunity recognition; Creative thinking	'Much indicates that formal education at universities tends to work against the development of creative and entrepreneurial competences among engineering students (Peterman and Kennedy 2003). Yet, in this article we demonstrate that a creativity camp designed and based on ideas of experiential learning as well as creativity principles holds the potential of combining advanced academic knowledge and creativity, and thus to produce knowledge intensive ideas. This makes the method a highly relevant learning approach for engineering students in the search for developing skills to both develop and implement innovative ideas.' (p. 287)
Lourenco and Jayawarna (2011)	Start-up and job creation	- For - Six months - Business students/cross-discipline scholars - UK - 'The training was designed to develop a number of entrepreneurial skills including creative thinking and was delivered in four sessions (total of eight hours) at the initial phase of an entrepreneurship education programme.' (p. 229)	Creative thinking	'[P]articipants who perceive themselves as having higher perceptions of creativity will have higher tendencies to learn. There is also support for a full mediation role of new learning in explaining the relationship between creativity and intention to exploit learning. Creative individuals also rate other training outcomes as positive; both perceived usefulness and perceived ease-of-use received statistical support. Perceived usefulness acts as a strong mediator to the relationship between learning from creativity training and nascent entrepreneurs' intention to exploit their learning.' (p. 224)

25

Article	Education/Article Objective	Description of Education	Outcome Measure	Main Findings
Botha (2010)	Start-up and job creation	- About/for - Semester - N/A - South Africa - 'The purpose of this project was to engage students in giving an account of their view of entrepreneurship after having received the adequate theoretical knowledge to do so (goal setting). Students had to come up with creative and innovative ways of demonstrating, by practical application, what they had learnt in entrepreneurship (OBS 124). Furthermore, they had to incorporate all the topics and chapters covered during the semester (learning goal).' (p. 221)	Creative thinking; Teamwork; Comprehension about entrepreneurship; Business basic	'[T]his paper demonstrates that this project-based learning approach is an effective method of teaching entrepreneurship to a large group of undergraduate students. Furthermore, it highlights the fact that certain entrepreneurial skills can be taught and that this can be done by using more creative pedagogies than the traditional classroom lecture. In addition, the paper illustrated how entrepreneurial skills can be gained by a large group of students if a practical approach is used.' (p. 230)
Pittaway and Cope (2007b)	Start-up and job creation	- Through - Semester - Management students - UK - 'NVP courses use all of the types outlined but it is the practice in form with which this article is concerned. New venture planning, in this form, seeks to simulate entrepreneurial learning by creating an environment where such learning can take place. In doing so, NVP tries to replicate behaviour that is required during venture creation. Courses reflect the actual experience of developing a business plan, a process that can be central to starting a business.' (p. 215). Excluding introductory lectures, the course is action-based and not lecture based.	Business basic; Attitude to entrepreneurship; Passion/inspiration; Business modelling	'The strength of the NVP course explicated here is that it affords students the opportunity to apply and adapt knowledge from a range of management disciplines, thus providing a practical and integrative pedagogic approach to entrepreneurship education. Uniquely, the creation of a business plan requires students to visualize the complex interdependency between different management subjects such as finance and marketing, for example. Without the students' prior experience of other management education the learning experience would not have been as successful. The research shows that management education can benefit from the use of experiential learning designs and that entrepreneurship education can provide one route through which such approaches can be more widely introduced.' (p. 230)

Article	Education/Article Objective	Description of Education	Outcome Measure	Main Findings
Collins et al. (2006)	Stimulate entrepreneurial skills	- For/through - Ten weeks, each session lasting four hours - Engineering, media, textile, and ceramics and glass students - UK - 'The Discovering Entrepreneurship (DE) programme took a tripartite approach, involving nascent entrepreneurs, existing entrepreneurs and facilitators (by nascent entrepreneurs we mean undergraduate students at an early stage of their entrepreneurial development). This mixed audience was chosen because we believe that there are benefits to be gained from creating collaborative learning experiences where these three groups learn with and from each other.' (p. 336)	Business basic; Creative thinking; Teamwork	'In the DE entrepreneurship pilot we applied participatory methods across a range of different contexts and in new ways. Participatory learning methods were developed for use within environments where problems are clearly defined or of immediate concern. The synergistic learning approach, as developed here, has been used in an environment where the focus is opportunity centred rather than problem centred, where there is a lack of clear definition and structure, and where the context is highly abstract, uncertain, ambiguous and complex in nature.' (p. 351)
Okudan and Rzasa (2006)	Start-up and job creation	- For - Semester - Business and engineering students - US - '[T]he course was broken down into 3–4 person student teams. Each team was asked to write business plans. In addition, the course began to include a focus on product innovation and improvement.' (p. 195)	Self-esteem; Teamwork; Creative thinking; Comprehension about entrepreneurship; Attitude to entrepreneurship	'This paper aimed to share the outcomes of the implemented changes to the course as an avenue for entrepreneurship educators to learn from others' experiences, and to contribute to the entrepreneurship education literature. As such it can be concluded that with the current content and the project-based teaching style, the course accomplished: 1. facilitating knowledge and skill development in the areas of leadership, motivation, innovation, communication skills, teamwork and writing business plans, and 2. developing knowledge and skills in ways that encourage entrepreneurial behavior.' (p. 207)

Article	Education/Article Objective	Description of Education	Outcome Measure	Main Findings
Chau (2005)	Stimulate entrepreneurial skills	- For - Semester (14 weeks a three hours) - Engineering students - Hong Kong - 'The key objective of this group project is to develop the undergraduates to be competent and innovative in taking the role of a civil engineer in the implementation of engineering infrastructures. It is tailored to assess professional readiness and to demonstrate the ability to independently conduct a project and to effectively communicate the business process and results in a professional written form. The project is defined in close consultation with industry and thus has as unstated objectives the professional apprenticing of students to a particular industrial working environment for development on entrepreneurship.' (p. 229)	Creative thinking; Teamwork	'A PBL approach for this project was proved to be an effective way of learning in providing an opportunity for the undergraduates to tackle a real engineering problem and in appreciating broader conceptual stages of engineering and business practice. Moreover, supervision inputs from practicing engineers to this group project are valuable in transitioning innovation best practices from industry to academia.' (p. 232)
Ohland et al. (2004)	Start-up and job creation	- For - Semester - Engineering, physical and mathematical, and forestry students - US - 'The goals of the EEP focus on improving the students' educational experience and their ability to function effectively in the workplace. [...] The EEP is an alternative to a traditional capstone experience done by a team of students at all academic levels—freshman through senior—who receive entrepreneurship instruction, give three presentations of their work discussing and reviewing corporate philosophy, mission, goals and strategies, and documenting their achievements, including demonstrating the prototype technology developed as a team project.' (p. 294)	Teamwork	'EEP participants have been shown to have higher engineering retention rates and higher grades. The EEP program has features that have already been shown to have a link to retention, so the program is suspected to be responsible for the improvement in retention. There is more likely to be a motivation bias in student grades, but this bias is at least partially offset by a competing mortality bias. Earlier assessment showed that the pro-gram helped develop teamwork and leadership skills among the participants. Students who participate for multiple semesters seem to get the most benefit—they learn teamwork skills and leadership skills and have the opportunity to continuously apply them as they develop more technical skills.' (p. 299)

Affective Outcome Measures

Regarding the studies that applied affective outcome measures (Table 5)—whether these were students' passion or inspiration, attitude to entrepreneurship or subjective norm— all articles stated that start-ups and job creation were the overarching educational objectives, except for one that focused on the stimulation of entrepreneurial skills. Moreover, one article, which applied affective outcome measures, also aimed to increase students' entrepreneurial spirit, culture or attitude in addition to creating start-ups and new jobs. Hence, the use of affective outcome measures predominantly occurred where the objective was to create new jobs or start-ups.

All the different educational programmes investigated in various studies lasted for an entire semester and were individual courses. In terms of educational approaches, the different programmes were almost evenly distributed between education 'about' and 'for' entrepreneurship. Students in these programmes had different backgrounds, spanning entrepreneurship (Bandera et al., 2018), tourism (Daniel et al., 2017) and all other backgrounds (Balan et al., 2018). Three of the six articles in this group had students that originated from business and management.

The different educational programmes were more or less action-oriented in their approaches and half of the programmes in the articles collaborated or worked with externals. The study of Balan et al. (2018) tested many different educational approaches—some of which were more action-oriented, although many could also be classified as traditional. The education described by Musteen et al. (2018) used online collaboration, where the students collaborated and interacted with students in other regions. It is, therefore, the case that most of the educational programmes in this group were more collaborative and action-oriented than those in studies that used the outcome measures introduced in the previous sections.

All articles focused on attitudes towards entrepreneurship in terms of the specific outcome measure applied. While von Graevenitz et al. (2010) also included other measures in their study, the other articles focused solely on students' attitudes. The findings from these studies primarily examined the pedagogical methods applied by the educational programmes but von Graevenitz et al. (2010), perhaps, focused more on a model for

assessment of entrepreneurship education. However, the studies also investigated special details about approaches to educational content (Bandera et al., 2018) or the tools used in the educational programmes (Musteen et al., 2018). The results indicate what pedagogies are preferred or should be applied and what focus entrepreneurship educators should have and how it is influenced by culture.

In their methodological approaches, the earliest articles applied quantitative measures and explored students' changes through surveys, while more recent articles applied qualitative approaches. Studies that applied a qualitative approach also used students' hand-ins as sources for empirical data gathering and could, thus, conclude on student activities.

When viewing the objectives found in different articles in light of affective outcome measures, some scholars argued that students need to have an attitude towards entrepreneurship as a career path in order to pursuit this career and, thus, also an intention towards this career later on. However, others also noted the importance of a positive attitude because it would make students more interested in entrepreneurship and in pursuing other learning opportunities—as well as the fact that the students could be more active in classes they were already a part of (Daniel et al., 2017). Thus, various studies argue that, through a positive attitude towards entrepreneurship, the students would pursue an entrepreneurial career by having higher intentions, which would lead to start-ups and new jobs. Consequently, different educational designs would influence this attitude and, thus, whether or not an educational programme manages to reach its objectives. However, students' attitude also influences students' interest in learning and, therefore, whether the students manage to gain the skills that are being taught in various educational programmes.

The main contribution to the assessment literature from investigating affective outcome measures is that different educational approaches have a positive influence on students' attitude towards entrepreneurship and that certain tools or contents can spark positive attitude. It is expected that this positive attitude would encourage the students to pursue their own start-ups or to create jobs, as the objectives of different articles solely focus on this. Moreover, if excluding Balan et al.'s (2018) work, the tested educational approaches are somewhat specific in their design.

Table 5 - Articles applying affective outcome measures in entrepreneurship education assessment.

Article	Education/Article Objective	Description of Education	Outcome Measure	Main Findings
Balan et al. (2018)	Start-up and job creation	- About - Semester - All backgrounds - Australia - An undergraduate entrepreneurship foundation course. Different pedagogies were tested in the study.	Attitude to entrepreneurship	'The research identified student perceptions of the nature of engagement with pedagogies, and of possible improvements that were used by the educator to increase student engagement during course delivery. Different pedagogies were found to have varying outcomes on students' engagement with entrepreneurship learning, and as such, contextual and spatial factors have to be taken into account when implementing new and/or adjusted pedagogies.' (p. 819)
Bandera et al. (2018)	Start-up and job creation	- About - Semester - Entrepreneurship students - US/France - Covering the four stages of entrepreneurship in what appears to be a fairly traditional way. '[T]he class chosen was the first undergraduate entrepreneurship course in the corresponding institution, typically attended by third year students. The main assignment is a written business plan, including market research, financial forecasts, and oral presentations.' (p. 185)	Attitude to entrepreneurship	'These findings suggest that for education to yield more balanced results across the stages of entrepreneurship (i.e., higher entropy mind maps), instructors of U.S. students should refocus the syllabus so that more time is spent on the benefits of growing a start-up and the underlying techniques, possibly at the expense of less time on innovation. This could in turn improve the long-term survival and growth rate of new ventures formed by the U.S. students. The findings also suggest that instructors of French students using a similar syllabus should refocus it so that more time is devoted to innovation and risk mitigation. In the long run, this could increase the formation of new ventures by the French students.' (p. 189)
Musteen et al. (2018)	Start-up and job creation	- For - Semester - International entrepreneurship and marketing students - US/UK/Spain - 'The GBGP involves semi-structured online collaboration between undergraduate student teams from three different countries to ideate, develop, and market a product (a board game) to another country.' (p. 2)	Attitude to entrepreneurship	'The qualitative analysis of student reflections on the project provided preliminary evidence that the GBGP, as a teaching tool, was effective in helping students create a more tangible link between IE theory and practice. In addition, it indicated that participating in the project influenced students' attitude toward entrepreneurship as a career path.' (p. 13)

31

Article	Education/Article Objective	Description of Education	Outcome Measure	Main Findings
Daniel et al. (2017)	Stimulate entrepreneurial skills	- For - Semester (sessions were held twice a week during a two-hour period for a total of 58 hours of classroom time) - Tourism students - Portugal - 'A cooperative learning technique was used in the program, which is a type of active learning method that involves structuring students into groups with defined roles for each of them and a task for the group to accomplish (Keyser, 2000). The approach followed in the program 'Learning To Be' was based on the Design Thinking process.' (p. 68)	Attitude to entrepreneurship	'As proposed by Fayolle (2013), the focus of entrepreneurship education was on the development of non-cognitive skills or soft skills, and in this case, by using Design Thinking process. This process enabled a cross-disciplinary and user-centered approach to the challenges proposed by the companies. It seems to have had a positive impact on the students' motivation to enrol in activities proposed in classes, as well as to create an atmosphere that is favourable to learning, and where students play an active role in gaining experience from their activities' (p. 71)
Daniel (2016)	Start-up and job creation; Increasing entrepreneurial spirit/culture/attitude	- For - Semester (sessions were held twice a week during a two-hour period for a total of 58 hours of classroom time) - Industrial engineering and management, economics, languages and business relations, biology and management - Portugal - 'This programme integrated three main phases: entrepreneurial awareness, the development of entrepreneurial skills and hands-on projects. Each phase included several steps with feedback cycles' (p. 219)	Attitude to entrepreneurship	'The findings suggest that design thinking had a positive influence on their motivation and their satisfaction with their overall performance.' (p. 215); 'The pedagogical approach described in the case study seems to have had a positive impact on students' motivation to enrol in activities proposed in class, and to have created an atmosphere favourable to learning, with students playing an active role in gaining experience from their activities.' (p. 221)
von Graevenitz et al. (2010)	Start-up and job creation	- For - Semester - Business administration students - Germany - 'The objectives of the "Business Planning" course are threefold: (i) to teach students basic capabilities needed in the planning and management of a startup enterprise, in particular to convey the necessary knowledge and skills for crafting a complete business plan; (ii) to sensitize students for entrepreneurship according to the classification by Linán (2004): students are supposed to acquire knowledge about small enterprises, self-employment and entrepreneurship so that they can make rational career decisions; (iii) to allow students to gain practical experience by interaction with real-world entrepreneurs.' (p. 95)	Entrepreneurial intentions; Entrepreneurial self-efficacy; Attitude to entrepreneurship; Risk propensity	'[W]e find evidence that students update their beliefs about their entrepreneurial aptitude. In particular, initially undecided students are most likely to change their beliefs most readily. More formally we show that the variance of beliefs about entrepreneurial aptitude increased significantly during the course if we focus on students who learn during the course. Two further hypotheses derived from our model cannot be rejected either. We show that strong ex ante beliefs and consistency of signals lead to stronger ex-post intentions to found or not to found, and that changes in intentions due to the course tend to be smaller if ex-ante signals are strong and if the signals received by students are consistent.' (p. 103)

Conative Outcome Measures

The fourth group of outcome measures, presented in Table 6, examined outcome measures that are most applied in entrepreneurship education assessment, i.e. entrepreneurial intentions and its antecedent entrepreneurial self-efficacy (Bae et al., 2014; Chen et al., 1998; Nabi et al., 2017). As entrepreneurial intention is often defined as an individual's intent to start a new venture, it is not surprising that 17 of 21 articles state that the objectives of the educational programme investigated—or education in general—are start-ups and job creation. The remaining articles focused on stimulating entrepreneurial skills, something that is relevant when investigating entrepreneurial self-efficacy. However, four of these articles could also be included in the group where start-ups and job creation are the objective but, as they were not explicitly clear about their objective, they were grouped into the skill-focusing education category. Hence, the use of conative changes as an outcome measure is primarily applied in education that aims at creating new start-ups and jobs.

The second, and perhaps the most shocking, feature of this group is that more than half of the studies (11 of 21), neither elaborated on nor presented the educational programme included in the study and, in addition, some of the remaining studies were quite brief in their presentation. Of these 11 articles, some included several different educational programmes, such as Mayhew et al. (2012) who used different educational programmes in an overarching regional investigation of entrepreneurship education. Other studies investigated different measures among university students in general and focused less on the education. However, it is surprising that articles lacked central information, especially since many of these studies concluded on behalf of entrepreneurship education in general. Of the studies that do present information about the explored education programmes, four educate 'about', another four educate 'for' and two educate 'through' entrepreneurship. Regarding the duration of the various programmes, the majority lasted for a semester and had a course design, while one was shorter but appeared to be more intensive (Díaz-García et al., 2015). The two courses that had a 'through-design' appeared to be longer, either in the form of a summer school or over two semesters (Oosterbeek et al., 2010; Warhuus et al., 2017). Thus, while entrepreneurial intentions and self-efficacy tend to be

much applied outcome measures in assessment literature, it is still unclear which educational designs are explored, and thus, the means applied to reach the objectives.

In seven studies, the students who are part of the educational programmes investigated had business, administration or economics backgrounds. Four studies had students from other disciplines, such as engineering or pharmacy, while seven had a mix of student backgrounds, although four of these were business-oriented. Hence, the majority of the studies on conative measures had students with business backgrounds.

When investigating different educational approaches, where these were presented clearly, it appears that a mix of traditional and action-oriented educational approached are found in various studies. However, a majority of traditional approaches is identified if compared to Mwasalwiba's (2010) definition. Some of the educational programmes were, nevertheless, organised with influence from the real world—for instance, those described by Shahiwala (2017) or Oosterbeek et al. (2010). The latter described students that organised their own course-limited start-ups, which were run together with real partners and approached real customers. If we disregard the last two examples, we can conclude that more traditional education was explored and concluded upon when using conative outcome measures, while more action-based and educational programmes 'through' entrepreneurship seem to be somewhat missing.

The results clearly indicate that the studies focused on either entrepreneurship education's influence on students' entrepreneurial self-efficacy or intention, however, some articles also explored and focused on the connection between self-efficacy and intention among students. Thus, as a consequence, a lack of educational programme descriptions leads to the conclusion that entrepreneurship education influences (or not) student's conative outcome measures. However, some articles were more specific in their approach and work. For instance, some tested whether certain groups of students benefit from entrepreneurship education by exploring their conative outcome measures (e.g. Aceituno-Aceituno et al., 2018), others focused on developing new outcome measures for assessment (e.g. Yi and Duval-Couetil, 2018) or on exploring whether a certain fundamental focus should be central in entrepreneurship education (e.g. Warhuus et al.,

2017). Moreover, for the articles describing special educational approaches, the influences on students' intentions or self-efficacy could give an insight into their effect.

The methods applied in the studies were almost only survey-based quantitative ones, either in a pre/post design or a quasi-experimental design. However, interviews were also used in some studies—e.g. in Aceituno-Aceituno et al.'s (2018) investigation of entrepreneurship education for journalism and communication students. In addition, Shahiwala (2017) employed what appeared to be a mixed method, using students' hand-ins and a survey as empirical sources. Thus, the students' self-assessed changes in intentions, self-efficacy and their antecedents, obtained through survey answers, were the primary base for the conclusions and results of these studies.

Looking at the stated objectives of the different studies and articles, it is clear that, when it comes to entrepreneurial intentions, the students' experiences with entrepreneurship through their education should increase their intentions to start their own venture and thus increase the possibility of new start-ups and job creation. In terms of the stimulation of entrepreneurial skills, it focuses more on entrepreneurial self-efficacy and an increase in this aspect would represent a measure for the stimulation of the students' entrepreneurial skills. Consequently, it can be concluded that those studies that apply entrepreneurial intentions as an outcome measure assumed that an increase in students' intentions would lead to new start-ups and job creation and, thus, that such an increase would be successful. Regarding changes in students' entrepreneurial self-efficacy, an assumption would be that their self-assessment reflects their actual stimulation and development of entrepreneurial skills that the educational programme's objectives aim towards. Another assumption, applied in this stream of outcome measures, was that entrepreneurship education is a general phenomenon. As the majority of the studies never presented nor explained the educational programmes assessed, it is expected that these are either somewhat similar or should influence students regardless of their background or interest in the topic. However, the results in this group (and other groups) also show that there are different educational designs that influence students differently.

Thus, it is clear that students' conative characteristics are influenced by entrepreneurship education. However, different educational designs are lacking in the literature and the

literature that does apply these measures appears to assess generally rather than focusing on a specific educational design. The studies that applied conative outcome measures also assumed that new jobs and start-ups would occur by changing the students' conative characteristics. Nevertheless, the quality of education, in terms of whether the students actually learn the intended knowledge or skills, was not explored.

Table 6 - Articles applying conative outcome measures in entrepreneurship education assessment.

Article	Education/Article Objective	Description of Education	Outcome Measure	Main Findings
Aceituno-Aceituno et al. (2018)	Start-up and job creation; Stimulate entrepreneurial skills;	- N/A - N/A - Journalism and communication students - Spain - N/A	Entrepreneurial intentions	'The results show how university training, when applied to entrepreneurial projects in the journalism and communication areas, is capable to increase the students' entrepreneurial intentions' (p. 97)
Baran et al. (2018)	Start-up and job creation	- About - Semester - Economics and management students - Spain and Poland - 'The whole concept of entrepreneurship education is based on student self-study techniques, teamwork, simulation in a controlled environment under the supervision of experienced specialists.' (p. 175)	Entrepreneurial intentions	'The presented research considerations evaluated the entrepreneurial profiles of university students with and without entrepreneurial training in the study program. The results show that those who participated in this training have a higher intention of entrepreneurship, greater perception of the feasibility and increased risk perception when undertaking business. Those who have not received such training see greater difficulties than those students who have been trained and who are more likely to try to start a business activity in the near future. The results also show that there is no link between the type of training and the perception of purposefulness, self-efficacy, and entrepreneurial thinking.' (p. 178)
Passoni and Glavam (2018)	Start-up and job creation	- N/A - N/A - Management, accountant and engineering students - Brazil - N/A	Entrepreneurial intentions	'This study also presented different results in terms of the effect of entrepreneurship education in the EI in students who undertook some kind of entrepreneurship programme. In management courses such as administration, the effect of EE on EI was more pronounced. It also had a significant result in the engineering course analysed; however, in the course of the financial field studied, accounting, the effect of EE on EI was irrelevant.' (p. 101)

Article	Education/Article Objective	Description of Education	Outcome Measure	Main Findings
Yi and Duval-Couetil (2018)	Stimulate entrepreneurial skills	- N/A - Capstone course - Engineering students - US - The students were enrolled in senior-level engineering capstone design courses (at three different universities). No more info.	Entrepreneurial self-efficacy; Entrepreneurial intentions	'Data obtained from 460 engineering students supported three factors underlying the construct of entrepreneurial motivation: Motivation for Creation and Solution (MCS), Motivation for Personal Interests (MPS), and Managerial Motivation (MM). MCS and MM effectively explained intention to become an entrepreneur with mediation effects of venturing and technology self-efficacy. These findings resulted in a more parsimonious categorization of factors underlying the construct of entrepreneurial motivation than identified in prior studies, providing a foundational understanding of entrepreneurial motivation among engineering students. The results can be useful in assessment, research, and/or policy decisions related to delivering entrepreneurship education to engineering students.' (p. 291)
Feder and Nitu-Antonie (2017)	Start-up and job creation	- N/A - N/A - Various - Romania - N/A	Entrepreneurial intentions	'This study confirms the TPB model's (Ajzen, 1991, 2002) use in the recognition of entrepreneurial intention antecedents in certain situational contexts and for specific investigated groups. In the case of the entire research sample presented here, our hypotheses emphasized that entrepreneurship education and behavioral characteristics are direct antecedents of entrepreneurial intention, while psychological characteristics and parental or social environment-specific entrepreneurial models are indirect antecedents of entrepreneurial intention, being mediated by behavioral characteristics.' (p. 99)

Article	Education/Article Objective	Description of Education	Outcome Measure	Main Findings
Hasan et al. (2017)	Start-up and job creation	- N/A - N/A - Business and administration students - Bangladesh - N/A	Entrepreneurial intentions; Entrepreneurial self-efficacy; Subjective norm; Attitude to entrepreneurship	'Generalized entrepreneurship education, motivational entrepreneurial education, and augmented entrepreneurial education explained 22.5 percent of the entrepreneurship development variance (R^2), confirming that entrepreneurship development was influenced by the three types of entrepreneurial education at the university level.' (p. 897-898) '[T]he current study defines the entrepreneurship development in terms of students' development of intention, aspiration, self-efficacy, positive social norms, and attitude toward business start-up.' (p. 895)
Herman and Stefanescu (2017)	Start-up and job creation	- N/A - N/A - Business and engineering students - Romania - N/A	Entrepreneurial intentions	'The research findings show a high level of students' entrepreneurial intentions, expressed through both entrepreneurial career choice and intention to become an entrepreneur, proving that engineering and business students have high propensity to entrepreneurship even without EE being provided. Thus, participation in EE did not determine significant differences in students' entrepreneurial intentions.' (p. 324)
Lee-Ross (2017)	Start-up and job creation	- N/A - N/A - MBA students - Australia - N/A	Entrepreneurial intentions	'The psychometric properties of the EIQ [Entrepreneurial Intentions Questionnaire] were confirmed. However, the "subjective norm" predictor variable was not corroborated as an antecedent of "entrepreneurial intent (EI)". [...] The weak relationship between subjective norm and intent questions the value of networking with industry groups. University education should focus on developing those characteristics associated with the remaining independent variables. For example, a positive attitude towards entrepreneurship should be developed together with confidence building and self-efficacy linked to "perceived behavioural control".' (p. 1180)

Article	Education/Article Objective	Description of Education	Outcome Measure	Main Findings
Matsheke and Dhurup (2017)	Start-up and job creation	- N/A - N/A (Modules on entrepreneurship) - N/A - South Africa - N/A	Entrepreneurial intentions; Entrepreneurial self-efficacy; Attitude to entrepreneurship	'The results indicate that the ENTCC, students' attitude towards entrepreneurship and students' self-efficacy exhibit significant predictive relationships with students' intentions to venture into new business creation. Our study makes two major contributions: (i) it fills the gap in entrepreneurship education in order to revisit our curriculum to make the module/s more 'hands on' and (ii) it provides an avenue to further explore the feasibility for a fully fledged entrepreneurship programme with mandatory, elective and incubation start-up practical training' (p. 259)
Roman and Maxim (2017)	Start-up and job creation	- N/A - N/A - Business administration, technical science, agricultural science and veterinary medicine (AVM) and medical science - Romania - N/A	Entrepreneurial intentions; Entrepreneurial self-efficacy	'The results also showed that receiving entrepreneurial training over the course of university enrolment is a determining factor when choosing an entrepreneurial career and that national culture likely has a moderating influence over the relationship between feasibility and intention to become an entrepreneur.' (p. 993)
Shahiwala (2017)	Start-up and job creation; Stimulate entrepreneurial skills;	- For - Semester - Pharmacy - United Arab Emirates - 'The student groups submitted their proposals, mimicking the process of submitting business proposals and obtaining approval in the real world.' (p. 698)	Entrepreneurial intentions; Entrepreneurial self-efficacy	'Based on the findings of this study, it can be concluded that introducing students to the business plan process fulfilled the objective of developing entrepreneur attitude and skills. This project activity develops a business mindset in students with necessary exposure in developing business project proposals and presenting them for financial sourcing while working as a team.' (p. 705)

Article	Education/Article Objective	Description of Education	Outcome Measure	Main Findings
Warhuus et al. (2017)	Stimulate entrepreneurial skills	- Through - Summer school in entrepreneurship - N/A - Denmark - 'The summer course combines each of the elements of "about", "for" and "through" with lectures, exercises in and outside the classroom, assignments, group work and plenum discussion.' (p. 239)	Entrepreneurial self-efficacy	'This paper has explored the relevance of using team formation as a learning tool and adopting a paradigm shift perspective on EEd, moving from "I" to "We". In many ways, this represents a new perspective on learning through entrepreneurship in which moving the students' images and articulations of self, of entrepreneurship and the entrepreneurial team come to the foreground. These three themes (perceptions of self, entrepreneurship and the entrepreneurial team) became evident when analysing and exploring the pre- and post-interview data from the course.' (p. 246)
Garcia-Rodriguez et al. (2016)	Start-up and job creation; Stimulate entrepreneurial skills;	- For - Semester/four months - Accountancy and finance - Spain - 'Students were required to develop their work in groups, in order to foster transversal competences such as team work, project/activity leadership, conflict management and the recognition of diversity and multiculturalism.' (p. 571)	Entrepreneurial intentions	'The results indicate that, after this process, the participating students displayed greater entrepreneurial potential than the group of students that had not participated. However, this difference is due more to a loss of entrepreneurial intention in the group not participating in the programme than to an improvement in the participating students.' (p. 565)
Iglesias-Sanchez et al. (2016)	Start-up and job creation	- For - Semester - All (Industrial Engineering, Sciences, Economic and Business Sciences and Business and Management, Social Studies and Labour Sciences, Law, Communications Sciences, Tourism, Other) - Spain - 'The University of Malaga has started to incorporate courses designed to foster entrepreneurship into the final years of some of its degree programmes. These courses are almost always compulsory, highly practical, and very much focussed on the business model and developing a business plan.' (p. 215)	Entrepreneurial intentions	'The study has concentrated on investigating the perception of entrepreneurship in the eyes of students at Malaga University and, consequently, their orientation towards entrepreneurship in the medium term. [...] PA, SN and PBC and these are the elements which explain the EI of this group. Although the correlations and regression analysis support the hypotheses, in the case of the university students, not all the dimensions play the same part in the intention to start one's own business. While PA and PBC have great influence, on closer analysis SN appeared to contribute to decision making but not as a determining factor.' (p. 222)

Article	Education/Article Objective	Description of Education	Outcome Measure	Main Findings
Karimi et al. (2016)	Start-up and job creation	- N/A - Semester/four months - Agricultural sciences, engineering sciences, humanistic science, and basic sciences - Iran - Compulsory and elective courses in EE called 'fundamentals of entrepreneurship'	Entrepreneurial intentions	'Our study indicated that the EEPs significantly influenced subjective norms and PBC but that these programs did not have significant impacts on students' attitude toward entrepreneurship and their perceptions of opportunity identification. The study also showed that the elective EEPs significantly increased students' EI but that this increase was not significant for the compulsory EEPs.' (p. 204-205)
Díaz-García et al. (2015)	Stimulate entrepreneurial skills	- About/for - 50 hours in length and taught over four weeks - Business/humanities/science students - Spain - 'The course is structured into three modules (Motivation, Creativity and Ideas Generation, and Developing a Business Plan). Its content is developed mainly through practical activities based on participative learning, in which the students internalise the different contents of the programme, either individually or in a group.' (p. 20)	Entrepreneurial self-efficacy; Entrepreneurial intentions; Attitude to entrepreneurship	'Second, with respect to entrepreneurial training evaluation, the findings indicate that the TPB is an appropriate theory to test the effectiveness of an entrepreneurship course that aims to promote entrepreneurial mindsets. We consider that a better knowledge of how entrepreneurial training impacts on cognitive variables is needed in order to adjust educational curricula to serve potential entrepreneurs and also to make an efficient use of those public resources allocated to foster an entrepreneurial mindset. If we achieve the reinforcement of students' perceptions not only of self-efficacy in entrepreneurial tasks but also of the environment, we will be able to observe an increase in entrepreneurial intention that might be translated into more entrepreneurial behaviour, which has to be appropriately sustained over time.' (p. 27)

Article	Education/Article Objective	Description of Education	Outcome Measure	Main Findings
Fretschner and Weber (2013)	Start-up and job creation; Increasing entrepreneurial spirit/culture/attitude	- About - Semester - Business students - Germany - Is termed an 'awareness' course where 'students should learn about the nature of entrepreneurship and develop knowledge in fundamentals like entrepreneurs' role in the society and economy, phases of the entrepreneurial process, entrepreneurs' tasks and challenges in the start-up phase, typical critical incidents, and crucial abilities and key competencies used by entrepreneurs.' (p. 412)	Entrepreneurial intentions	'Quantitative findings show high applicability of Liñán and Chen's (2009) EIM in an entrepreneurship education context. Results from PLS-SEM demonstrate that the entrepreneurial intervention principally worked in the assumed way: as all three antecedents exert an influence on EI prior to the awareness course, students' decision for self-employment is heavily dependent on the PA component after participating in the program. This provides support for the causal link from awareness education to entrepreneurial attitudes derived in the EEM and implies that perceived control over entrepreneurial tasks is not a relevant predictor of start-up intentions in an awareness setting.' (p. 421-422)
Duval-couetil et al. (2012)	Stimulate entrepreneurial skills	- N/A - N/A - Engineering students - US - N/A	Entrepreneurial self-efficacy; Venture creation; Intrapreneurship	'[E]ngineering students expressed interest in learning more about entrepreneurship but relatively few reported being exposed to it even at institutions with formal entrepreneurship programs. Those who took one or more courses were found to have significantly higher entrepreneurial self-efficacy than those who did not. They were also much more likely to get hands-on skills related to market analysis, technology commercialization, business communication, or internships within start-up companies all of which are in demand by employers today.' (p. 434)

Article	Education/Article Objective	Description of Education	Outcome Measure	Main Findings
Mayhew et al. (2012)	Start-up and job creation	- N/A - N/A - N/A - US - N/A	Entrepreneurial intentions	'Dominating scholarly discussions focused on innovative entrepreneurship are lingering questions concerning its ontology: Is innovation something that can be nurtured in college? Results from this study suggest that it can. After controlling for a host of covariates, including dimensions of personality, family history with entrepreneurship, student entry characteristics, and involvement experiences, it appears that enrolling in an entrepreneurship course and the practices faculty enact within courses are related to students' intentions of becoming innovative entrepreneurs.' (p. 853)
Oosterbeek et al. (2010)	Start-up and job creation	- Through - Two semester - Business studies and accountancy, management and law, personnel studies, and small business and retail - Netherlands - 'The SMC program involves taking responsibility as a group, for a small sized and short-time business, from its setting up (usually at the beginning of the school year) to its liquidation (usually at the end of the school year). Students sell stock, elect officers, produce and market products or services; keep records and conduct shareholders' meetings. Thus, students get into contact with social and economic reality in the real business world out of the school. This is a structured project which takes 5–10h per week and is managed by a team of lecturers. Lecturers are supported by staff of the local non-profit organization ''Young Enterprise''. The activity takes place in class within the established curriculum, but may also be continued outside the school as a voluntary activity for the students. Each mini-company is supported by one or two advisers coming from the business world and sharing their experience with the students (EU, 2006).' (p. 443)	Entrepreneurial intentions; Entrepreneurial self-efficacy; Need for achievement; Risk propensity; Creative thinking	'The results show that the program does not have the intended effects: the effect on students' self-assessed entrepreneurial skills is insignificant and the effect on the intention to become an entrepreneur is even negative.' (p. 442)

Article	Education/Article Objective	Description of Education	Outcome Measure	Main Findings
Chen et al. (1998)	Start-up and job creation	- About - Semester - MBA entrepreneurship - US - '[T]he MBA curriculum in general was heavily oriented toward technical management skills associated with bureaucratic rather than entrepreneurial firms.' (p. 310)	Entrepreneurial intentions; Entrepreneurial self-efficacy	'However, what differentiated the entrepreneurship students from their management and psychology peers was not self-efficacy of innovation or risk-taking but self-efficacy in various managerial functions of marketing, management, and financial control. There may be several reasons for the inconsistency between the students and the entrepreneurs. First, it may be the case that the MBA curriculum in general was heavily oriented toward technical management skills associated with bureaucratic rather than entrepreneurial firms. Students who felt they had a good mastery of these tools might also have felt that they were well equipped for starting their own businesses. Secondly, because the surveys were administered at the beginning of the entrepreneurship course, the potential of gaining self-efficacy in innovation and risk-taking may have not come to fruition. Lastly, it may be the case that self-efficacy in innovation and risk-taking are more likely to be developed through real-world experience, which the entrepreneurship students were still lacking.' (p. 310-311)

Behavioural Outcome Measures

The last group of studies is differentiated based on their use of behavioural outcome measures and it represents the smallest group of the five investigated, as illustrated in Table 7. The constituents of the behavioural outcome measure are nascency, venture creation, intrapreneurship, social entrepreneurship and employability. Although calls have been made for investigations of the careers and activities of graduates (e.g. Pittaway and Cope, 2007a), the objectives of the educational programmes in these studies focused only on start-ups and job creation. This might not be a surprise because many defined entrepreneurship as start-ups and job creation and, hence, expect this outcome. In addition, the studies are rather new, with the oldest published in 2016, showing that students' behaviour and post-graduation action is something that has been explored to a lesser degree.

In this group, only three studies present the educational programmes investigated, however, the article by Dukhon et al. (2018) examined multiple education and included information about them as variables in their model. Regarding the other three articles, none of them presented education 'about' entrepreneurship but rather follow a 'for' or 'through' approach. The durations of the various educational programmes were one semester or longer, although only two studies stated the duration of the programme in question and whether it was a course, a minor or similar. Thus, when presenting this last group of outcome measures, it is clear that none of the studies investigated in this literature review explored Master's, Bachelor's or similar degrees in entrepreneurship.

Only two articles state the backgrounds of students, which were business and social sciences (Lyons and Zhang, 2018) or entrepreneurship (Jones et al., 2017). While Premand et al. (2016) do not state which students were included, it appears that a cross-disciplinary initiative was investigated in their study.

When investigating the educational approaches applied in these studies, they appear to be a mix of traditional and more action-based approaches. The article by Lyons and Zhang (2018) showed a more progressive approach, where students work on real ventures and business ideas, which is similar to the educational approach described by Rasmussen and Sørheim (2006) or Lackéus and Williams Middleton (2015). Lyons and Zhang's (2018)

studied educational programme also appear to have a mix of education 'about', 'for' and 'through' entrepreneurship, as they state that students have classes with experts from different fields associated with entrepreneurship but also work on their own business ideas. The study by Premand et al. (2016) had a more limited span regarding 'about', 'for' or 'through' approaches; however, here the students were also working with externals and writing business plans for local businesses. The descriptions of the last two studies in this group were of a general nature so that it is hard to grasp how the educational programmes they examine were designed. Hence, it is clear that behavioural measures applied here were on more action-oriented and progressive educational designs, having a 'for' or 'through' approach, and that more traditional educational approaches was not explored with these measures or methods.

While it is clear that action or behaviour of graduates regarding new ventures were the focus of these studies, they used different methodological approaches to conduct their examinations. While all investigated the influence of educational programmes on entrepreneurial action, Dukhon et al. (2018) investigated entrepreneurship education in different regions and compared this with each region's new venture activities. The other three articles focused on self-employment or start-up activity, although Lyons and Zhang (2018) also investigated student backgrounds and the effect of the courses in that respect. Furthermore, except for the study by Dukhon et al. (2018), all studies used surveys and Lyons and Zhang (2018) also used panel data, while Premand et al. (2016) conducted telephone interviews with their participants.

The findings of these studies show somewhat varying results and that some students might benefit from entrepreneurship education while others might not (Lyons and Zhang, 2018). In addition, even though students and graduates could become more self-employed, the overall employment rates might remain unchanged (Premand et al., 2016). If we look at the studies by Lyons and Zhang (2018) and Premand et al. (2016) in particular, it also appears that the quality of these studies is somewhat better in comparison to the those in the other outcome measure groups. This is especially the case because these two studies included control groups and handled self-selection bias from which assessment studies in entrepreneurship education can suffer. However, as this group only contains four studies,

which are not all necessarily perfect in terms of their methodological choices, such a conclusion about the quality of this group of studies cannot be conclusively drawn.

In their contribution to assessment literature, the studies that investigated the behaviour of students or graduates showed that entrepreneurship education has an overall positive influence on these outcome measures. However, these educational programmes, especially those that were presented in these articles specifically, appear to be more progressive than others explored in the existing literature. Therefore, we know little about traditional education's influence on student and graduates' behaviour. Furthermore, something else that is still lacking in assessment literature is the behaviour of students or graduates outside the creation of start-ups and jobs but, instead, as established business developers or similar.

Table 7 - Articles applying behavioural outcome measures in entrepreneurship education assessment.

Article	Education/Article Objective	Description of Education	Outcome Measure	Main Findings
Dukhon et al. (2018)	Start-up and job creation	- N/A - Varying (used as variable in study) - N/A - Russia - N/A	Venture creation	'The findings allow for evaluating the role of the national education system in promoting entrepreneurship among the population based on reliable and relevant statistical information consistent with the international standards as well as measuring the effectiveness of entrepreneurship education programs and promotion strategies in various regional contexts. The article puts forward recommendations on choosing the types of entrepreneurship education to deliver at different levels of the education system in Russia.' (p. 140)
Lyons and Zhang (2018)	Start-up and job creation	- Through - Nine months (mostly part time) - Business and social sciences - Canada - 'For instance, participants receive formal education through courses on topics such as entrepreneurial finance, entrepreneurial strategy, and international business, taught by faculty from Harvard, Georgetown, MIT, and Toronto. Participants also explore starting their own venture during the program.' (p. 93-94)	Venture creation	'[W]e show that individuals with a higher predisposition toward the type of entrepreneurship being taught by the program, measured by prior technology entrepreneurship experience, are less likely to benefit from training. Our findings imply that individuals who enter programs with the skill set being taught benefit less from the program at the margin, and that individuals without prior experience can be trained in entrepreneurship.' (p. 85)
Jones et al. (2017)	Start-up and job creation	- For - N/A - Entrepreneurship students - UK - 'This study utilises the QAA's (2012) definition of "enterprise and entrepreneurship" programmes as focussing "on the development and application of an enterprising mindset and skills in the specific contexts of setting up a new venture, developing and growing an existing business, or designing an entrepreneurial organisation" (p. 6). Thus, the focus is on graduates who have completed a programme of EE that aims to educate students for self-employment and prepares them for an entrepreneurial career.' (p. 693)	Venture creation; Employability	'The findings discern further understanding regarding the retrospective value of EE course content towards various career outcomes and eventual career outcomes achieved […] The results also confirmed that while self-employment (36 per cent) was the most obvious ultimate career outcome both at the point of survey and in previous career choices (50 per cent), respondents had often experienced a portfolio of different career occupations with time spent in a variety of sectors (e.g. public, private and charity sector).' (p. 699-700)

Article	Education/Article Objective	Description of Education	Outcome Measure	Main Findings
Premand et al. (2016)	Start-up and job creation	- For - Semester - N/A - Tunisia - The students could chose to write a business plan for an external business. The students were mentored by external entrepreneurs and the faculty.	Venture creation; Employability	'Results show that entrepreneurship education significantly increased the rate of self-employment among university graduates approximately one year after graduation. However, the effects are small in absolute terms, ranging from 1 to 4 percentage points. Given the low prevalence of self-employment in the population, these small absolute effects imply that program participants were on average 46–87% more likely to be self-employed compared with graduates from the control group. However, the employment rate among applicants remained unchanged, suggesting a substitution from wage employment and into self-employment.' (p. 312)

Summary of Assessment Literature on Entrepreneurship Education

The literature on the assessment of entrepreneurship education has been shown to apply many different measures, explore many different educational approaches with different objectives and present numerous findings that give insights into different effects of various educational programmes. On the next page, Table 8 illustrates the main findings from the different groups of outcome measures, which are summarised in the same format as the tables in the prior sections. This section summarises the main conclusions in the last column and last row of Table 8. The focus is, therefore, placed on the conclusions that were drawn from the outcome measure groups and the overarching focus areas of the entire review, respectively. The latter is presented first, ending this chapter with an overview of the outcome measure-objective-fit in the assessment literature.

The main conclusions from the investigation of the 65 articles identified in this literature review show that the main objective of entrepreneurship education is to create start-ups and new jobs, followed by a stimulation of students' entrepreneurial skills. This is illustrated in the last cell of the second column in Table 8. Some studies also aimed at changing the students' entrepreneurial spirit, culture or attitude; however, such articles and educational programmes are few and they often incorporated this aim in addition to other objectives. One could also assume that if the objectives are organised in a hierarchical manner, then one needs to change the student spirit to achieve changes in their skill level. However, an education 'for' or 'through' entrepreneurship could change the students' skill level but, at the same time, negatively influence their attitudes and intentions (e.g. Oosterbeek et al., 2010). Hence, different objectives are expected to be somewhat independent.

In terms of the educational approaches offered in entrepreneurship education, which are described by the literature presented in this review, they are still quite traditional in their design (Mwasalwiba, 2010) and few offer education 'through' entrepreneurship. If looking at the third column of Table 8, it is clear that educational designs develops more into education 'through' entrepreneurship the closer it gets to outcome measures that focus on action or behaviour. In addition, the few educational programmes that did offer education 'through' entrepreneurship appeared to be of longer duration and to include

Table 8 - The main characteristics and conclusions from the assessment literature.

	Education/Article Objective	Description of Education	Outcome Measures	Main Findings	Main Conclusions
Cognitive	Entrepreneurial action and utilising entrepreneurial skills were the objectives that were identified in the majority of the articles applying cognitive outcome measures.	Little knowledge about cognitive outcomes for education 'through' entrepreneurship and for education with longer duration. The literature was also rather limited when it came to exploring the more action-oriented designs. Education often had one group of students; few comparison studies.	Entrepreneurial orientation: 2 Need for achievement: 3 Proactiveness: 3 Risk propensity: 2 Comprehension about entrepreneurship: 10 Business basic: 5 Self-esteem: 6 Mix with other: 6	The majority explored pedagogical methods and their effects on the students' cognition, but some also explored student groups not familiar with entrepreneurship, or developed measures for future research.	High level of students' self-assessment through surveys as main method, but varying methodological quality. Changes in cognition expected to influence future performance in terms of new ventures, or stimulate the development of skills through building a knowledge foundation.
Skill-based	No studies where changes in entrepreneurial attitudes, spirit or culture was the objective, however, approximately half of the education aimed on new start-ups and job creation, and other half on the stimulation of entrepreneurial skills.	Few studies on education 'about' or 'through' entrepreneurship, but education in this group had a semester or longer duration, and their approaches were more traditional in their educational design. Majority of students from business or engineering, but also other groups of students present.	Opportunity recognition: 6 Creative thinking: 11 Teamwork: 7 Business modelling: 2 Mix with other: 7	The studies focused mostly on the different pedagogical approaches' influence on the students' skill development. The skills opportunity recognition and creative thinking had the most prominent focus.	The skills are expected to facilitate new start-ups by being central in the start-up development, but also to stimulate the entrepreneurial skills to be used in other situations, e.g. by being creative. Majority of the studies applied self-assessment in the research, but also students' hand-ins in classes were part of the empirical data in some studies.
Affective	All studies that applied affective outcome measures had the objective of creating new jobs and start-ups. In addition, one education had also changes in entrepreneurial attitudes, spirit or culture as its objective.	The education described were more action-oriented than other groups' education, however, not without some traditional educational approaches. None were education 'through' entrepreneurship, but focused mostly on 'for' and to some degree on 'about', and all the education lasted one semester. Mostly business students.	Passion/inspiration: 0 Attitude to entrepreneurship: 6 Subjective norm: 0 Mix with other: 1	The different pedagogical approaches, and especially design thinking approaches, positively influenced students' attitude toward entrepreneurship.	A positive attitude toward entrepreneurship is expected to be a good measure on the objective of new job and start-up creation, as this attitude is necessary to start a new venture in the first place. It is also interesting to explore that none of the education had changing students' attitude as an objective, although this was the only outcome measure applied in this group.

Conative	The majority of the articles explored aimed at new start-ups and jobs as their objective, in addition to four that aimed at stimulating the entrepreneurial skills. However, the latter four could also aim at the 'start-up or job' objective, although they did not state this explicitly. Moreover, these four used self-efficacy as the main outcome measure.	The majority of the articles did not describe the education assessed. Eight focused on either education 'for' or 'about' entrepreneurship, while two had a 'through design'. Most were also traditional in its design, and as such is it not explored action-based education 'through' entrepreneurship's influence on students' conative measures. Mostly business students.	Entrepreneurial intentions: 19 / Entrepreneurial self-efficacy: 10 / Mix with other: 5	Entrepreneurship education is found to influence students' conation. However, which educational approaches that are more effective cannot be concluded on, as the different education explored are to a lesser degree presented.	Higher entrepreneurial intentions or self-efficacy are expected to be central in the development of new jobs and start-ups. However, mostly traditional education are explored in this group, and half of the articles lacked a thorough presentation of the education. Moreover, the use of intent as a measure of the objective of new start-ups and jobs, assumes that the students obtain knowledge to handle the aimed behaviour when graduating from the education.
Behavioural	All the articles that applied behavioural outcome measures had start-ups and job creation as the education's objective. Thus, in terms of education that aim at e.g. skill development, none has explored the graduated students' behaviour.	The education in this group appear to all be more action-oriented, progressive and educating 'through' entrepreneurship, when compared to the other groups of articles. As such is there little knowledge about more passive education's influence on behaviour. Mostly business students.	Nacency: 0 / Venture creation: 4 / Intrapreneurship: 0 / Social entrepreneurship: 0 / Employability: 2 / Mix with other: 0	Entrepreneurship education influence students' post-graduation behaviour, however, in different ways, and the results cannot conclude on one result, as contextual difference influence the results, e.g. students' background or measures used.	When investigating entrepreneurial behaviour, it is clear that the literature is in an early stage, with few articles published, and all investigating venture creation as an outcome measure. However, being a clear measure to the objective for the education explored, the literature still illustrate some influences from e.g. students' background that influences the results. Moreover, the studies do to a lesser degree explore the success and quality of the outcomes, and assumes that these are beneficial.
Main Conclusions	Few of the articles aimed solely on changing the students' attitude, culture or spirit, although this might be part of the other objectives. Moreover, the minority of the articles aimed at students' skill.	Few education 'through' entrepreneurship identified, but for more behavioural-oriented outcome measure, an increase is found in such education. Although some mixed student groups, mostly business students.	Most applied in each group: / Entrepreneurial intentions: 19 / Creative thinking: 11 / Comprehension about entrepreneurship: 10 / Attitude to entrepreneurship: 6 / Venture creation: 4	Most explore a method or approach in an education to reach the objectives, however, many describe the education in less details.	

education 'about' or 'for' entrepreneurship offered in a more traditional approach (e.g. Lyons and Zhang, 2018). Hence, while action-oriented education is advocated for in entrepreneurship education literature, fewer results from such education are presented in the field. Moreover, in terms of contextual factors, the majority of the educational programmes explored in the literature were intended for business students or students studying business oriented topics. However, many of the articles included in the review lacked a good description of the educational programmes explored, which has also been identified in previous reviews (Nabi et al., 2017). Thus, these educational programmes and the studies that address them tend to conclude on behalf of entrepreneurship education in general.

With respect to different outcome measures applied—presented in the fourth column of Table 8—almost one third of all articles focused on entrepreneurial intentions, thus making this the most applied measure in this body of literature. Second most applied measures were creative thinking and comprehension about entrepreneurship, in the skill-based and cognitive outcome groups. The two groups of affective and behavioural outcome measures focused primarily on one measure each, attitude to entrepreneurship and venture creation, respectively.

Exploring the results, it is clear that the purpose of most studies was to investigate an educational approach's influence on outcome measures or to develop these measures for future research. Examples here include the effect of using design thinking for tourism students, intending to change their attitude towards entrepreneurship (Daniel et al., 2017), or the effect of using a self-directed learning approach on students' proactivity (Verzat et al., 2017). However, the review also shows that many of the studies lacked, to some degree, methodological rigour and quality, especially when reviewing their conclusions. This is also something that prior reviews on the existing literature have commented on (Longva and Foss, 2018; Rideout and Gray, 2013). The results found in the conative outcome measure group studies are especially problematic, as some draw conclusions on the false condition that entrepreneurship education has *one* universal approach.

The use of self-assessment is the main methodological approach, regardless of the outcome measures applied, and are for the most applied in a pre- and post-evaluation. In

studies using such an approach, students self-reported on whether they feel that they have entrepreneurship knowledge, can be creative in their thinking or possess the intent to start a new venture in the future. However, some of the studies also explored the students' actions in terms of the work they hand-in, thus evaluating students' performance directly.

When reviewing the outcome measure-objective fit, it is clear that many of the articles had underlying assumptions on which their conclusions were drawn. For instance, the assumptions that: knowledge obtained in a course would lead to development of entrepreneurial skills; self-assessment of obtained skills (and their quality) is correct and would lead to new start-ups and job creation; or students who have intentions also have the necessary skills for running successful start-ups or create jobs. Although these prior examples are extremes and do not represent all articles in this review, which might have different focuses, they are nevertheless very much present and a necessity in the assessment literature in its current state.

When looking at different rows in Table 8, we begin with the second row, which represents the cognitive outcome measures group. For this group, in which many of the articles aimed at start-ups and job creation, the measures applied assume that obtaining knowledge or developing traits would lead to the creation of start-ups. The same applies to the articles that had stimulation of skills as their main objective—the assumption was that knowledge about entrepreneurship would lead to skill development. This is also clear when we look at the overall findings from the articles in this group, found in the last cell of the second row.

For the group that applied skill-based outcome measures, many of the same assumptions are found regarding the objective of developing start-ups and job creation—skills are necessary for this development and, with these in place, it is assumed that there is a higher chance for entrepreneurial action. However, with respect to stimulation of entrepreneurial skills as a main objective of entrepreneurship education, these studies had, to a high degree, an outcome measure-objective-fit.

Moving on to the articles that applied affective outcome measures, the objectives of the educational programmes they examined were almost exclusively new start-ups and job creation and, thus, they claimed that attitudes towards entrepreneurship should increase

the chances for reaching this type of outcomes. However, taking the abovementioned groups of articles into account, students should also obtain cognitive changes and entrepreneurial skills to successfully reach these objectives. Thus, attitude would influence students' conception of entrepreneurship but it could also influence their development of cognition and skills, e.g. through their educational engagement (Balan et al., 2018). Hence, with cognition and skills established as necessities for the development of start-ups and job creation, attitude would influence students' entrepreneurial development in several ways—and this development would further be successful if the cognitive and skill-based changes are effective and valuable.

When it comes to the most applied outcome measures—conative outcomes—the articles that applied them had somewhat similar assumptions as those of the previous group but were closer to actual entrepreneurial action: '[w]hile affection refers to emotions and perceptions, conation takes the mind one step closer to behaviour' (Longva and Foss, 2018: 359). Hence, the intention to become an entrepreneur represented a measure for the educational objective of creating start-ups and jobs, which would, most likely, be influenced by the cognitive and skill-based development of students, e.g. through entrepreneurial self-efficacy (Chen et al., 1998). Thus, this measure also assumes that students obtain required competences during their education and that these are of the quality that is necessary to create effective, sustainable and valuable entrepreneurial action.

The final group of articles, which applied behavioural outcome measures, had a good outcome measure-objective-fit because all aimed at start-ups and job creation. However, this group of articles consists of only a few studies. In addition, the articles applying behavioural outcome measures explored more action-oriented education 'through' entrepreneurship, while the previous groups focused more on traditional education in entrepreneurship. Thus, we know more about progressive education's influence on behaviour in comparison to its influence on other outcome measures, while the opposite is true for more traditional educational approaches.

To summarise, there are two overarching objectives in entrepreneurship education— stimulating entrepreneurial skills and start-up and job creation. The first education group

is mostly assessed through cognitive and skill-based measures, whereas the second is assessed through all outcome measures—but with more focus on affective, conative and behavioural measures. The group of articles that assessed the objective of stimulating skills through skill-based measures could be said to provide a good outcome measure-objective-fit. However, there are more assumptions to be fulfilled in the assessment of the other objectives of start-up and job creation, as already mentioned, not including the behavioural outcome measures.

3. Theoretical Framework

A central goal of this thesis is to analyse how students' learning and learning situation influence the assessment situation. As presented in the previous section, there are several outcome measures that based their results directly on student learning, that is, which implicitly assumed that students obtain the necessary knowledge and skills in order to be able to fulfil the educational objectives. Thus, with this in mind, the following section introduces the theoretical framework developed for this thesis. This chapter is divided into four sub-sections that introduce learning theory first, prior to introducing the experiential learning theory as the main theoretical framework of this thesis. Third is the students' learning situation further explored, in terms of authentic learning situations, before the conceptual framework is developed based on the theoretical developments presented in this chapter.

Learning Theory

The learning theories we have today stem from the two outermost philosophies—behaviourism and constructivism (Illeris, 2007; Pritchard, 2003). Behaviourism was the first theory to be developed in the works of Watson in the United States in the late nineteenth and early twentieth centuries (Pritchard, 2003). Watson (1925) describes the birth of behaviourism as a result of envying other fields of science, such as medicine, physics and chemistry, where results provided significant progress. The behaviourists avoid the cognitive or consciousness side of human psychology, as this is neither definable nor usable, and instead focus on the observable—an individual's behaviour. Specifically, behaviourists focus on the stimuli and responses of an individual.

Some years after Watson worked with and on the behaviourist views in the United States, the Swiss psychologist Jean Piaget developed his theoretical works by focusing on the cognitive side of an individual in stark contrast to the behaviourist view. As Piaget (1950: 15) wrote, '[e]mpiricism … scarcely upheld any longer in its pure associationist form, except for some authors, of predominantly physiological interests, who think they can reduce intelligence to a system of "conditioned" responses'. Piaget is famous for two theories of learning, the first of which was developed in the 1920s and focused on the development of an individual and how different 'development stages' influence learning

and mental processes (Pritchard, 2003). This theory has been important for research on learning and child development but 'modern thought has gone beyond Piaget's view' (Pritchard, 2003: 18). However, Piaget's other theory—and perhaps the one that has been applied the most to general learning theory—is his view on the adaptive nature of intelligence (Piaget, 1950). Piaget focused on the environment and stated that an organism's relation to its environment influences its learning and mind. He described intelligence as being of adaptive nature and learning, consequently, as a process of adaption, where this adaption could be described as 'an equilibrium between the action of the organism on the environment and vice versa' (Piaget, 1950: 6). At equilibrium, there is no difference between new and established knowledge. Furthermore, Piaget introduced *assimilation*, which is when new knowledge is discovered and aligned with already obtained knowledge, while *accommodation* is when existing knowledge has to be altered because the action experienced contradicts existing knowledge. Thus, according to Piaget's view, knowledge and learning are constructed within an individual based on the experiences of action occurring in that individual's environment.

Additionally, Piaget introduced the concept of schema, which could somewhat be defined as organisation of knowledge. While Piaget's focus was on the development of and schema among children, later research adopted the idea of schema in cognitive learning theory (Anderson et al., 1978; DeChenne, 1993). DeChenne (1993) defined schemas as cognitive structures in a hierarchical manner, where constructs, the highest level, would subsume relevant generalisations, which would relate to a series of relevant concepts. The concepts are further assembled by facts, examples or attributes at the bottom of the hierarchy. DeChenne (1993: 178) built on Anderson et al. (1978) and argued that these mental structures are necessary for learning:

> *In the absence of these mental structures, new factual information is learned by rote, in isolation, and is easily forgotten. Learners who lack appropriate schemata have no meaningful way to process information, no 'slots' or 'placeholders' to accommodate facts, no way of relating information to a conceptual structure.*

Pritchard (2003), on the other hand, defined schema as a connection of nodes, where each node consist of some type of information or idea, with the nodes being connected together in numerous ways. A connection is made 'as a result of there being a meaningful link

between the connected items' (Pritchard, 2003: 21). In addition, Pritchard added that the connections are altered and created over time and that this 'creating and updating takes place every time that we read, listen to, observe, try out or sense in any other way anything new' (2003: 22–24). Thus, with every new experience, development and learning occur within an individual.

Experiential Learning

Kolb's (2014) experiential learning theory built upon the works by, among others, John Dewey, Kurt Lewin and Jean Piaget, describing the learning process as a recursive process in which experience, reflection, thinking and acting are central to the learning process. Kolb (2014: 78) described learning as knowledge created through transforming experiences, with '[l]earning, the creation of knowledge and meaning, occur[ing] through the active extension and grounding of ideas and experiences in the external world *and* through internal reflection about the attributes of these experiences and ideas'. The theory holds two dimensions of learning—*prehension* (or grasping) and *transformation*. Both dimensions are 'dialectically opposed adaptive orientations' (Kolb, 2014: 66). That is, experiences could be grasped through representative symbols or the conceptual representation of the real world—*comprehension*—or through the physical and felt qualities of immediate experience—*apprehension*. On the other hand, transforming our grasp could occur through internal reflection—*intention*—or through what Kolb (2014: 67) describes as 'active external manipulation of the external world, here called *extension*'.

As experiential learning theory revolves around two dialectic dimensions of learning, Kolb (2014) first identified that there are four different learning styles. These learning styles differ from person to person and each individual has their preferred learning style. However, these styles are also influenced by the environment and the different tasks that are being conducted (Kolb and Kolb, 2009). The different styles depend on whether an individual is located more towards acting-reflecting or experiencing-thinking in their learning situation. The first learning style is labelled as *diverging* and individuals with concrete experiences and reflective observations as dominant learning abilities possess this learning style. The second learning style, where an individual has abstract conceptualisation and reflective observation as dominant learning abilities, is known as

the *assimilating* style. An individual with abstract conceptualisation and active experimentation as dominant learning abilities has the *converging* learning style, while an individual with active experimentation and concrete experiences as dominant learning abilities uses the *accommodating* style. Later research, however, has identified that there is a total of nine learning styles. In four of these, which are additional to the four described above, each dominating learning ability is also a distinguished learning style, while the last one is the balanced learning style (Kolb, 2014; Kolb and Kolb, 2009, 2018).

The experiential learning theory has been applied in a number of different disciplines, of which educational research has given it the most attention (Kolb et al., 2001). Kolb et al. (2001) found that more than 400 works on education applying the experiential learning theory have been published from 1971 until 1999 and that this number continues to increase (Kolb and Kolb, 2009). The theory has also been applied in the field of entrepreneurship education, where it has become one of the central theories for explaining learning and teaching of entrepreneurship (Hägg and Kurczewska, 2016). In the field of entrepreneurship, experiential learning was introduced and applied as a fundamental framework for explaining entrepreneurial learning (Corbett, 2005; Politis, 2005). The theory of entrepreneurial learning later on became more researched and applied in entrepreneurship as well as in entrepreneurship education (Hägg and Kurczewska, 2016). During this period, an increasing focus on more action-based learning approaches in entrepreneurship has sprung (Rasmussen and Sørheim, 2006) and the use of experiential learning and entrepreneurial learning was increasingly applied to explain and understand this educational approach (e.g., Fayolle, 2008; Pittaway and Cope, 2007; Vincett and Farlow, 2008). Today, there exist several different approaches to entrepreneurship education and traditional teaching methods appear to be more often replaced with designs focusing on hands-on and action-based activities (Mwasalwiba, 2010; Neck and Corbett, 2018). This action-based educational approach in entrepreneurship education has been advocated by several scholars in different studies (Lackéus and Williams Middleton, 2015; Neck and Corbett, 2018; Neck and Greene, 2011; Pittaway and Cope, 2007b) and, with this growth, the use of experiential learning has become increasingly mentioned; however, it is not without critics. While Pittaway et al. (2015) introduced experiential learning as a framework in their exploration of student clubs in entrepreneurship

education, they also accurately pointed to the fact that not all experiences represent experiential learning. Different parts of the learning cycle must be included in a learning situation and the dimension of transformation must be present to transform experiences into knowledge. This is also something Hägg (2017) illustrated in his work on reflective thinking in experiential entrepreneurship education and that other scholars also discussed (Blenker et al., 2008; Kassean et al., 2015).

The use of the experiential learning theory in itself has also been a source for critique. Reynolds (1997) argued that the contextual factors in which education occurs cannot be ignored and that learning styles alone cannot explain an individual's learning. This has also been discussed somewhat in entrepreneurship education and within the topic of entrepreneurial learning. For instance, it was mentioned that the context in which entrepreneurs operate influences the learning situation and, consequently, the future decisions that entrepreneurs face (Pittaway, Missing, et al., 2009). This was also mentioned by Politis (2005), who noted that an entrepreneur's learning process is often a more complex process that does not necessarily follow a determined sequence that Kolb (2014) described. Instead, an entrepreneur bases future choices on previous situations he or she has faced, where contextual differences influenced learning and decision-making. Hence, while the topic is not much discussed and commented on in entrepreneurship education, the context of learning does nevertheless influence the learning process through experiences and the learning situation (Macht and Ball, 2016).

While an individual learner is at the centre of the learning cycle and the theory of experiential learning (Kolb, 2014), research has also noted that the involvement and activity of a student is of importance for the learning process (Kolb and Kolb, 2009; Svinicki and Dixon, 1987). While the theory of experiential learning has been thought of as a counterbalance to classroom activity, the theory itself is clear that classroom activities are also experiences (Kolb, 2014; Macht and Ball, 2016; Pittaway, Missing, et al., 2009). However, whether a student passively receives knowledge or is active in a learning situation also has an influence. Kolb and Kolb (2005, 2009) argued for situations in which students are in control of their own learning situations because making students take charge of their learning might enhance their ability to learn from their experiences. Svinicki and Dixon (1987) created a model in which they implemented student-centred

and teacher-led learning situations into Kolb's model of experiential learning (see Figure 1). They also argued that different disciplines should find a combination of student-centred vs teacher-led learning approaches that fit their students. This is based on Kolb's (1976) extensive work on different learning styles, showing a connection between the theory of experiential learning's different learning styles and the students' fields of study. This difference between teacher-led and student-centred educational approaches has also been a focal part of a central entrepreneurship education discussion in recent years. In this discussion, some argue for a change towards action-oriented education (Kassean et al., 2015; Neck and Corbett, 2018; Pittaway and Cope, 2007b), while others discuss the dilemma of whether education should be taught 'about, for or through' entrepreneurship in a more holistic view (Blenker et al., 2006; Robinson et al., 2016).
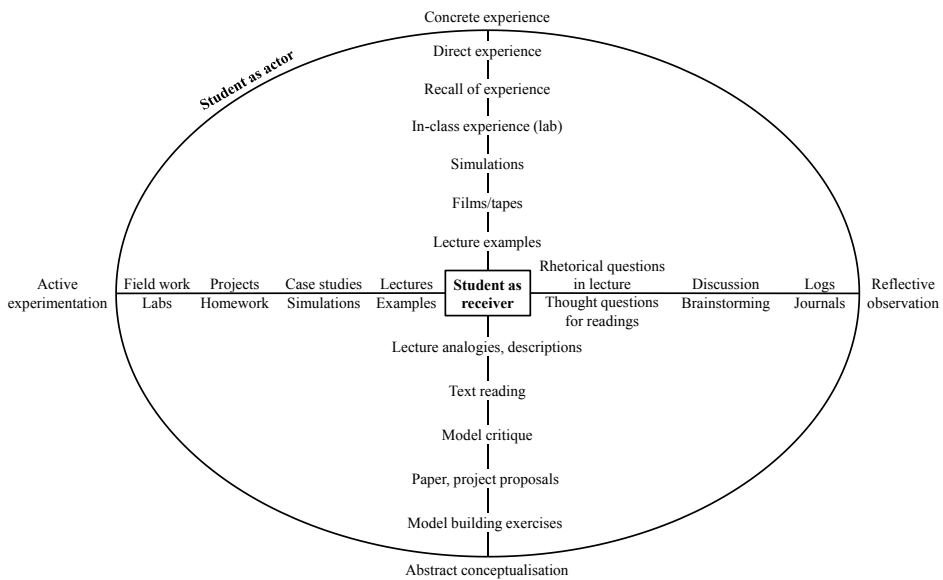
Figure 1 - Teacher-led vs student-centred learning approach in Kolb's learning cycle. Adopted from Svinicki and Dixon (1987).

The foremost arguments regarding adopting a more action-based entrepreneurship education approach is that it would, together with reflection and real-world experiences, lead 'to greater entrepreneurial abilities and propensity' (Kassean et al., 2015: 701). Another argument is that traditional pedagogical techniques cannot replicate the entrepreneurial activities that occur in new ventures (Pittaway and Cope, 2007b).

However, there is also a focus on learning from failure experiences (Bolinger and Brown, 2015; Shepherd, 2004), which is a central topic within the theory of entrepreneurial learning (Politis, 2005). This approach does, on the other hand, require students to be more in control of their educational activities. This is in line with the opinion of Robinson et al., who wrote that they 'are not advocating a complete move to student-centred, but we need to involve students as co-creators of the classroom in order to promote *ownership* of the learning process' (2016: 676, emphasis added). This implies that education in entrepreneurship should, perhaps, not only move towards student-centred education, as illustrated in Svinicki and Dixon's (1987) model, but that entrepreneurship education should also move towards a student-*directed* approach. As Politis (2005) underlined, previous experiences guide an entrepreneur's future choices and actions and, thus, entrepreneurs or students must have freedom to explore and learn from their experiences as well as the opportunity to make mistakes. Ollila and Williams Middleton (2011) present an education approach in which students are encouraged to make mistakes, the environment is designed to allow for this and is supported by peer students, faculty, alumni and external parties. Thus, students get the freedom to test their ideas with the possibility to fail but still with a great opportunity for learning. Hence, one might argue that student-directed education differs from student-centred education in the entrepreneurship field and that the former gives students more ownership over their learning activities, where learning also holds the possibility of making mistakes and failing. However, as Politis (2005) stated, experiences must also have a degree of relevance, arguing that this might be impossible in an educational setting. Nevertheless, the focus on educational designs that support authentic entrepreneurial learning situations still occurs and is advocated in the literature (e.g., Lackéus and Williams Middleton, 2015; Macht and Ball, 2016).

Authentic and Situated Learning and the Community of Practice

A learner's experiences are a central aspect of experiential learning. Kolb and Kolb (2018) clarified that all parts of the learning cycle are experiences in some manner, but that it is the 'here-and-now experiencing that initiates learning' (Kolb and Kolb, 2018: 9). Thus, while the theory of experiential learning does focus on the learning situation (Kolb, 2014; Kolb and Kolb, 2009, 2018), it tends to focus more on the influence and

conception of an individual's experience and situation and less on the cultural and social environment in which the experience and learning occurs (Reynolds, 1997; Seaman, 2008). In the work by Kolb and Kolb (2005), however, the context and environment were included into the theory through the concept of learning spaces. This concept is a development on Lewin's concept of life space and was introduced to create an understanding of the interface between the educational setting and environment and a student's learning style (Kolb and Kolb, 2005, 2009). However, while admitting that the context and learning situation are central for the student's experiences, the realness and authenticity of situations are receiving less focus. Kolb and Kolb (2005) emphasised that the theory of situated learning (Lave and Wenger, 1991) adds to the experiential learning theory but only through reminding that 'learning spaces extend beyond the teacher and the classroom' (Kolb and Kolb, 2005: 200). Hence, the university setting alone is not necessarily the only context for education based on experiential learning. However, if we dig deeper into Lave and Wenger's (1991) notions of situated learning and community of practice and into authentic learning situations (Brown et al., 1989), we see that these provide a more holistic view of learning situations and experiences that form learning.

Lave and Wenger's (1991) theory of situated learning states that knowledge only has power in specific circumstances and that the acquiring it is not something that can be separated from context in the form of a simple, abstract transmission between individuals. However, they go on to stress that learning is not only situated in practice but is 'an integral part of generative social practice in the lived-in world' (Lave and Wenger, 1991: 35). Thus, this theory builds on the foundation that learning has to be authentic and in communities of practice, that is, in contexts in which knowledge also has meaning in interaction with other people. Brown et al. (1989) noted that learning must involve activity, concept and culture because these are interdependent and cannot be understood on their own. Thus, activities must be authentic in the sense that they represent ordinary practises of the culture in which they usually occur. To understand their content requires insights into both situation and culture, which is again defined and practiced by the members and former members of a community (Brown et al., 1989). The concept of authentic learning situations has been further developed and explored since the works of

Brown et al. (1989) and Lave and Wenger (1991) and has been implemented into the literature on education and learning as well as entrepreneurship.

In an educational setting, situated and authentic learning focus on giving the students activities that are meaningful and coherent, reflecting the activities conducted in the social context in which these activities occur (Brown et al., 1989). Several researchers have explored this theory and concept in educational settings and various definitions of authentic learning situations have consequently emerged. Herrington and Herrington (2006) defined the learning context as encompassing a physical environment that reflects how knowledge is used and where activities should have real-world relevance and be completed over a longer period of time. Furthermore, they also stated that the context could be illustrated by metaphors through, for example, web interfaces or similar, which would provide students with authentic learning situations (Herrington et al., 2014; Herrington and Herrington, 2006; Herrington and Oliver, 2000). Others, like Rule (2006), noted that learning cannot only be authentic in terms of reflecting the real world but must also include social learning in a community of practice. Another important distinction of Rule's definition is that the 'students are empowered through choice to direct their own learning in relevant project work' (2006: 2). As problems are open-ended and authentic learning should adjust to the level of experiences and knowledge of the students, students must have the freedom to define problems and select the solution direction (Rule, 2006). Ultimately, this results in education being student-directed.

The entrepreneurship education literature has also discussed authentic learning but few works have explored authentic learning in entrepreneurship education as a special focus (Macht and Ball, 2016). However, authentic learning is nevertheless present in entrepreneurship education. Rasmussen and Sørheim (2006) explored an educational approach in which students are project owners and their ideas are coupled to the real world; Pittaway and Cope (2007) focused on simulating entrepreneurial learning because it is difficult to adopt real entrepreneurial activities in the learning process; Kassean et al. (2015) advocated real-life experience, action and reflection to engage students in authentic learning. In addition, there are others who focused, specifically, on authenticity in entrepreneurship education (e.g. Fenton et al., 2014; Nab et al., 2010). In Macht and Ball's (2016) work, the concept of authentic alignment in entrepreneurship education was

constructed, where learning is aligned to two authenticity dimensions—resemblance to and relevance for real entrepreneurial activity. However, while their educational example focused on starting real ventures in an educational setting, they admitted that this comes with a limitation because students are forced to work in teams but might wish to do so on their own instead (Macht and Ball, 2016). On the other hand, this problem is solved through venture creation programmes, where students start their own venture during their educational pathways (Lackéus and Williams Middleton, 2015; Ollila and Williams Middleton, 2011; Rasmussen and Sørheim, 2006; Warhuus and Basaiawmoit, 2014). In these educational programmes, students start and work in a real venture and, in contrast to the description of Macht and Ball (2016), they show a 'commitment and dedication needed for starting a real-life venture', 'treating the venture as "theirs"' (Lackéus and Williams Middleton, 2015: 64).

Conceptual Framework

Thus, to summarise, while experiential learning explains an individual's learning situation (Kolb, 2014) and separates learning in teacher-centred and student-centred educational approaches (Kolb and Kolb, 2009; Svinicki and Dixon, 1987), there is still some limitations in the theory regarding the authenticity of the learning situation. This is especially so with respect to cultural and social conditions (Reynolds, 1997; Seaman, 2008). Moreover, as stated by many scholars, all experiences do not necessarily give a reason for learning (Kolb, 2014; Pittaway et al., 2011). For instance, in entrepreneurship, the learning situation and context need to have some relevance in order for entrepreneurial learning to occur (Politis, 2005)—thus, the situation needs to be authentic (Kassean et al., 2015; Macht and Ball, 2016). As such, this thesis applies an integrated model of the theory of experiential learning (Kolb, 2014), in addition to the situated and authentic learning theory (Brown et al., 1989; Lave and Wenger, 1991). Student activities can be divided into being teacher-centred or student-centred as well as being more authentic and student-directed. This is illustrated in Figure 2. In this figure, Kolb's learning cycle and Svinicki and Dixon's model of learning approaches provided the base for the model and their circle is combined with the concept of authentic learning situations. Thus, on the rim of the circle, where students are more active, an additional axis of authenticity was added.
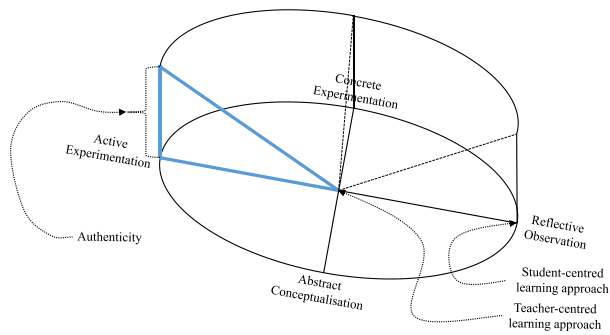
Figure 2 - Conceptual framework.

By integrating the previously mentioned views and theories, the framework focuses more on the student-directed view of education, where student-centred design and authenticity of the learning situation force students to make their own choices. These choices could be about deciding what problems to pursue and how to solve them. As students need to be more active and choose their problems and approaches, the authenticity axis is placed on the student-centred side of Svinicki and Dixon's model. Each part of Kolb's learning cycle could then be illustrated as a triangle, where Svinicki and Dixon's learning approach and student activity are illustrated along the horizontal axis, while the addition of authenticity is illustrated along the vertical axis. This is shown in Figure 3, where the blue triangle from Figure 2 is presented.
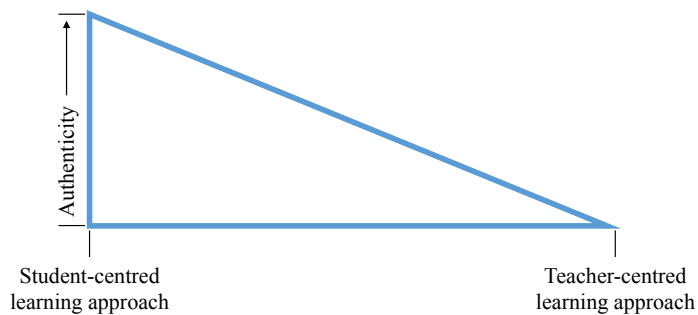
Figure 3 - Conceptual model based on Kolb's experiential learning theory, Svinicki and Dixon's student activity or learning approach and the inclusion of authenticity into the learning process.

68

4. Methodology

This section aims to give more detailed insight into the methodological choices and stands present in this thesis and its papers. The first section begins with a presentation of the journey that this study has been on—during which the researcher's background and work have been formed, influencing much of its development—and how this has shaped the development and results of this thesis' cover essay. A discussion of the philosophical views and their development is also presented. This is followed by a presentation of the research design of this thesis in which the methods of the four papers are discussed. Furthermore, the strengths and weaknesses of this thesis and its papers also receive attention in this section.

The Development of the Research and Its Author

The papers and the cover essay of this thesis developed over several years and the same applies for their researcher. Being both an entrepreneur and a recent alumnus from a master's programme in entrepreneurship, the topics discussed in this thesis are both well-known to and experienced by the author. On the other hand, delivering knowledge, facilitating skill development of others, encouraging and motivating others towards entrepreneurship and conducting research on these topics were unfamiliar grounds for the author when applying for the position as a PhD student. However, with ideas obtained during time spent as a student, combined with emerging experiences and new learning, this thesis has evolved together with its researcher over time.

When the journey began, the overarching interest was rooted firmly in the assessment of entrepreneurship education—a topic that did not alter during the course of the research and writing, for better or for worse. With the beginning came broad reading and an early conference paper on entrepreneurial intentions provided experiences and thoughts that lead the thesis away from that topic—which, in combination, raised more questions than it provided answers. For instance, some results showed that a cohort's self-efficacy could go up over a year, while their overall entrepreneurial intent went down, although many became entrepreneurs later on. A central question here was whether the intent to become an entrepreneur had the same meaning for all students. As Rosenberg (2012) explained, the question is whether the intent to do something would be dependent on the subjective

character of what this something is and, thus, would the intent itself change if the subjective view changes. Hence, this, together with the complexity of entrepreneurship education, gave birth to the idea of taking one step back and exploring different educational approaches and methods of assessment at an overall level. Through this idea, the goal was to explore this topic better and to provide the existing body of literature with new knowledge about entrepreneurship education assessment.

At the same time, as this thesis' proposal was finalised, a proposal for a centre for excellence in education, with a basis in entrepreneurship, was formed through the author's contribution to and creative vision of what this centre could develop into in the future. At this centre, both narrow and broad views of entrepreneurship education were established, focusing on an individual labelled as 'change agent', with this creating challenges in terms of educational outcomes and how they could be assessed. At the same time, many of the alumni from the researcher's master's programme cohort ended their venturing and start-up activities, slowly making a minority of prior classmates in paid employment into a majority. However, seeing them obtain positions as business developers, fund managers and product developers, it was clear that their education had results within innovation and entrepreneurship spheres but through outcomes that receive less focus in the literature. Thus, these experiences positively influenced the increasing interest of this researcher in the theme of objectives vs outcomes in entrepreneurship education.

Different approaches to entrepreneurship education were numerous and outcomes spanned a broader spectrum than only start-ups. However, the literature on assessment often lacked presentations of the educational programmes assessed and, in many cases, the studies used assessment methods with the objective of start-up creation as the educational programme's main outcome. Thus, the first idea for the thesis was to explore various educational designs discussed in the literature and in the real world so that this could be used as a foundation for organising different approaches to entrepreneurship education.

Initial Idea and Final Results
As assessment struggles with numerous variations in educational designs and results of the different studies, the first paper's objective was to create a typology that would allow

for a more fine-grained systematisation of entrepreneurship education. As other researchers had called for this in the existing literature (e.g. Fayolle and Gailly, 2008), this work appeared timely and a literature review was conducted to organise the body of literature's content. The various articles identified supported a learning approach and outcome impact differentiation and a two-axes matrix illustrated this result. This result also implied that there was more to entrepreneurship education than the standard classification of education 'about', 'for' or 'through' entrepreneurship (Pittaway and Cope, 2007b). Some connections to the outside world were present, although they were less discussed in the literature. Nevertheless, while the results were interesting and gained attention, the research based its foundation on research articles that described studies of educational programmes in which the authors themselves were often the faculty. Moreover, the focus in these articles was not on describing the educational programmes, which often meant that the descriptions varied in respect to details and quality. This led to the conception of the idea that entrepreneurship education deserves to be explored in further detail when it comes to various educational designs and, especially, to investigating further their connection to different educational contexts and environments. Thus, the development of a second study and paper on entrepreneurship education in the Nordic countries started.

While the second paper was placed in an engineering educational context, the focus on different designs of entrepreneurship education remained. Thus, the framing involved each individual engineer as a potential entrepreneur rather than entrepreneurship education *in* engineering. With results from the first paper in mind, the second paper explored the impact, collaboration and interaction of various educational approaches with the real world. Ten different universities in the Nordic countries were visited and, while the articles in the first paper focused on the impact of education on its context, this was less of a focus in the second paper when investigating the empirical data. Observing an impact was nice but the focus veered towards student development instead and was the result of collaboration with the real world—consequently, an impact on this world was a merely a by-product. Thus, the concept of action realness evolved, developing from theories on authentic learning situations, and a taxonomy distinguishing between the educational approaches and action realness was created.

During the same period in which the first and second papers were written, a paper outside the framework of this thesis was also written on the topic of ownership and teamwork[2] in entrepreneurship education, accentuating the differences in educational processes that students go through. As a former entrepreneurship student, the differences in the process and development of students in an education programme were obvious; however, this focus also lacked in the literature. Numerous researchers have called for process studies in entrepreneurship education and, together with new insights into alternative research methods, they initiated the creation of the third paper in this thesis on the learning process of students in a venture creation programme. In that study, the Zaltman Metaphor Elicitation Technique (ZMET) was applied as the research method. The results from this study had some similarities to those of the additional paper on teamwork and ownership— the students' educational processes differed within the cohort. The contextual influences from peers and the real world, in particular, were found to affect the process. Thus, new questions appeared regarding student learning and how it would influence programme assessment and outcomes. The latter issue led to the creation of the fourth study and paper on the outcomes of an entrepreneurship education programme in terms of the entrepreneurial careers of its graduates.

One of the author's first publications was based on the work conducted for the master's thesis prior to the PhD position and was quantitative in its approach.[3] Its focus was on start-up boards, a topic which is outside the scope of this thesis. However, the experiences with quantitative approaches obtained in the process of writing this work also opened possibilities for answering questions that needed more quantitative approaches—for instance, the activities and careers of graduates. This focus was also called for in the literature (Pittaway and Cope, 2007a) but few works had actually focused on post-graduation activities, as already identified in the second chapter of this thesis. Thus, the

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[2] Haneberg, DH; Brandshaug, SW; Aadland, T (2018) Eierskap og teamprosess i aksjonsbasert entreprenørskapsutdanning [Ownership and team processes in action-based entrepreneurship education]. *UNIPED* 41(1): 42–53.

[3] Bjørnåli, ES; Aadland, T; Fedorova, E; Mohammadi, A; Aune, TB (2017) Nettverkskapabiliteter og integrerende adferd hos lederteam og styrer [Network capabilities and behavioural integration of the top management team and board members]. In: Busch, T; Olaussen, JO; Pettersen, IJ (eds) *Bred og spiss! NTNU Handelshøyskolen 50 år: En vitenskapelig jubileumsantologi*. Bergen: Fagbokforlaget, pp. 271-287.

fourth paper studied all graduates from a venture creation programme and investigated their careers, focusing on entrepreneurial activities in a quantitative manner.

With all these developed papers and studies, the cover essay was then developed and constructed with a basis in learning from the processes of writing the different papers as well as in their results in a cumulated manner. For instance, the results of the second and third papers influenced the inclusion of additional focus on authentic and situated learning, as illustrated in chapter 3, in addition to Kolb's (2014) experiential learning theory. In these papers, a focus on student processes is also present, introducing the concept of time as a processual view of an educational programme and development of students' experiences. Moreover, in the first and second papers, the findings regarding an educational programme's approach and the learning situation of students led to the inclusion and development of the teacher-led vs student-centred approaches, which Kolb (2014) and Svinicki and Dixon (1987) focused on. The third and fourth papers increased the focus on the connection between educational design, objective and outcome, as this is in focus in chapter 2 and later in the discussion. Thus, the insights, results, knowledge and experiences obtained from the work of these research papers shaped the cover essay of this thesis into what it has become. Moreover, the development of the papers themselves was also a result of prior findings as well as the researcher's experience and development.

Other Projects and Articles

As already mentioned, other works that were developed during the writing of this thesis— a paper about teamwork and ownership and one about the position of boards in start-ups. In addition, other projects, reports and papers have also emerged during the same period. The most important was the development of a tender for becoming a centre for excellence in education, which was the first and most prominent activity of the researcher during the first year of the PhD position. In this work, creativity, networking and teamwork skills were applied, providing invaluable experiences and insights. With the tender being awarded, the centre, *Engage*, received status as a centre for excellence in education, and additional activities and possibilities emerged—for instance, additional resources for executing the study presented in the fourth paper.

Another project was a working paper on the importance of time in an incubation process among students in higher education. The influences of the work undertaken for that paper have also shaped, developed and clarified the view and focus of the work on this thesis. Moreover, the work on the thesis also developed other reports based on the knowledge obtained in its process. For instance, one report was written about the role of students in innovation and entrepreneurship in higher education, while another was written focusing on different outcomes of a specific entrepreneurship education programme. In addition, the author has created cases to be applied to different learning situations and has lectured on different topics known to entrepreneurship scholars.

Last but not least, the process also left a pile of empirical data, new ideas and executional experiences that are waiting to be utilised in the continuation of the author's career.

Philosophical Stance

What appears to be an eternal debate in the social sciences is whether all questions could be answered in an empirical manner, as they are in natural sciences, or whether the questions posed by social scientists differ from those posed by natural scientists and, thus, need alternative approaches (Rosenberg, 2012). Morgan and Smircich (1980) described this debate as a pendulum that initially focused on an objective view in the course of early social science research in which positivism had a strong stance—but this pendulum has since started to move more towards the subjective stance. However, development often sails between many of stances in-between extremes and depends upon the phenomenon being researched (Morgan and Smircich, 1980), which could be said to be the case in the research conducted for this thesis. Furthermore, in the discussions of objectivity and subjectivity, the idea of an intersubjective world also exist, which has a strong foundation in the philosophy of pragmatism (Biesta, 2010). The view of the author of this thesis follows the pragmatic one.

The ideas of pragmatism was born in the beginning of the twentieth century with the works of John Dewey and his views on knowledge and reality (Biesta, 2010). The epistemological stance of pragmatism is that there is a real truth—however, this truth is changing based on actions and experiences resulting from these actions. As Biesta (2010: 111; italics in original) stated, Dewey's view is a constructionist view but, where

traditional constructivism is purely mental and subjective, pragmatism differs: 'Dewey's constructivism is a *transactional* constructivism, a constructivism that holds that knowledge is at the very same time constructed *and* real'. Instead, it is the interaction with the real world that creates knowledge and, therefore, different views and knowledge might not be a result of different realities but might actually depend on different individuals' interactions with the real world. Thus, the answers that research in general has provided today are tentative but, in the longer run, may be able to develop into an absolute truth even though this absolute truth might reveal itself at the 'end of history' (Johnson and Onwuegbuzie, 2004). This does not mean that naturalistic research cannot be conducted but only that 'the act of observation is not a neutral registration of reality "out there" but always already involves particular selections from an infinite number of possibilities' (Biesta, 2010: 112).

Regarding what is 'out there', the pragmatic view on ontology is not as uniting as the epistemological view developed by Dewey. Biesta (2010) separated between a 'mechanistic' ontology and a 'social' ontology in terms of to social and behavioural research. In the latter view, intentions and reasons are the foundations from which an event could be explained as meaningful. On the other hand, the mechanistic ontology extreme would reduce different social activities to natural or physical phenomena. In terms of ontology, Biesta (2010) stated that Deweyan pragmatism is placed further at the end of causality in the spectrum but also stresses that Dewey did not support a deterministic universe. It is, nevertheless, dependent upon the side of pragmatism on which one's stance lies, while others have a more interpreting view (see Johnson et al., 2007). Some have argued that pragmatism focuses on practical implications of different research ideas and 'help[s] in deciding which action to take next as one attempts to better understand real-world phenomena (including psychological, social, and educational phenomena)' (Johnson and Onwuegbuzie, 2004: 17).

This philosophical view thus 'endorses a strong and practical empiricism as the path to determine what works' (Johnson and Onwuegbuzie, 2004: 18). Pragmatism offers logic in its view and focuses on answering questions using the most-correct methods for exploring different questions and phenomena. Hence, the pragmatic view is therefore a tradition that is open to and supportive of the use of mixed methods (Johnson et al., 2007).

Additionally, as Morgan and Smircich (1980: 498) wrote, it is not a method that decides upon a researcher's philosophical stance but, instead, the methods and techniques' 'precise nature ultimately depends on the stance of the researcher, and on how the researcher chooses to use them'.

The papers included in this thesis study different phenomena and apply different designs that explore different questions. They span from the more constructivist side to the positivistic side; however, they follow these views based on the phenomenon they are examining (Morgan and Smircich, 1980). For instance, if exploring which papers that stand furthest apart from one another in this thesis, we would find the third and fourth papers. One examined the student process in a strictly qualitative manner, while the other focused on the activities of graduates quantitatively. Both hold an assumption that assessment of education should also include a focus on the individual student; however, their views and approaches are based on in very different research traditions.

The third paper, involving the ZMET-approach, consisted of different steps that, on their own, could be placed in a more constructivist view. While individuals presented their personal views about their education through metaphors, the creation of mind-maps built on several students and omitted those that had 'outlier' views in order to create a more holistic view. Thus, the approach applied an intersubjective discussion between the interviewer and the interviewees to create a common view of the education. Moreover, in terms of the mind-map development, the design was constructed through the casual relationships between different constructs, representing more of a mechanistic view. As such, this approach followed the pragmatic view as presented.

However, this development of the approach, from an individual to a consensus through mind-maps, could also be viewed in light of metatheories. Reihlen, Klaas-Wissing and Ringberg (2007: 56) described organisations as 'individuals as well as processes, structures and environmental constraints' when discussing the two sides of individualism and holism as one—*systemism*. In their view of systemism, transformation of knowledge can only be 'appreciated if researchers take into account both cognitive dispositions (individualism) and social feedback mechanisms (holism)' (Reihlen et al., 2007: 59). As such, when interviewing students for the ZMET paper, a view of humans as social actors

was initially adhered to (Morgan and Smircich, 1980) but was later in the method combined, in a rigorous manner, with a collective student mind-map approach, showing the adoption of a systemism view in this method. Thus, while some parts of the ZMET paper used the idea of humans as social actors, the development of the results also focused on mapping contexts and on studying systems, processes and changes—with the latter often being found more on the objective side of the discussion (Morgan and Smircich, 1980). Moreover, this view also fit well with the ideas of pragmatism, as Deweyan pragmatism describes the universe as a 'moving whole of interacting parts' (Biesta, 2010). It can also be described as an 'evolutionary universe in which human beings are a creative factor and in which new things can emerge' (Biesta, 2010: 113).

Although somewhat different, the same could be said to be present in the fourth paper— i.e. that a systemism view is also found in its approach. This paper applied a strictly quantitative approach, often identified as a positivist method, but focused on the changes in and processes of students in the research design. The approach rejected use of cross-sectional data and used panel data to identify the development of the graduates participating in the study. The study might, therefore, place itself in a reality as a concrete process (Morgan and Smircich, 1980) and, as such, assess and explore the outcome of an educational programme through the development of the individuals within it. It is also clear that the research question in this paper, to a lesser degree, needed an interpretive approach and could be answered using positivist approaches. Or, differently put, if an education programme's aim is start-ups as an outcome and the concept of time is of interest, then the use of panel data as a longitudinal data source of the graduates' entrepreneurial careers answers this question. However, as the data from this paper were based on the use of LinkedIn data, as well as telephone interviews and survey results, the approach was also a pragmatic approach because the knowledge obtained results from an action with and in the real world (Biesta, 2010).

The second paper in this thesis presents a case study in which different countries and universities were examined. These different sites were analysed to study the system of entrepreneurship education and to also explore contextual collaboration with and interference in education. The paper used thematic analysis to explore empirical data but employed somewhat different methods. It used both an inductive and deductive approach,

depending on whether an educational approach or authenticity were being analysed. Hence, the different problems and issues were answered differently in the second paper. As a result, the findings were a result of both construction from theory and literature, as well as from empirical data collected at different sites, and is, thus, a result of the action taken by the researcher.

As stated in the beginning of this chapter and, indeed, in the very title of the thesis, this research focuses on the designs, learning and outcomes of and in entrepreneurship education and on how these influence its assessment. However, these three concepts are fundamentally different and studying them often raises different questions—some that could be answered in a purely empirical manner, while others could demand interpretation (Rosenberg, 2012). When investigating this thesis' stance at an overall level, it is clear that it also follows a more pragmatic approach. With the introduction of Kolb's (2014) experiential learning theory into the theoretical framework, a theory with influences from the subjective side of the debate was introduced, which also has its basis in the work by Dewey. However, as this view is developed in the theory section to also include the theory of authenticity, the view somewhat moves towards objectivity. While Kolb (2014) also focused on action and reflection, Dewey's dualistic mind-world view is contradictory and builds further emphasis on these two as being one. It is clear that students develop their knowledge through reflection and conceptualisation but the influence from and to the students' surroundings also affects student actions. Thus, while Kolb's (2014) work plays as a central role in this thesis, the development of its theoretical framework using self-directed learning and authentic situations moves this view further towards the objective side of the discussion. However, this view is far from a positivistic one. Rather, the stance follows pragmatism and rejects traditional dualisms (Johnson and Onwuegbuzie, 2004)— here illustrated in the subjective–objective discussion as Morgan and Smircich (1980) described it.

Research Design

As explained and elaborated on in the previous section, this thesis consists of several different research methods and the development of the results in this cover essay builds upon different studies in addition to the thesis' individual work. As such, this thesis applies a mixed method design, as defined by Johnson et al. (2007: 123), where a mixed

method could also be defined as a type of research: 'a mixed method program would involve mixing within a program of research and the mixing might occur across a closely related set of studies'.

The research question and purpose of this thesis revolve around students' learning and learning situation and how these influence assessment, as both learning and its situation have received increasing focus and development in recent years. This question is complex and demands investigation on several levels and from multiple perspectives. For instance, knowledge about the learning of an individual requires a close study of this individual, while the learning situation might follow a different and less 'interventionalist' approach. Thus, different papers investigate different phenomena central for the assessment of entrepreneurship education by implementing a range of methods and designs. For instance, both papers three and four are used to illustrate the influences and outcomes of an entrepreneurship education programme and have a central place in this thesis' results. Thus, they are being used to broaden the knowledge and discussion of this work.

However, while the thesis as a whole consists of different approaches, the cover essay is what Johnson et al. (2007) refer to as the program of research. From the literature review in chapter 2 (described in detail below), the results provide knowledge about the assessment literature and especially about how different outcome measures seem to fit different objectives in the literature. That is, how different outcome measures need certain assumptions in order to match their objectives. Furthermore, the third chapter builds the conceptual model that helps to identify and clarify the points to which different papers and methods are able to contribute (Burch and Heinrich, 2016). This builds a foundation and knowledge base for the topic, where logic later guides the analysis of different findings (Biesta, 2010; Burch and Heinrich, 2016).

Hence, this thesis uses the results and insights from its individual papers for the analysis presented later, in chapter 6, where the theoretical framework from chapter 3 is revised. As different research has many levels of analysis with different focuses, the conceptual models' phenomena are explored through different lenses in the different papers. For instance, the first and second papers shed light upon the topic of learning approaches in particular as well as develop knowledge regarding the connection to the outside world.

The third paper builds further on the insights regarding the outside world and the contextual factors that students might encounter in their learning situation. Furthermore, this paper develops the knowledge base about the learning that students in an entrepreneurship education programme might have and how their situation influences this learning. The last paper follows up on the contextual influence and explores an educational programme's outcomes in terms of the careers of its graduates, broadening knowledge about one educational design's effect on its students. The revised framework and the results are then discussed in light of the literature presented in chapter 2, which answers this thesis' research questions.

In the following sub-section, the data collection methods of different papers are presented. The analysis and exact procedures are found in the papers themselves in part two of this thesis. However, the next section also includes the procedure used for the literature review conducted in the second chapter of this thesis.

Research Papers and Data Collection

The literature in chapter 2 was collected through a systematic literature review. The ISI Web of Science database was investigated and the following search string was applied to identify the articles of interest in the database: *((entrep* OR enterp*) AND educat*) AND (assess* OR eval*).*[4] Both entrepreneurship and enterprise education were included in the search and both assessment and evaluation of such education were included. These terms are, to some degree, used interchangeably and assessment is often applied at the programme or course level (Falkäng and Alberti, 2000), while some assessment practices in Europe, and the United Kingdom especially, tend to use assessment as a term for testing student knowledge in the form of an exam or similar (Pittaway, Hannon, et al., 2009). In this thesis, assessment means the former—i.e. indicating the course or programme level and their evaluation. However, this does not mean that an exam or similar assessment format cannot also be used for either programme or course assessment.

The initial search resulted in 758 articles, whose abstracts were read. From these, 127 articles were included to be read and coded as the final sample. The majority of the articles

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[4] The keyword search was conducted in article titles, abstracts and keywords. Furthermore, only articles in English were selected.

were excluded in this first phase because they: focused on issues outside academia (e.g. enterprising); did not assess entrepreneurship education; missed the assessment or evaluation aspect; or were conceptual. Of the 127 identified articles, 65 were included in the final coding. The articles that were excluded in this phase did not clearly state its method and measures, did assess a method (e.g. massive open online courses) used in entrepreneurship education but without focusing on entrepreneurship or were conceptual.

The review focused on the designs, learning and objectives and, especially, on the different outcome measures applied in entrepreneurship education assessment. In this respect, the data, as described above, were important in viewing the different phenomena and developing insights about them while still maintaining a focus on assessment.

In terms of the different papers in this thesis, Table 9 shows their respective research designs and approaches at an overall level. All of them, as already presented, investigated different phenomena and used different approaches, which required different data collection methods, as presented below.

Table 9 - Research design and descriptions of the different studies in the thesis.

Paper	Research design	Observations and Level of Analysis (LoA)	Sampling Approach	Data
1	Literature review	122 articles	41 articles coded that held information about the education studied	Articles' education coded after questions 'why, for whom, what and how'
2	Case study	10 universities LoA: education	32 semi-structures interviews with faculty; data from websites	31 hours of interviews, 330 pages of data
3	ZMET	12 students LoA: venturing vs non-venturing students	12 interviews following the 'laddering technique'	18 hours of interviews, 228 pages of data
4	Linear and Poisson regression; applying 'Wooldridge's double-robust' estimator	178 graduates LoA: graduates vs non-graduates	LinkedIn data verified through telephone interviews; survey follow-up	Job history; demographics; educational history for all participants

As the purpose of the second paper was to systematise entrepreneurship education and ask how students are engaged in the real world through entrepreneurship education, a case study approach was applied (Yin, 1994). Although there are several classifications of entrepreneurship education, these have some limitations, as illustrated in paper 2, and, in

order to explore the dynamics in a university setting, a case study presents an acceptable approach (Eisenhardt, 1989). The data were collected through interviews with faculty members at different universities and a total of 32 interviews were conducted. The different interviewees and universities were selected through an identification of universities through the Nordtek[5] organisation, which had entrepreneurship education programmes. Two universities in each of the Nordic countries were visited. Thus, the trends in different countries could be identified and regional differences could be brought to light, illustrating different designs of and approaches to entrepreneurship education in the Nordic higher education sphere.

Prior to conducting the interviews, information about different faculty members and their courses in entrepreneurship was collected from the universities' websites so that these could be fully understood in the interview setting. The topics that were included in the semi-structured interviews revolved around the university and education contexts, the educational programme(s), and the interviewee. There was a particular focus on establishing a clear view of the educational programme(s) in question, aiming especially at student activities and the design of the educational programme. The question of 'how' an educational programme could be designed was identified as a topic that could help differentiate between different educational programmes in the first paper and this did receive attention in the data collection.

The interviews were conducted by two researchers in 30 interview sessions and the interviews were semi-structured in their design; however, the questions asked aimed at covering topics at an overarching level. The interviews also focused on the development of the educational programme(s) so that historical events could also be identified. This could provide insights into the trends in different countries or in higher education in general, as well as explore whether prior designs could be found in other places and vice versa. The collected data were insightful and the analysis established a foundation for a taxonomy of entrepreneurship education.

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[5] Nordtek is an organisation of technical universities in the Nordic countries that have advanced engineering programmes up to the master and PhD levels.

Moving to the third paper, which focused on new venture activities of students in a venture creation programme (VCP, Lackéus and Williams Middleton, 2015), the question now revolved around the students' learning process and, in particular, focused on the differences between students with and without new venture activities. As previously mentioned in this chapter, few articles in the existing literature have explored the student learning process and process studies are generally lacking. Although the third paper cannot be considered a true processual study due to its cross-sectional data collection method, the approach applied through the ZMET method is especially powerful for understanding topics that have been explored to a lesser degree (Catchings-Castello, 2000). In addition, as Zaltman and Coulter (1995) stated, it is a method useful for investigating experiences and the context of students' experiences with their new venturing activities.

To obtain insights and explore the student processes depending on their venturing activities, those students who were in their last VCP semester and who either worked in their own new venture or did not do so were identified and asked to participate. Moreover, the students selected also needed to be clear about how they intended to continue and what their career choice upon graduation was. In this manner, we could identify the differences between those students who planned to only focus on working in their own new venture upon graduation and those who had signed up for paid employment, thus only focusing on academic responsibilities at the time of the interviews. Not many students in the cohort satisfied the mentioned requirements so that only 12 students were included in the study. However, the identified consensus and saturation point found in previous research was met (Zaltman and Coulter, 1995). None of the students were told about the ideas behind the research, other than that the researchers were interested in their views on their education.

The data collection process followed the procedure as described by Zaltman and Coulter (1995). Five to seven days prior to the interviews the participants were asked to bring five pictures that represented their thoughts and feelings about their education. The interviews were then opened with the question whether they would share their thoughts and feelings about their education. Different students then used their respective pictures as metaphors to explain their views. In this part of the interview, the interviewers collected specific

concepts that were focused upon later on in the interview and the entire interview followed a laddering technique, digging deep into important concepts and topics. Through this method the connections between means and ends could be identified by exploring whether certain concepts were important to the interviewees and why they were important. During the later analysis, the data were shown to be powerful in describing the different students' views about their own education and, thus, to have answered the research question and fulfilled its purpose.

The last study moved the focus towards the outcome level and its purpose was to investigate the careers of graduates in order to obtain answers about the effect of entrepreneurship education. As illustrated in chapter 2, few articles focused on the general careers of the graduates, which was also a finding of Pittaway and Cope (2007a)—however, the fourth paper's question revolved around the activities of graduates in start-ups. The VCP that was explored in this paper view its objectives as broader than only new start-ups (although this is also important for its faculty); however, the question of outcomes in terms of start-ups is an important one for the literature. The theoretical foundation of the paper focused on the entrepreneurial careers of graduates, which means the graduates' involvement in start-ups. Especially important were the duration, the number of concurrent entrepreneurial activities and the underlying reasons for entering into an entrepreneurial career of interest.

The paper focused on time-specific aspects and longitudinal panel data were collected to answer its questions and hypotheses. Moreover, as students who enter into an entrepreneurship education programme are expected to have a positive attitude towards entrepreneurship prior to entering the programme, a well-known problem is handling this self-selection bias. However, the programme studied in this paper had a limit in the number of admitted students but a high number of applicants and, as such, allowed for both groups of students to be investigated. If the programme did not influence the students, a statistical difference between the groups would not be present. A problem with this approach is that the application process could potentially influence the results but this could be handled by controlling the application process, which is done using Wooldridge's double-robust' estimator.

The two groups of graduates, those previously enrolled in the programme and those that applied but were not enrolled, were imported into a database. Their LinkedIn profiles were then identified and the different jobs were entered into the same database. After this work was completed, all the graduates were contacted by phone to confirm the information obtained from LinkedIn, to add additional information about their work activities and to ask questions about their choices to move from job to job in their careers. Several weeks later, all graduates received an email with a survey asking for additional information about their backgrounds, opinions and careers. This survey resulted from a collaboration with Chalmers University in Gothenburg and with Lund University; it was ultimately labelled the Entrepreneurship Programme Alumni Survey (EPAS). However, in the fourth paper, the data from the EPAS database were only demographics used as control variables—the graduates' grades, whether they had entrepreneurs in their family and the educational level of their guardians.

A total of 536 former applicants were included in the original database, of which 260 went through the programme. Not all were reached by telephone and not all those who were interviewed over the telephone responded to the survey. In the end, 178 graduates answered both the telephone interview and the survey, of which 108 were graduates from the programme and 70 had applied but were not enrolled.

Strengths and Weaknesses

One of this thesis' greatest strengths is that it investigates its research questions through extensive use of many different sources of data, explores the topic of interest through several lenses and on several different levels. The thesis is both broad in its view when exploring the different entrepreneurship education programmes in Nordic countries, but it is also narrow when digging deep into students' perceptions of their education in the third paper. The work conducted in the first paper and in the cover essay's second chapter also provides insights into the literature in the field and its developments. Moreover, through the last paper, the accumulated insights and knowledge about assessment of entrepreneurship education come to light when a thorough assessment method is applied on a venture creation programme. Thus, the breadth and depth of the mixed method approach applied here is considered to be a strength of this research study.

When it comes to the validity and reliability of this work, a major point for the thesis, overall, is that it applies a triangulation in its design. This builds upon the discussion of Golafshani (2003), where triangulation—in a constructivist view (and further, based on the previous, pragmatic view)—is appropriate due to the intersubjective nature of knowledge. Triangulation is there to increase the strength of the study by combining different methods and studies in order to collect and analyse data about the phenomena in question (Golafshani, 2003). Hence, in this thesis' cover essay, different parts of the conceptual model are viewed, analysed and discussed using the four different papers to obtain different insights about the topic's different phenomena. Consequently, the effort put into the different research papers and the use of these in this cover essay, increases the trustworthiness of the work (Golafshani, 2003). However, for the different papers themselves, these hold different levels of reliability and validity because the different methods they use follow different philosophical traditions with different definitions of these terms (Golafshani, 2003). While the last paper obtained the most reliable data through the different tests and controls performed in its method, the more qualitative papers are also reliable, or dependable, although they applied different controls. However, the reliability or dependability of the research conducted in the third paper is the weakest, as it is context-specific—however, its viability is strong due to its rigorous and transferable method.

Nevertheless, while the thesis has several strengths and has applied methods that would make the entirety of its research trustworthy, some limitations also exist. The empirical data were collected from Nordics and from one particular entrepreneurship programme in Norway. The Nordic countries differ from other countries in many aspects, with low unemployment rates and more opportunity-driven entrepreneurship in comparison to other developed countries (Dvouletý, 2017). As such, a question from this is whether more graduates, both those applying and those enrolled, would focus on the pursuit of entrepreneurship if the society had a more necessity-driven entrepreneurship tradition or culture. Moreover, following this view with more opportunity-driven entrepreneurship, it might be possible that different educational efforts focus more on opportunity and creativity in the Nordic region in comparison to other countries or regions. Thus, education in Nordic countries could be more focused on aspects such as reflection or

creative thinking. Another interesting point is that European (and thus not only Nordic) researchers have a broader view of entrepreneurship in comparison to our North American colleagues (Hägg and Gabrielsson, 2019). The latter focus on self-employment and start-ups, while the former, for instance, also include social entrepreneurship. Hence, this limits the results somewhat to the Norwegian, Nordic and European contexts, which encourages further research.

It should also be mentioned that the author of this thesis graduated from an entrepreneurship programme. Although this also means that the insights into the programme are strong, it also indicates the potential influence of the author's subjective opinions and biases. However, following the view of an intersubjective development of knowledge, these insights and knowledge would be in development with the objects, colleagues or co-researchers. For instance, the data analysis was conducted together with one other co-author, the collection of the data also included student assistants and the results were investigated and critically commented on by colleagues. Nonetheless, this strong connection and experience of entrepreneurship education might guide the development of the research in some instances. Thus, in terms of trustworthiness, the researcher has taken steps in the design to increase this factor by, for instance, increasing the inter-reliability and co-coding in the qualitative papers and by controlling for the enrolment process in the fourth paper.

5. Presentation of Research Papers

Paper 1: Systematising Higher Education: A Typology of Entrepreneurship Education

Introduction

The first paper in this thesis presents a literature review on entrepreneurship education literature. As the literature on entrepreneurship education often lack detailed presentations of the different educational programmes that are being researched, it is difficult to compare the different results and findings of different studies, calling for more systematisation to be made (Fayolle and Gailly, 2008; Haase et al., 2011; Pittaway and Cope, 2007a). Some classifications of entrepreneurship education have emerged, with the most famous separating education *about, for, in* or *through* entrepreneurship (Hannon, 2005; Pittaway and Cope, 2007b; Robinson et al., 2016). However, a problem with this classification is that it claims that entrepreneurship education programmes fits into either groups and that educational approaches with clear differences in designs and outcomes are placed in the same group. Thus, in terms of assessing entrepreneurship education, the theoretical developments within the field with respect to classifications are unfinished (Fayolle and Gailly, 2008). The objective of this paper is to create a more fine-grained systematisation of entrepreneurship education. By investigating the existing literature, this study explores different designs of entrepreneurship education and, by analysing this through an educational level lens from the work of Fayolle and Gailly (2008), a typology of entrepreneurship education is created.

Method

A structured search on central keywords was conducted through the ISI Web of Science, resulting in 279 articles when limiting the search to the database's research areas. The abstracts of these articles were read and, on the basis of that screening, 132 articles were selected for a full reading. Of these, 122 articles were collected and read, resulting in 41 articles describing 42 programmes or courses in full. The descriptions of these 42 programmes were then entered into an Excel datasheet, organising them following Fayolle and Gailly's (2008) teaching model framework that evaluates programmes or courses using five questions: 'why', 'for whom', 'for which results', 'what' and 'how'.

When analysing the questions across the different educational programmes described in the literature, we identified that the question 'how' was the best differentiator of the framework's question and this was thus the foundation of this paper's typology.

Findings

The paper identifies two dimensions that classify entrepreneurship education, where the first emerges from the 'how' question of Fayolle and Gailly's (2008) teaching model framework. The second, the 'why' question, was combined with the 'when' question, creating the second dimension of the typology. The first dimension, labelled 'learning approach', classified educational programmes depending on whether these were passive (traditional), participatory (outcome focused) or self-driving (method focused). The second dimension labelled 'educational outcome impact' classified educational programmes depending on whether they had a student-centred impact or a contextual impact. This created a six-class typology for entrepreneurship education.

Moreover, the literature confirmed the need for a better classification of entrepreneurship education, as it is fragmented and because there is less focus on describing the education explored in different studies. It also shows that assessment of entrepreneurship education often uses entrepreneurial intentions as a measure as well as that there are several different approaches in this type of research.

Contribution

The paper contributes to the literature by offering an alternative to the most applied classification of entrepreneurship education: the 'about,' 'for' or 'through' framework (Hannon, 2005; Pittaway and Cope, 2007b). By introducing this typology, it is possible for scholars and programme managers to share their knowledge about their educational efforts, making it easier to compare different assessment studies. These implications are also opens for cumulative research in the field of entrepreneurship education.

Paper 2: An Entrepreneurship Education Taxonomy Based on Authenticity

Introduction

In engineering education, there have been many efforts to introduce entrepreneurship because it provides different and new opportunities for students—for instance, through

more hands-on, action-based or real-life learning situations. Entrepreneurship has been advocated among engineering scholars because it gives students experiences that go beyond traditional internships. However, this development also introduced discussions about educational efforts and there has been no consensus on how these educational efforts should be organised. Nonetheless, entrepreneurship education often creates authentic learning situations for students. Authentic learning is defined as situations in which students face coherent, meaningful and purposeful activities and where these activities reflect the actual activities that usually occur in the social context in which they are normally found. Authentic learning has been introduced and mentioned in some studies on entrepreneurship education and Macht and Ball (2016) used authenticity in their classification of education 'through' entrepreneurship. Other classifications also use or mention authenticity (or some similar terms) in their definitions, like those of Rasmussen and Sørheim (2006) and Pittaway and Cope (2007). However, all the mentioned classifications miss providing a clear and broad definition of authenticity in entrepreneurship education or leave out some of the educational programmes found within entrepreneurship. Thus, the research question of this paper is: How are students engaged in real-world learning opportunities through entrepreneurship education in technical universities?

Theory

Authentic and situated learning comes from Brown, Collins and Duguid's (1989) work, and focuses especially on how students can better understand the context in which they conduct their work in the end, how professionals in this context conduct their work and how they could obtain and utilise knowledge in this context. After the introduction of this idea, several definitions were developed for the theory, with some overlapping views, and this paper uses Rule's (2006: 2) definition of authentic learning:

> 1) the activity involves real-world problems that mimic the work of professionals in the discipline with presentation of findings to audiences beyond the classroom; 2) open-ended inquiry, thinking skills, and metacognition are addressed; 3) students engage in discourse and social learning in a community of learners; and 4) students are empowered through choice to direct their own learning in relevant project work.

Furthermore, as mentioned previously, several classifications have already tried to organise entrepreneurship education, of which the most applied version might be the 'about, for, in or through' model (Hannon, 2005; Hoppe et al., 2017; Pittaway and Cope, 2007b). In addition, action-based entrepreneurship education was differentiated by Rasmussen and Sørheim (2006) and Mwasalwiba (2010), four worlds of entrepreneurship education were identified by Neck and Greene (2011) and a continuum of entrepreneurship education was introduced by Neck and Corbett (2018). However, while apparently having different approaches to the types of entrepreneurship education, the different classifications still have similarities, and this paper illustrates that entrepreneurship education could be divided into the following educational approaches: 'teacher-directed', 'participatory' and 'self-directed'—a continuation and refinement of the findings presented in the first paper of this thesis.

Method

This paper has two different research questions that require somewhat different approaches. To create a taxonomy of entrepreneurship education, ten different universities in five Nordic countries were included in the study, where three to four course or programme managers and teachers were interviewed about their universities' educational offerings in entrepreneurship. The universities were selected based on a report on entrepreneurship education among 27[6] technical universities in the Nordics, all part of the Nordtek organisation (which is an interest organisation for technical universities in the Nordics). A total of 32 interviews were conducted at these universities, resulting in over 300 pages of transcribed interview data covering the topics of university policy, course development, assessment, objectives, outcomes, content, etc. The data were afterwards analysed differently according to the focus of the analysis. While a deductive approach was applied for different educational approaches in order to empirically confirm the different educational approaches, an inductive approach was applied for the authenticity dimension using the same data. Thematic analysis was also applied in the analyses and themes were identified across various universities when investigating their educational approaches, while the themes were identified within the

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[6] The number at the time of the research. The organisation has 30 members as of August 2019.

different educational approaches when investigating the authenticity of the different entrepreneurship education programmes.

Findings

The results show that the educational approach in entrepreneurship education can be divided into 'teacher-directed', 'participative' and 'self-directed', as identified from the literature and the first paper of this thesis. However, the empirical data also shows that these educational approaches were organised in a hierarchical manner. That is, an education could introduce the participatory educational approach to its students but the students also needed to be introduced to the teacher-directed approach if the participatory approach is to reach its full potential. This could be explained by noting that students need some sort of theoretical foundation connected to the application of their knowledge. The same applies for the self-directed approach—an education needs to introduce the participatory approach before the self-directed approach could reach its full potential. However, while these educational approaches are organised in a hierarchical manner, this does not mean that one needs to go from a teacher-directed *to* a participative approach or from a participative *to* a self-directed approach. Instead, it means that, when introducing the participative approach, the educational programme should also introduce the teacher-directed approach in the educational pathway at some point.

Moreover, the findings also show that entrepreneurship education has different levels of action realness. When analysing the data through the lens of authenticity, the educations offered had either a lack of authentic learning situations, an authentic learning situation in which the real world was mimicked or the learning situations offered were in the real world. Hence, the educational activities could be divided into 'pretence', 'authentic' and 'real' when it comes to action realness in entrepreneurship education. However, these types only exist in some educational approaches. Pretence was present in all educational approaches, while authentic could only be found in the participative and self-directed educational approaches, as the definition of the teacher-directed educational approach does not allow it to coincide with an authentic learning situation. The same applies for the real class of action realness, which can only be found in the self-directed educational approach.

Contribution

This paper itself contributes to the literature by introducing an empirically developed taxonomy of entrepreneurship education that will aid researchers in their assessment efforts as well as educational programme managers in finding and designing educational programmes according to intended objectives. It also reveals that entrepreneurship education is semi-hierarchically organised, where different educational approaches are closely connected to and build upon one another.

Paper 3: Learning from Venture Creation in Higher Education

Introduction

In entrepreneurship education over the last one or two decades, there has been a massive shift towards more experiential and action-based learning. One type of such educational programmes are venture creation programmes in which students start, organise and run their own new ventures. By organising the educational programme around a new venture, the faculty can connect the curriculum to the ventures and, therefore, these venture become a vessel for learning. However, as new ventures are full of unforeseen occurrences and situations often outside the students' control, the use of new ventures in the learning context has an inherent uncertainty. As a result, some of the students end their venturing efforts before graduation; however, academic activities still remain in their educational programme. Little is known about students who decide to abandon their venture creation efforts in such an action-based education setting and the purpose of this paper is to investigate potential differences in the learning process of students that end their venturing efforts in comparison to those who do not.

Theory

This paper applies entrepreneurial learning (Politis, 2005) as its framework to investigate the learning that the students participating in the study undergo. As entrepreneurial learning is closely connected to the entrepreneurial process, this framework is especially applicable as students go through a process while starting their own new venture. The framework of entrepreneurial learning has also been applied in entrepreneurship education research to an increasing degree. This paper uses learning through the new venture process and social and situated learning as its two overarching themes to investigate the learning among students. The learning from the new venture process has

for long been connected to entrepreneurial learning and the different events that students go through in their venturing process are expected to increase their knowledge and, thus, their learning. Moreover, as the learning and venturing process is context-dependent, this is also included in framework. It has been found that context does not merely have an influence on the venturing process but that it should be considered a part of the process. The context also has a dynamic characteristic and changes over time, which implies that the learning changes as the context develops its interaction with the venturing process. In addition, students might also experience different learning although being in the same situation and this type of learning could be connected to the theory of communities of practice and the social learning occurring in the context of the educational programme.

Method

As little is known about the influence from ventures (and the lack of it) in an educational setting, an inductive and explorative design was applied to fulfil the paper's purpose. The theoretical frame of reference in this paper was later applied to investigate the result of the inductive approach. Thus, the Zaltman Metaphor Elicitation Technique (ZMET) was applied. The ZMET used metaphors to bring forth and characterise the interviewees' mental models and the method was described by Zaltman and Coulter (1995) as being useful for understanding consumers' images of, for example, experiences or life experiences, e.g. students' images of their own education. This method was thoroughly described by Zaltman and Coulter (1995) and has seven distinctive steps. In these steps, the laddering technique and mean-end theory stand central and were applied for the construction of mind maps, which were developed from the groups of interviewees. Twelve students from a venture creation programme (Lackéus and Williams Middleton, 2015) were recruited for the study, of which six worked on their own start-ups, while the other six did not and were only focused on the academic activities of the programme.

Findings

The result show that, for both the students that had a venture and those that ended their venturing process, the social milieu and culture are the most central constructs of the venture creation programme. While prior research has pointed out the importance of the social milieu and context, this paper suggests that this has an even more important role than what prior research has indicated—especially for students who ended their venturing

efforts because the context seems to play a central role in their learning. Moreover, the results show that, although the students who do not have a venture they work with, it is clear that they are still a part of the learning situation but that the context contributes to the learning to a higher degree, while the students with ventures tend to focus more on them in their learning situations as expected. However, an interesting finding is that student learning through new ventures appears to be more complex than previously assumed in the literature and that it is filled with uncertainty and different challenges.

Contribution

The two main contributions of this paper are, first, that the culture, social milieu and student learning are central concepts in educational programmes with venture creation. Second, and more importantly, is that these aspects differ between the students who work on a new venture and those who have ended their venturing efforts. Hence, the students without a new venture effort must obtain their learning from other sources and tend to focus on and reflect about their future career and life in their learning situation. However, the group with new ventures tends to focus more on contemporary issues connected to their ventures when they engage in their learning situation. The communities of learning that these programmes have developed nonetheless facilitate the learning of both groups of students.

Paper 4: Career Characteristics of Entrepreneurship Education Graduates

Introduction

While entrepreneurship has grown over the recent decades and has received more focus and resources during this increasing trend (Fayolle et al., 2006), several assessment studies have occurred. However, different methods that were introduced came with varying results and quality (Duval-Couetil, 2013; Rideout and Gray, 2013). In addition, few of the methods applied in the literature explore the activities of graduates over time. While some studies have investigated the venturing processes of graduates post-graduation (Åstebro et al., 2012), they have still not provided information about the activities that graduates do over time, something that has been called for many times (Pittaway and Cope, 2007a). Thus, the purpose of this paper is to investigate the

entrepreneurial careers of graduates from an entrepreneurship education programme and explore the effect that the entrepreneurship education programme have had on them.

Theory

Careers of individuals were described in early literature as organisation-dependent and of a linear fashion. That means that an individual could be promoted gradually within an organisation. However, recently, the focus of careers has shifted from an individual being organisation dependent for their career to an individual taking more control over their own career. Thus, the careers have become more dynamic and non-linear. The reasons to become an entrepreneur are many but internal or external forces might influence the decision to become an entrepreneur—and whether an opportunity occurs will also be central in this process. To objectively investigate the careers of the graduates from an entrepreneurship education programme, we introduce Katz' (1994) theory of entrepreneurial careers. It states that an individual in an entrepreneurial career will have multiplicity, that is, multiple occupations simultaneously, have a shorter duration of their entrepreneurial activities and have more emergence into entrepreneurship, which is explained by Katz as the want for wealth and the presentation of an opportunity making an individual pursue an entrepreneurial career.

Method

To be able to test the hypotheses, information was collected about the careers of applicants to a venture creation programme (Lackéus and Williams Middleton, 2015). A total of 536 students were interviewed during the year for acceptance into the programme (260 were later enrolled). All were entered into a database together with information about their careers collected from LinkedIn and other web sources. Later, these students were called and interviewed about their careers so that their career information was confirmed and they were, simultaneously, asked to participate in a survey about their education and careers. A total of 178 former students participated in both the telephone interview and answered the survey (108 former entrepreneurship programme students and 70 non-programme students). To be able to control for the admission process, Wooldridge's double-robust estimator (Wooldridge, 2010), or the inverse-probability-weighted regression-adjustment (IPWRA) estimator, was applied in the analysis. Multiplicity was defined as the number of activities, in addition to the main occupation,

that an individual has in new ventures. This measure was calculated as an average over the number of years in which an individual had been working after graduation. Duration was measured as the average number of years during which an individual worked in a new venture (however, this group was limited to those that had been working in new ventures). Emergence was defined as an action by someone who entered into a new venture due to external motivation and initiated by this individual him/herself, as defined by Katz (1994). This latter measure was collected through telephone interviews.

Findings

The results showed that the alumni from the entrepreneurship programme had a higher level of multiplicity and longer duration in their new ventures, while the emergence measure was inconclusive. Hence, our first hypothesis was confirmed, our second was rejected, while the third was inconclusive. Regarding multiplicity, the results showed that the students who participated in the entrepreneurship programme had almost twice as high a rate of multiplicity as the graduates who applied but were not enrolled. It also showed that, of the treated students who were older at the time of application, there was a higher rate of multiplicity. Moreover, for respondents who were treated but who also regarded their grades as above average, the multiplicity level was lower. When it comes to duration, the findings showed that the graduates from the programme, on average, had a six-month longer duration in new ventures in comparison to the students who were not enrolled (untreated group). On average, the mean outcome model showed that the entire sample would remain in new ventures for two years once they joined one. Furthermore, only the untreated group had control variables that influenced the duration significantly. The age at application influenced it negatively, years since graduation positively and having entrepreneurs in the close family had a significantly negative influence. The latter control variable also had a high factor value, illustrating a strong influence.

Contribution

On an overarching level, the results illustrate the diverse paths that individuals can pursue in their careers. They may follow new ventures only, for a short period, or several at the same time while they are employed. However, the paper findings also indicate that there is a significant difference between those who participated in the entrepreneurship

programme and those who were not enrolled. Thus, some influences from the programme on the careers of individuals could be drawn as a conclusion from these findings.

The paper also contributes by introducing a method that could be applied to effect research in entrepreneurship education assessment and which handles the issues with selection of students (and thus also the self-selection to the programme). Moreover, the findings open new questions for future research. For instance, as discussed in the paper, the duration of being in new ventures might result from better ideas being pursued by the graduates from the programme, indicating that their opportunity identification has increased because of the programme. However, it could also be a result of the graduates' experiences and that they can cope in their activities and work in new ventures while dealing with difficulties that other nascent or fresh entrepreneurs encounter for the first time. The multiplicity level of the programme's graduates might be a result of these graduates testing different ideas while, at the same time, reducing the risks connected to starting a new venture or from the fact that they follow their passion and have the best of both worlds in a multiplicity career.

6. Analysis

The papers in this thesis can be organised in two different categories. The first focuses on entrepreneurship education at an overarching level, identifying different courses or programmes and organising these into a typology based on the literature of entrepreneurship education (first paper) and later through a taxonomy based on entrepreneurship education programmes at ten different universities (second paper). The second part, papers three and four, investigate a venture creation programme (Lackéus and Williams Middleton, 2015), where start-up creation is a part of the education and where this activity is dependent on students. The third paper explores the students' views on their own education, where some of the students work in a start-up, while others have ended their venturing activities. The fourth paper explores the influence from this programme on the careers of students and is an example of different results from receiving or not receiving such education. Hence, this chapter is split into two parts, focusing on educational designs in the first part and on a venture creation programme in the second.

The analysis in this chapter follows the framework developed earlier in this thesis and is contextualised in entrepreneurship education. The framework is illustrated in Figure 4. As this thesis' overarching research question is how student learning and learning situations influence assessment, the third part of this chapter focuses on the findings from the perspective of evaluation and assessment.
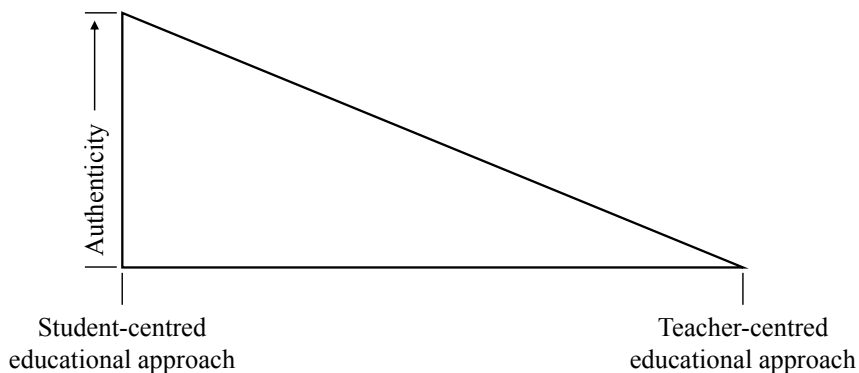
Figure 4 - The conceptual framework of the thesis.

Variety of Entrepreneurship Education

The first paper shows that, while entrepreneurship education seems to follow a traditional tripartition, similar to the traditional division of 'about, for or through' (Hannon, 2005; Pittaway and Cope, 2007b), it also appears to be diversified on another dimension, where the context is central and of importance. This second dimension, dividing entrepreneurship education on its influence on its context, where student-centred impact and contextual impact are the two relevant groups, shows similarity with the authenticity-dimension presented in this thesis' conceptual framework (Brown et al., 1989; Lave and Wenger, 1991; Rule, 2006). The paper focuses on whether the students are connected and intertwined to the 'real' world or whether the educational activities are limited to affect the students and the actors in the classroom only. Authenticity and real-world impact are found present in the literature and this builds the foundation from which to further explore education programmes and whether they are differentiated in terms other than their educational approaches only.

The second paper, much like the first, also identifies three class differentiations in terms of educational approaches. These classifications differentiate entrepreneurship education programmes in terms of whether their educational approach is *teacher-directed*, *participative* or *self-directed*. This is a continuation of the first paper and is based on previous salient classifications of entrepreneurship education found in the literature (Hannon, 2005; Hoppe et al., 2017; Mwasalwiba, 2010; Neck and Corbett, 2018; Neck and Greene, 2011; Pittaway and Cope, 2007b; Rasmussen and Sørheim, 2006). However, while previous classifications are somewhat unclear about the connections between different educational approaches—whether some of these require a continuity into new classes and special antecedents or whether they should be organised in a hierarchical order—this paper's findings show that educational approaches in entrepreneurship education should be hierarchically organised. Thus, to educate through a *participatory* approach, one should also include an educational approach that is *teacher-directed*. The same applies for the *self-directed* approach, which should be implemented together with the *participatory* approach. However, they do not need to succeed one another, that is, a *teacher-directed* approach does not need to appear *before* the other approaches but they do need to be included in the portfolio of courses or parts of courses. Moreover, these

classes are differentiated based on the students' activity levels. The *teacher-directed* approach is more traditional in its design and students might be more passive in these educational programmes. On the other hand, the *self-directed* approach has students who are more active in the learning situation and are more self-driven in their activities. This differentiation seems to support the horizontal axis in Figure 4, which builds on Svinicki and Dixon's (1987) 'student as a receiver' and 'student as an actor', or teacher-led and student-centred, differentiation. However, it also adds to this by showing that the students need to build their knowledge by including a receiver-part in their education if this also includes an actor-part. Hence, if students are to be actors in the learning situation, they also need to be receivers at some point, which puts a more holistic view on entrepreneurship education (Robinson et al., 2016). This could be a result of the higher complexity of being an actor and to the fact that some fundamental knowledge might not be obtained, which makes the activity difficult to reflect and think upon. This could also be viewed in light of the schema theory (Piaget, 1950; Pritchard, 2003), according to which the meaningful connections between nodes are difficult to accomplish without a foundation to build the knowledge further upon. This could be viewed as a sort of scaffolding design (Brown et al., 1989), which has been advocated as a necessary balance in entrepreneurship education (Robinson et al., 2016).

The second dimension, the vertical axis, presented in the second paper, differs from the vertical axis in the first paper. However, it builds on the same assumptions that the educational authenticity and connection to the real world differs among different entrepreneurship education programmes. The second paper's findings show that the level of action realness in entrepreneurship education, which is based on authenticity, can be separated into *pretence*, *authentic* or *real*. Moreover, while the first paper found that the connection to and impact on the real world could be differed in all three educational approaches identified, the second paper discriminates the different educational approaches with basis of action realness. Educational programmes with a *teacher-directed* approach do not have an *authentic* action realness level. The same applies for the *participative* approach—it does not have a *real* action realness level. This supports the increasing level of authenticity in this thesis' conceptual framework, where educational approaches close to the centre of Svinicki and Dixon's (1987) model have a

low possibility of being authentic, while the approaches near the rim have the possibility to be more authentic. In addition, the activities closest to the rim also have the possibility of being *real*. This builds on the definition by Rule (2006) in which authentic learning is defined as mimicking the real world. However, the second paper presents educational programmes in which the activities are real new ventures, often based on the students' own ideas, where the students are in management positions and where these ventures might be their actual jobs after graduation. Hence, the second axis in the taxonomy of entrepreneurship education shows a broader level of realness than anticipated and, as such, adds to the conceptual framework, spanning beyond authentic learning and moving education beyond the classroom (Lave and Wenger, 1991). This also implies that students might receive education that has a higher level of relevance in terms of entrepreneurial activity, the possibility of which has been questioned in prior literature (Politis, 2005).

Entrepreneurship Education Programme Explorations

The venture creation programme investigated in papers three and four can be placed in several of the categories found in the taxonomy presented in paper two but with a focus on having students learn through a *self-directed* and *real* format. In addition, the educational programme is diverse in the sense that the activities included in its different parts and courses support all parts of Kolb's (2014) learning cycle. Thus, this educational programme has several approaches that it introduces to its students and, although it consists of a diverse group of students, they should all be able to learn despite having different learning styles (Kolb, 2014). However, the results of the study in the third paper reveal that the educational programme is differently perceived by the students who work in a new venture and those who do not. The learning processes especially varied and, for the students who had a new venture, more complex descriptions of different factors influencing learning were used—for instance, that uncertainty, prioritisation and the choice of opportunities were central to their learning. For the students who did not have a new venture, less complicated learning descriptions were used. Moreover, the two groups differed in their descriptions of the learning environment and milieu. Where the group that had new ventures described it as a place for sharing, supporting, caring and being social, the group that did not work with a new venture also described it as a place in which there were expectations among students. They described this as a place that was

caring and supporting, as well as social, but in which students had expectations about the work and participation conducted in the learning environment. Hence, to be part of the 'core', certain requirements needed to be fulfilled. This could be viewed in the light of the descriptions by Lave and Wenger (1991) of legitimate peripheral participation, where newcomers learn by conducting tasks that, over time, increase in complexity and relevance for the activities in a community. Therefore, the students who had a new venture might be viewed as full participants and the requirement for this is to strive towards some sort of entrepreneurial activity. This shows that, although the educational programme offers students the same activities and resources, the immediate learning process appears to differ between the groups and that the environment, community and culture that the students are a part of act differently according to the students' activities, which might also influence student learning (Reynolds, 1997).

On the other hand, while educational activities and learning differ *in* the programme, the fourth paper finds that students from this educational programme significantly differ in their entrepreneurial careers after graduation in comparison to those that applied for the programme but were not enrolled. The main findings of this paper are that the graduates have a higher extent of multiplicity, that is, that they are engaged in one or more new ventures and combine this activity with paid employment. In addition, they also show that the graduates have longer durations at their new ventures in comparison to those who applied but were not enrolled. Three important aspects could be discussed from these findings, some of which were explored and discussed in the paper as well. The first is that the multiplicity aspect of the graduates results from opportunity exploration and that the students appear to test these opportunities, benefit from them in terms of passion or develop them into sustainable businesses. However, it also shows that there are many alternatives when graduating. The students do not need to pursue only new venture creation or paid employment but could pursue hybrid versions, as found in other studies (e.g., Dahlstrand and Berggren, 2010). Moreover, another discussion and suggestion for future research is that students, who are not in new ventures or do not follow a multiplicity approach in their careers, could conduct entrepreneurial activities as 'intrapreneurs' or similar (Antoncic and Hisrich, 2003; Hisrich, 1990).

A second aspect and finding is that the duration of the ventures started by graduates from the programme is, on average, longer, which implies sustainability, persistence or long development periods—differing from the group of graduates that did not enrol in the programme. This is in contrast with the theoretical framework of the paper and, as such, presents an interesting contribution. Moreover, if a venture is sustainable and the business is becoming profitable, this might be due to, among other things, the entrepreneurs in the new venture coping with its liabilities of newness (Shepherd et al., 2000). The latter point brings us to the third aspect, which relates to whether entrepreneurship education can create entrepreneurs. In the fourth paper, the discussion also touches upon the educational programme's ability to create a 'long-lasting' culture among its students and graduates so that the graduates expect from one another to pursue entrepreneurial activities and begin new ventures. However, another reason might be that graduates, to a much higher degree than those who did not enrol, have obtained relevant experiences so that their future choices are more entrepreneurial. Hence, the high pursuit and identification of opportunities (multiplicity) and the longer duration (if a result of coping with liabilities of newness) in comparison to the students who did not enrol, might illustrate that the students in such programmes can obtain relevant entrepreneurial knowledge, in contrast with Politis' (2005) view.

Summary of Main Findings

An individual is central in Kolb's (2014) theory of experiential learning. An individual's prior experiences shape his or her future actions (Kolb, 2014; Politis, 2005) and, consequently, future experiences and learning. Moreover, an individual's learning style also influences the learning process (Kolb and Kolb, 2009). However, our findings show that entrepreneurship education can be classified based on the educational approach and the authenticity of the design used, adding to Svinicki and Dixon's (1987) model with an additional axis of *action realness*. This action realness influences educational programmes and the findings in papers three and four demonstrate that students in entrepreneurship education might have different impressions of it. Thus, by moving educational design further towards the student-centred approaches—and higher in terms of action realness—the more student-driven and open-ended the education becomes. Not only would educational programmes in this area encounter higher levels of uncertainty if

new ventures or real-world business collaborations are activities but the complexity of problems and choice of solutions would also make students follow different pathways and encounter different experiences, which might lead to differences in learning.

The venture creation programme in papers three and four has an educational design in which students are teacher-led and have student-centred activities with low action realness; however, also activities in which students are active in real ventures and are thus self-driven. The design span educational approaches from teacher-led to student-centred, and with *pretence*, *authentic* and *real* educational activities. In addition, the learning is adjusted to different learning styles, with content that includes journals, discussions, text reading, paper writing, lectures, case studies, field work, lecture examples and direct experiences (Kolb and Kolb, 2009; Svinicki and Dixon, 1987). However, the complex, free and uncertain approach in terms of new venture creation (and maybe just the close interaction with uncertainty in the real world and context) influences individuals. Ending a venturing activity would make an individual's view and learning in this educational pathway different and would move this individual towards a more peripheral type of participation by not being part of the 'core'. In addition, coming from the same educational programme and significantly differing from those who did not enrol in the education, the fourth paper still illustrates that the outcomes of such educational programmes might produce graduates from portfolio entrepreneurs to those who only focus on one career at a time.

Based on this, a revised version of the conceptual model is presented in Figure 5. As illustrated in this model, authenticity is replaced with action realness, which includes *pretence* at the bottom, *authentic* in the middle and *real* at the top in a gradually increasing and changing manner. This axis has also been marked with uncertainty, indicating that it, to a higher degree, occurs in various activities that are conducted in and intertwined with the real world. The horizontal axis has the same labels, teacher-centred and student-centred on either end, but here there are also arrows that have been added to indicate the differences on this axis. One arrow indicates the increasing level of the student-directed educational approach. The second arrow indicates the complexity of moving towards the student-centred approach, as this entail a combination of both teacher-led and student-directed approaches in a hierarchical manner.

Two arrows have also been added on the hypotenuse of the model, illustrating the open-endedness of such educational programmes and contextual influences. The first arrow indicates an increasing level of open-ended problems and, thus, solutions or approaches, to the activities conducted in the education programme—a direct result of its design being more student-directed. In addition, the action-realness and the uncertainty that the higher level of this implies make certain problems more relevant for some students, while others might not encounter them. For example, customers might be more abstentions in one industry in comparison to others and students might have to work differently and over a varying time span in terms of sales. Thus, one student might experience the sales process, while another student with similar product progress could struggle with it. The second arrow on the hypotenuse is also connected to this, illustrating that contextual factors increase in influence the higher the action realness is that an education has, as well as in terms of the social influence that more student-centred activities imply. This is clearly illustrated in the third paper, while the fourth also shows this through dependence within cohorts. Hence, the context, environment and milieu of an entrepreneurship education programme can influence the careers of its students upon graduating.
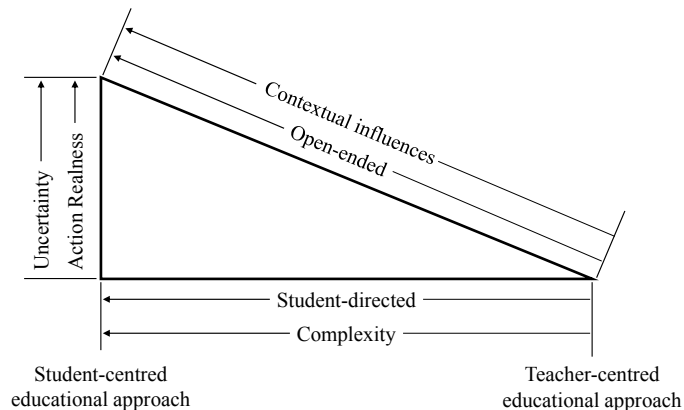
Figure 5 - The revised conceptual framework.

Therefore, in an educational programme where the students go through the same curricula, participate in the same lectures, conduct the same activities and interact with actors in the real world, this might influence the students differently and they would have different learning processes. Thus, in terms of assessment in entrepreneurship education, these individual differences might influence the results.

7. Discussion

The results and the revised theoretical model of this thesis illustrate issues in the assessment of education in general. At an overall level, the conceptual model illustrates the connection between educational design and the students' learning situation, thus implying consequences for outcome measures for assessing against the educational programme's objectives. The educational approach is central for student engagement in the programme and is dependent on whether student activities are self-directed or controlled by teachers and how the two are combined. The action realness further adds to this by including and utilising externals in the educational activities; however, without necessarily embedding these externals into the curricula. These two central issues further develop a third—an open-endedness in the educational programme, where problems, solutions and methods are used by the students in various ways, influenced by the educational approach and action realness.

The findings do, therefore, answer the questions and address the purpose of this thesis and the following chapter point to and discusses the results and contemporary assessment approaches in entrepreneurship education in more detail. Furthermore, the findings can also be viewed in light of educational designs at an overarching level. This chapter is therefore divided in two sections. The first section explains the findings in light of educational designs in general but maintaining the focus relevant for assessment. This section uses the previous analysis and findings, in addition to the empirical data from this thesis' papers, to build a foundation upon which the second section bases its arguments and discussion. The second section then focuses on the results in the context of entrepreneurship education and discusses contemporary approaches to assessment as found in the literature.

Explaining the Findings

It is important to stress that this thesis has its foundations in entrepreneurship education and that its empirical data are, without exception, based in this context. However, some of the conceptual developments could still apply in different educational situations, as mentioned previously, and this first section discusses assessment from a more general perspective with basis in the results from previous chapters.

Complexity

The findings in this thesis lead to and underpin three important implications of the different choices in educational design: complexity, uncertainty and open-endedness. We start with the first implication, complexity, which is here influenced by the teacher-centred vs student-centred axis in the model. Educational programmes that have more teacher-centred approaches also have more control over what students are doing and what they are experiencing in comparison to the other end of the scale. For instance, *teacher-directed* approaches will, to a high degree, decide about the activities of students. In the *participative* approach, which is a more goal- or method-oriented educational approach, students now control some of the aspects of their education. However, in the *self-directed* approach, students have full control and solely decide on their educational activities. Hence, in the more student-centred approaches where students have several choices, different activities might vary a lot among the students within the same cohorts. Thus, taking all different decisions and options into account, this would make an educational programme more complex. For instance, studying empirical data from the second paper, 'Faculty I' at 'India' university talked about the options that students have in their last semester of the programme, where some go abroad, some work in internships and some work on their own start-ups. The faculty member also mentioned that the thesis required by the programme, to be written during the last semester, could be based on special theoretical topics or be connected to the students' start-ups. In the former approach to these two situations, the teachers could shape the focus of the thesis and its development; however, in the second situation, the students might choose to focus on particular problems or themes and ignore other topics, methods or similar.

Hence, the choices that the students have become many when they are more self-directed in their learning, which again creates many potential outcomes in terms of student learning and development. One result of this would be the challenges in controlling the educational programme for its faculty members. This is something that Kolb (2014) also stated—there would be less control over student learning when an educational programme becomes less teacher-centred and more student-centred. Therefore, as a result of this, the different designs of educational approaches influence the assessment of the

education. If an assessment tool is based on a topic that one group of students decides to study extra, this could favour this group in an assessment situation.

Uncertainty

While more student-directed education is appropriate in some situations, educational choices among the students might also be influenced by the actors outside the educational setting. Different educational programmes strive to obtain more authentic learning situations in some cases because students value experiencing the contexts and situations in which they can later apply their skills and knowledge (Rule, 2006). Thus, different educational programmes are, for instance, implementing multimedia simulations (Herrington and Oliver, 2000), internships (Creed et al., 2002) or allowing students to perform real business creation (Lackéus and Williams Middleton, 2015). Consequently, through these educational designs, students experience more action realness.

However, as students are in more contact and collaboration with externals and their actions become more similar to real world activities or become real world activities, the factors also become more uncontrollable and uncertain than what would be the case in a typical university context. For instance, again from the cases presented in the second paper, 'Faculty I' at 'Juliet' university discussed different considerations that students need to handle when working together with an external business. Not only do they need to focus on their educational efforts but they also need to consider the wishes of the business and to act on their behalf. Hence, it might be up to the business to decide how and when students meet their customers or partners. However, as 'Faculty II' at 'Delta' university mentioned, this uncertainty could be of interest in some situations. Since the educational programme aims at preparing students for situations that would occur if they pursue a start-up career, then students should experience the pressures that they might feel in such a situation in the future.

On the other hand, the uncertainty mentioned here could also restrain student learning and access to different experiences. As the participating students mention in the third paper, the (external) network central to the social milieu of the educational programme further develops learning outcomes and opportunities, which could challenge and bring uncertainty to the students. However, the latter example depends on whether students

work in a start-up or not, as this would influence their utilisation of the network. Moreover, it is also the acting in the real world that often decides whether students end their start-up activities in the first place. Thus, the activities that students aim at conducting could be inhibited by contextual situations and thus students may not experience a situation in which their knowledge and skills are to be utilised at a later stage. This would also have an influence on student learning and on the assessment education that uses such an approach.

Open-Endedness

The third point builds on the two prior ones. Open-ended outcomes are a result of the students being self-driven and choosing some activities over others, in addition to the uncertainty of acting in and with the real world, both of which could change their focus and experiences. Hence, the students' experiences and learning are open-ended, which is closely connected to an increase in contextual influences. If students expect a certain behaviour of their peers, as illustrated in paper three, then the activities conducted are influenced by this. Moreover, if contextual influences outside the educational programme and university change, then this would also force the students to adapt their activities if the education has a higher level of action realness. Thus, student learning is influenced by course-specific or contextual factors and educational programmes that seek a more student-centred approach and action realness are more open-ended—thus, the assessment should account for context and design.

Entrepreneurship Education Assessment

The following sections discuss the theoretical framework, in terms of framing entrepreneurship education assessment, and the findings from chapter 2 now take a central role in the discussion. Open-endedness, to some degree, particularly questions the results from certain assessment methods used in entrepreneurship education. Furthermore, the uncertainty of acting and collaborating with the real world could negatively influence some outcome measures used in entrepreneurship education assessment, although the actual results from the educational programme might be quite good. However, in terms of entrepreneurship education and its assessment, some of the most important implications and findings are found in various educational approaches, where the concept of time and duration appears to have an important influence.

Complexity and Control

While educational approaches influence student activities and their learning, it is surprising how many articles on entrepreneurship education assessment do not thoroughly present the educational approaches and programmes assessed. As illustrated in previous sections, an educational approach influences what students actually do, indicating a clear need for education being assessed to be explained. When investigating different outcome measures, there is also a need to explore what causes the changes to these. However, the papers discussed in chapter 2, which do present the educational programme they focus on, appear to be examining more traditional designs that follow a more teacher-centred approach, although some examples show that the literature is interested in and explores more progressive designs (e.g. Lindberg, Bohman, Hulten, et al., 2017; Verzat et al., 2017). Nevertheless, the majority of the educational programmes explored in the articles, regardless of outcome measures applied, are more traditional in their design. Thus, courses 'about' entrepreneurship, designed in a traditional manner, could be assessed through students' knowledge development (e.g. Dube et al., 2015) or changes in entrepreneurial intentions (e.g. Fretschner and Weber, 2013). However, whether these assessment approaches fit the objectives of the educational programmes, or the latter have right designs, remains uncertain. For instance, the use of entrepreneurial intentions would imply that an educational programme aims at start-ups or job creation but, then, as the literature shows, a traditional education 'about' entrepreneurship would struggle to reach this objective alone.

For educational programmes that are more traditional, the use of cognitive or skill-based measures could provide a clear insight into changes students obtain due to participation in the course or programme. The same, however, cannot be said about entrepreneurial intentions, although this measure is applied in traditional educational programmes repeatedly in the literature. To substantiate this argument, we can look at various educational programmes found in the teacher-directed group in the second paper. The quotes from educators show that such educational programmes are designed to get the students to understand the topic of entrepreneurship in general and in theory. Here, 'Faculty II' at 'India' university and 'Faculty I' at 'Echo' university particularly aimed towards increasing the knowledge and academic understanding among the students.

However, to develop entrepreneurial intent appears to demand more than just developing knowledge among the students, e.g. self-efficacy (Chen et al., 1998). Souitaris et al. (2007) found that entrepreneurship programmes could trigger events that inspire students, which changes their mind-sets and develops their entrepreneurial intentions. Krueger (2007) supported this latter view and also stated that changes in deep cognitive structures lie behind the development of the intent to become entrepreneurial. However, Krueger (2007: 127) also stressed that for students to change their deep cognitive structures, a more self-directed learning situation is preferred and that, while an individual's deep cognitive structures could change overnight, the '[d]eeply held beliefs are learned and relearned over time, but are typically anchored on some initial belief that makes them difficult to change'.

Thus, while knowledge or skills could be developed during a teacher-led course, one could question whether conative or affective changes might demand more from educational programmes. In addition, most of the articles applying affective or conative outcome measures had objectives that aimed at new start-ups or job creation. If changes in the students' mind-set are needed to reach the objective of new jobs and start-ups, it is unlikely that traditional and teacher-led approaches will have the same impact as more student-centred educational approaches. Following this argument, the outcome measures that focus more on the mind-set of the students, as well as the conative and affective measures, might have a better fit when education is more progressive and aims at student-centred design.

However, if education is progressive and student-centred, another question that arises is whether the students would learn what is intended for them to learn, as more student-centred education also becomes more complex due to less control over what students learn. For instance, students who work on their own start-ups in the third paper appear to focus more on contemporary issues connected to their start-ups rather than on more general topics and skills needed in entrepreneurship. Hence, while problems they encounter are solved and learned from, they might not have experienced situations that require them to focus on other important topics that are necessary for being a successful entrepreneur. Thus, if an educational programme has as its foremost objective job and start-up creation—for which the intent is central—then the assessment of skills and

knowledge alone is not a good measure because students would vary their learning processes extensively, as illustrated in the third paper.

The educational approaches are, consequently, of importance when assessing entrepreneurship education and the outcome measures that are applied in different studies could be influenced by various educational approaches. Thus, while the current literature on assessment in entrepreneurship education appears to apply a variety of outcome measures on all educational approaches, these different educational approaches should have different, or combined, outcome measures. There should be less focus on affective or cognitive measures in more traditional approaches but the inclusion of cognitive and skill-based measures should also be considered in more progressive approaches.

Educational Approaches and Duration

This development of the discussion in the previous sections also points to the question of time in entrepreneurship education. Most of the more progressive approaches and education 'through' entrepreneurship, which were identified in chapter 2, appear to have a longer duration in comparison to the more traditional designs. Many of these also combine different educational approaches in their designs, thus supporting the findings of this thesis, which indicate that, to be more self-directed in the learning situation, students also need to be introduced to more traditional and teacher-centred educational approaches. Hence, through a combination of educational approaches, their mind-sets would be developed by connecting knowledge and experiences (Kolb, 2014; Krueger, 2007; Pritchard, 2003).

However, while some argue for a successional design that incorporates the different educational approaches, the opinions of various faculty members noted in the second paper illustrate that it is important to create a system for students during the educational programme rather than aiming to go from a solely teacher-led to a solely student-centred approach. Mäkimurto-Koivumaa and Belt (2016), for instance, advocated for introducing a student-centred approach prior to a teacher-centred approach—but this thesis does not find the same need for such a succession. This thesis does, instead, support the view of Robinson et al. (2016) regarding the balance between a teacher-led and a student-centred approach, based on what an educational programme is trying to achieve. However, while

they promote a balance of educational approaches, it should also be considered how this balancing would influence the assessment methods and how an educational programme's assessment should be designed in light of the combined educational design. For instance, if students are self-directed before a teacher-centred design is introduced, then their skills and knowledge might be lower in the first half of the programme but their conative and affective characteristics might develop differently throughout the programme in general.

Moreover, the faculty members interviewed in the second paper also focused on how different combinations of educational approaches take time and that they should be introduced over time, as 'Faculty I' at 'Bravo' university mentioned. Other scholars have also focused on the concept of time when educating in entrepreneurship, especially if students are able to obtain the amount of knowledge necessary to become successful entrepreneurs in a shorter amount of time (Garavan and O'Cinneide, 1994). This point, nevertheless, should be viewed in light of the educational programme's objectives. As found in chapter 2, many educational programmes aim at stimulating the students' entrepreneurial skills to be utilised in situations other than start-up creation—situations that appear to occur frequently among graduates, as illustrated in the findings of the fourth paper. In these situations, the students' development of knowledge or skills might be of the utmost interest and the programme's duration might not need to be very long. Many of the articles that assess education and aim for skill-development among their students also use cognitive or skill-based outcome measures in their assessment.

However, if an educational programme is more student-centred, the duration is not necessarily much longer than if it is teacher-centred. Many of the educational programmes explored in chapter 2 only last for a semester and none longer than two, although they are more student-centred. Since these educational programmes are focused more on experience-creating and challenging the students' mind-sets, they are better fitted for applying affective and conative outcome measures—but one can still question whether they are able to fulfil their objectives. The majority of the articles applying these measures aim at new jobs and start-ups, as mentioned, but then the question posed by Garavan and O'Cinneide (1994) comes into focus again—would the students have learned the skills and knowledge needed to become successful entrepreneurs? Although the fourth paper does not investigate whether shorter entrepreneurship education duration influences

graduates' entrepreneurial careers, it is still clear that going through an entrepreneurship education programme influences their subsequent entrepreneurial careers.

Contextual Influences

As found in both the first and second papers, as well as in chapter 2, many educational programmes use and include collaboration with external industries, organisations or actors at the university in their educational activities. While this has been favourably advocated because of the authenticity that these educational programmes provide students (Creed et al., 2002), they risk that uncertainty would influence their students negatively. While a pure negative influence might not be identified in the third paper, its findings still show that the influence from other actors could affect students differently. The findings of this paper are, therefore, clear and important for illustrating outside influences, especially how students who attend the same educational programme could experience very different learning processes. Hence, by involving the context in the educational activities, students could have different experiences although they might plan the same activities, providing a foundation for different learning among the students. This could also influence the educational programme's assessment. Different processes that students go through should be accounted for in the assessment. For instance, the assessment could map the experiences of the student in addition to outcome measures so that a clearer insight could pinpoint the educational programme's influence on the students.

Prior literature has also identified contextual influences that are similar to the results obtained from in the third paper. For instance, Jones and English (2004), even though the education they described is purely student-centred, found that students in the same cohort could experience a difference in their processes due the influence of reality. They also found that students appear to have a decrease in motivation when encountering the reality they are in. Hence, while experiences could reduce the skills developed or knowledge obtained by students from an educational activity, the students' affective measures could also be influenced. The students might be more negative towards entrepreneurship when they realise how difficult it could be (Jones and English, 2004; Walsh and Powell, 2018). This could also influence their entrepreneurial intentions—the lack of 'success' in comparison to other student groups or differences in expected and actual results could reduce the intent of students to start their own start-ups after graduating from an

entrepreneurship education programme. The third paper also show that students in the programme have expectations for one another and could also influence one another's affective or conative characteristics.

However, the mentioned situation could also be viewed in a different light. Students who approach customers or partners but who fail to reach their own goals or come short compared to their student peers might learn from these experiences, although they are regarded as mistakes by the students themselves. Hence, as the project or educational activities did not go according to plan, the students' attitudes might become negative or the intent to start their own start-up might be low after completing the educational programme. However, their skills could have improved or their knowledge might be broader—their learning process might have changed in comparison to those of their peers and still be valuable. The multiplicity and duration results presented in the fourth paper are an example of this. Although the study was not controlled for motivation at the end of the programme nor for how well the students' start-ups performed during and after the education programme, it is still clear that the programme influenced students to follow several opportunities post-graduation. In that respect, it becomes important how student intent develops over time and whether negative attitude changes with time after students have graduated. If negativity towards entrepreneurship is context-related and time-limited, then it might be that the skills developed or knowledge obtained are utilised at a later stage, as the fourth paper might imply.

Two characteristics of entrepreneurship education—the educational approach and action realness—show that students might have many contextual influences and choices in their educational programmes that influence and change the outcomes of such educational programmes in various ways. Students might collaborate with industry in the region (Stone et al., 2005), have a close collaboration with the university's technology transfer office (Lackéus and Williams Middleton, 2015) or be influenced through other collaborations, as illustrated in some of the cases presented in the second paper. These contextual collaborations influence students during their education—but this is ignored in the assessment literature to a high degree, although there are some advocating for its importance (Nabi et al., 2017). This importance is also clearly illustrated in paper three, in which student activities in the real world and with one another are of great importance

for an individual student's learning process. Where collaboration with externals is central for the educational programme, e.g. through collaboration with local businesses as is the case for 'Juliet' university from the second paper, the context is of importance. Students who utilise and have access to collaboration and different industries obtain broader experiences in comparison to students in educational programmes located in regions with few and less collaborative industry parties. At the same time, students located at an entrepreneurial university, with a flourishing entrepreneurial ecosystem, might be influenced by this and by their peers, as illustrated in paper three.

Student Experiences and Their Influence on Assessment

In terms of assessment, the more open-ended educational programmes described here make it difficult for a researcher to interpret results. If a researcher is investigating an entrepreneurship education programme in which students are self-directed, action realness is higher and outcome measures are certain entrepreneurial skills, then the results might point in different directions and for potentially different reasons. Hence, questions can be asked about whether entrepreneurship education could be assessed without establishing thorough insights on student activities in different educational programmes and about how contextual differences influence education and students.

As paper three illustrates, students who have start-up activities also have a different educational focus, showing that their experiences and learning might be different but also that their affection and conation towards entrepreneurship varies as a result of contextual influences. Therefore, aiming for methods that include and illustrate student activities could counteract varying results. For instance, going deeper into students' choices in a self-directed educational programme, in order to control for their experiences when investigating different outcome measures, would give researchers fuller insights into their findings. This could also nurture the field's knowledge of different educational approaches' possibilities or difficulties in obtaining certain experiences and thus learning situations. Hence, this insight could develop new methods, tools or knowledge to assist students' development in these educational programmes. However, obtaining this knowledge, as described here, would also challenge a researcher's resources.

The same challenge applies for the inclusion of several different outcome measures. This would demand more from a researcher but, at the same time, it would handle some of the challenges that certain outcome measures might encounter when different educational approaches and action realness occur in various educational programmes. Moreover, these assessment designs should span over a longer timeframe since different educational activities could be introduced at various times. As research shows varying results for certain outcome measures (Bae et al., 2014), new knowledge about these measures and about the influence of educational approaches on them is important.

However, the context in which an educational programme operates should not be ignored either. All papers show that contextual characteristics should be considered in assessment of entrepreneurship education, as illustrated through: the outcome impact of the educational programme in paper one; the development of authentic and real education in terms of action realness in paper two; the contextual and in-class influences on students' choices in paper three; and the participation in context-specific education and its different cohort developments in paper four. The various characteristics could be many and future research should try to identify the most central factors for obtaining knowledge about how they influence student development. As such, this thesis supports Nabi et al.'s (2017) view and calls for further contextual investigations and understanding. However, while the latter article also separates between students or peers and external factors when describing contexts, its view appears to precede the educational programme when it comes to student characteristics. This thesis, on the other hand, also finds support that community development that might occur in *one* cohort should also be understood and accounted for in addition to an individual's development. From the findings in paper three, it is particularly cleat that the student milieu and community influence students but that students also shape and influence both the milieu and community.

Hence, the different papers show results that are significant for entrepreneurship education and the assessment of entrepreneurship education. Current measures and approaches used for the assessment of entrepreneurship education encounter difficulties and limitations in some situations. While a lot of research has been conducted in this field, the assessment of entrepreneurship education should, nevertheless, welcome further development.

8. Conclusion

This thesis has explored assessment in entrepreneurship education through the overarching research question: *How does an educational programme's design influence the results of the assessment of entrepreneurship education?* Furthermore, this question was elaborated on in two additional sub-questions: *How does an educational programme's interaction with real-world actors influence the results of the assessment of entrepreneurship education?* And: *How does the students' action level influence the results of the assessment of entrepreneurship education?* The answers to these questions can be concluded on using the different concepts discussed in the previous chapter.

First, this thesis has illustrated that educational approaches have an impact on student learning and that various educational approaches need different outcome measures. This is illustrated through the complexity of an educational programme and through the control that the faculty has over student learning as well as in terms of time. Starting with the former, teacher-centred educational approach allows the faculty to control the learning situation, which might inhibit the development of affective or conative characteristics of students. On the other hand, student-centred educational approach might develop the students' affection or conation but faculty cannot be sure whether they have learned the necessary skills to become an entrepreneur. Thus, to reach the intended learning level, educational programmes should aim to building their educational approaches hierarchically. This further brings us to a discussion of time and educational approaches, in which it is expected that outcome measures are influenced by the duration of an educational programme. It is clear in the literature on student learning that an individual needs time to build concepts and learn complex subjects but this is more or less absent in the assessment literature on entrepreneurship education. Thus, this thesis contributes to the discussion on student-centred vs teacher-led entrepreneurship education and to how it could be designed and organised (Robinson et al., 2016), adding on the question of time in this discussion.

Second, the level of action realness in an educational programme influences students and the outcome measures that are used. The uncertainty that more action realness brings into an educational setting could inhibit the students' expected plans and activities. Student

groups could experience different activities with different parties and thus need to focus on different subjects and activities. However, the differences in influences might also affect the students in terms of their affection or conation. Experiencing difficulty or rejections in the real world could reduce students' interest and create a negative attitude towards entrepreneurship. Nevertheless, students might, as mentioned, still learn important skills or obtain knowledge but their intent to pursue an entrepreneurial career might be low. Hence, this thesis adds to the discussion of authenticity in entrepreneurship education and to how it should be implemented and designed (Kassean et al., 2015; Macht and Ball, 2016).

Third, a combination of student-centred education and action realness cultivates an open-endedness in entrepreneurship education. Thus, the context—in terms of educational design and uncertainty from outside actors—makes the assessment situation difficult. The potential activities are many when education becomes student-driven and, if an assessment outcome shows negative results, a researcher might not know whether it is the educational design that has influenced the result. In that case, it could be that students' choices led to a poor result or that the context influenced specific outcome measures negatively. Therefore, this thesis presents important views regarding student interactions and choices, as well as about the uncertainty of more action realness in an educational setting, to the discussion about contextual influences in the assessment of entrepreneurship education (Nabi et al., 2017).

The discussion and points above might imply many recommendations or areas for further research. However, one of the main conclusions of this thesis, in terms of the next steps for the assessment of entrepreneurship education, would be to follow the actual learning process of students and not just the stated curriculum. In other words: while other streams of the literature on entrepreneurship explore what an entrepreneur actually does, the literature on assessment in entrepreneurship education tends to assume what students do. However, when moving more in the direction of open-ended entrepreneurship education, the uncertainty of what students actually do, experience and learn becomes higher.

Implications and Future Research

Implications for Entrepreneurship Education

The prior discussions have pointed to educational approaches and to the matters of time, action realness and contextual influences—which all have implications for the assessment of entrepreneurship education as well as for the design of entrepreneurship education in general. The faculty should put the objectives of the educational programme into focus when designing courses. For instance, education that works on developing cognition or skills might not need to be far along the student-centred educational approach scale—students might value participative education as such. On the other hand, if the objective is new start-ups and job creation, then entrepreneurship education programmes might have to move more towards student-centred designs. Here, educators would lose some control over what students actually learn but they might not have a choice if certain affective or conative changes need to appear. However, a balance towards teacher-centration, as argued by others in the literature (Robinson et al., 2016) and illustrated in the findings of this thesis, should be present in educational programmes with more student-centred designs.

In addition, while prior results focus on balancing the educational approach, the results and discussion here also indicate that a balance in terms of action realness should be considered. Balance here means that students should not only experience *one* situation with *some* uncertainty. Instead, if the introduction of action realness is an educational goal, then students should experience both situations that hold more action realness and uncertainty as well as situations that do not. This way, students might experience certain situations regardless of contextual influences outside their educational programmes but they would also feel the uncertainty and thrill of operating and acting on different levels in the real world. As the latter might reduce the students' experiences, as explained, a well-balanced education would still allow students to encounter similar situations but in a more *pretence* design.

Implication for Research

With the mentioned course design philosophy, the assessment of entrepreneurship education should also change in a similar manner—assessment also needs to be balanced. If some educational designs span from teacher-centred to student-centred and have a

varying degree of action realness, assessments could be conducted through several outcome measures. Even though an objective might be to develop new jobs and start-ups, student's entrepreneurial intent might not be the right measure for it, especially if the affective and conative characteristics of an individual change over time and are influenced by recent experiential shocks or critical incidents. Entrepreneurship education should, therefore, combine different outcome measures, adapt them to the objectives that it holds and explore the results over time. Numerous studies have called for longitudinal research and graduate investigations in the assessment of entrepreneurship education (Pittaway and Cope, 2007a; Scott et al., 2016; Westhead et al., 2001)—not only to explore the activities of graduates but also to explore the effects of various educational designs and choices.

Thus, this balance of outcome measures could also create stronger knowledge about the connection between different measures. Thus, different educational programmes would also learn what their students might lack or obtain from the education they receive and the faculty could adjust the educational design for individual students or groups of students so that objectives might be achieved more fully.

Implication for Policymakers

The findings of this thesis are also important for policymakers. As many educational programmes move in the direction of student-driven education, characterised by open-endedness, real-world interaction and various results, a balance of outcome measures should be applied. Judging a course based on its influence on entrepreneurial intentions is wrong on many levels but also in terms of the educational design, as stressed in this thesis. Policymakers should consider several outcomes of entrepreneurship education rather than limiting themselves to one, as this could be influenced by educational design. However, to do this requires different measures, methods and durations. This would be costly and scholars who are already conducting different assessments of their courses or programmes might follow known paths, as this might be required and limited by regulations and policymakers. Nevertheless, policymakers should support and seek new designs, outcome measure combinations and new methods for future research because contemporary assessment of entrepreneurship education could misinform and be less fitting for current educational designs.

Another point is that different objectives require different outcome measures as well as different educational designs. Education that aims to increase student skills or raise their attitudes does not need to move far towards an open-ended entrepreneurship education. Hence, policymakers should be clear what their objectives are when investigating results from different initiatives. This thesis uses a coarse discrimination of objectives and future objectives might be more specific; however, with new objectives new outcome measures should also be introduced and tested.

Future Research

In terms of future research, one focus should be placed on the process behind different designs that are found in entrepreneurship education. As has already been established by this thesis and other research (Nabi et al., 2017), articles often lack a presentation of the educational programmes that are studied, which makes the comparison and validation of various studies' different findings difficult. The taxonomy presented in paper two addresses some of these issue but future research should also focus on students' learning processes. This is somewhat addressed in paper three, where student learning processes in a venture creation programme are investigated; however, other educational designs should also be explored. For instance, an educational programme that has a low interaction with the real world but in which the students influence one another, e.g. through peer assessment (Faherty, 2015). Through such focuses, knowledge about different contextual variations could be obtained and fuller insights into the student processes could be established.

Scholars should also continue to focus on investigating the affective and conative characteristics of students in entrepreneurship education but, at the same time, their cognitive and skill-based outcomes as well. As already mentioned, it should be asked whether student's entrepreneurial intentions and attitudes would be of interest if they change over time and how long positive or negative experiences influence an individual— the answers to these questions will be of great importance for the overall outcome of entrepreneurship education. Moreover, mental models, their development and students' knowledge and skills should be explored over time and viewed in light of the action or behaviour that graduates later perform. Through such research designs the scholars could control for contextual changes in and between cohorts, in addition to knowing the

knowledge and skill levels of students and graduates, before the actual behaviour or action is explored.

Moreover, as mentioned in the methodology section, the context of the studies in this thesis is in the Nordic countries and, consequently, there is a need to explore other education settings in different regions. Hägg and Gabrielsson (2019) mentioned the difference between European and North American researchers in terms of defining entrepreneurship and this could be mirrored in the educational focus and intended outcomes of the different educational programmes in these two regions. For instance, the different objectives could vary, which would narrow the assessment focus somewhat. Moreover, the Nordic countries appear to be ahead when it comes to action-based entrepreneurship education (Rasmussen and Sørheim, 2006; Warhuus and Basaiawmoit, 2014) and, hence, the ideas and findings from this thesis should be explored in other regions around the world.

A last but important topic for future research concerns different educational programmes' graduates and their career activities. As illustrated in this thesis, few articles exist that exploring the behavioural activities of students. While this thesis contributes to this topic through the findings and approach of paper four, it only explores the entrepreneurial careers of graduates in terms of new start-ups. However, as many of the students are not pursuing this career, aiming for paid employment instead, it is important to also explore this in more detail. Questions about graduates in terms of intrapreneurship or business development should be explored. Calls have been made for research on the activities of graduates (Pittaway and Cope, 2007a) and, while this thesis contributes to this, there is still a long way to go until the actual long-term outcomes of entrepreneurship education are identified.

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Part 2: Research Papers

Research Papers

Paper 1: Systematising higher education: a typology of entrepreneurship education

Torgeir Aadland and Lise Aaboen

Status: published

Aadland T and Aaboen L (2018) Systematising Higher Education: A Typology of Entrepreneurship Education. In: Hytti U, Blackburn R, and Lavern E (eds) *Entrepreneurship, Innovation and Education: Frontiers in European Entrepreneurship Research*. Cheltenham, UK: Edward Elgar Publishing, pp. 103–122.

Paper 2: An Entrepreneurship Education Taxonomy Based on Authenticity

Torgeir Aadland and Lise Aaboen

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Paper 3: Learning from Venture Creation in Higher Education

Dag Håkon Haneberg and Torgeir Aadland

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Research Paper 1:

Systematising higher education: a typology of entrepreneurship education

Torgeir Aadland and Lise Aaboen

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Systematising higher education: a typology of entrepreneurship education

1. INTRODUCTION

Entrepreneurship education has expanded from a business school offering to other disciplines (e.g. Ohland et al., 2004; Faherty, 2015), and new ways of teaching have been developed featuring new methods and overarching ideas of what entrepreneurship education should be (Vesper and Gartner, 1997; Katz, 2003; Neck and Greene, 2011; Fayolle, 2013). Universities offer cross-disciplinary activities, co-curricular activities and students' clubs for entrepreneurship, with business plan competitions, internships, grants and venture creation activities (Morris et al., 2014; Levie, 2014). Activities found in entrepreneurship education span from case solving, simulations, games and simple semester-only student enterprises to internships, consultant businesses and new technology-based venture creation. All of these educations feature different designs and methods, and all have different curricula and focuses. Although some have the same objective – to create new ventures or entrepreneurial graduates – the means used to reach the ends vary extensively. Thus, comparisons between different entrepreneurship programmes and courses, and prior research are difficult.

Despite the large range of offerings that exist, the current entrepreneurship education literature tends to only distinguish between three different educational classifications – education 'about', 'for' and 'through' (or 'in' or 'embedded') entrepreneurship (Hannon, 2005; Pittaway and Cope, 2007b; Robinson et al., 2016). Pittaway and Cope (2007b) differentiate between the classes: 'about' focuses on traditional approaches to teaching entrepreneurship, where the students should obtain knowledge about entrepreneurship. The techniques could take the form of lectures, discussions and case studies as examples. The 'for' design is intended to teach the students skills that are necessary for entrepreneurs, preparing them for entrepreneurial careers. The last design, 'through', teaches the students through actual entrepreneurship, using learning through practice as its basic approach. However, if we examine the different meanings in this classification of entrepreneurship education, we see that it has a combination of objective and activities combined. 'About' and 'for' could be connected to the objective in a course, while

'through' could be connected to the activities. In addition, the focus is more on the teacher's activities rather than student-centred. Thus, this classification is coarse, somewhat unclear and gives little detail about specific programmes or courses. An example is the difference between an internship and a venture creation programme. The former might aim to create future entrepreneurs (Nitu-Antonie et al., 2014), whilst the latter aims to create new ventures in which the students continue to work after graduating (Lackéus and Williams Middleton, 2015), producing entrepreneurs *in* the educational pathway. Both could be classified as education 'through' entrepreneurship, but evaluating and comparing these might produce results that are difficult to interpret. Another question remains regarding whether entrepreneurship education can actually be divided into these three groups and whether entrepreneurship education should fit into only *one* of these.

Previous literature has struggled to assess entrepreneurship education, prompting several calls for a more systematised classification (Pittaway and Cope, 2007a; Fayolle and Gailly, 2008; Haase and Lautenschläger, 2011). The objective of the present work is to construct a typology (Smith, 2002) that allows for a more fine-grained systematisation of entrepreneurship education. Haase and Lautenschläger (2012) developed a multi-dimensional typology for entrepreneurship education. Although elegant, it does not provide the simplicity needed for assessing entrepreneurship education and classification for cumulative research. In other words, the classification needs to be more fine-grained, focused and student-centred than the 'about', 'for' and 'through' model whilst concurrently simplifying the reality enough. This study therefore contributes to the entrepreneurship literature in three ways. First, it creates a framework for entrepreneurship education, enabling scholars to better compare and evaluate the different entrepreneurship programmes and courses. Second, it presents entrepreneurship education in theory, identifying different ways to teach entrepreneurship. Third, it enables cumulative research in the field of entrepreneurship education because it allows scholars to pinpoint their contributions. From a long-term perspective, it improves the entrepreneurship education field in both theory and practice and counteracts the current fragmentation and lack of theory in the field (see Fayolle, 2013; Fiet, 2001).

The next section describes how we conducted the systematic literature review of the field. The following section presents an overview of the results of the literature review of

entrepreneurship education. The programmes and courses identified in the literature review are further analysed in section four, while we construct a new typology of entrepreneurship education and then demonstrate the use of this in section five. The final section discusses the research limitations and presents our conclusions.

2. METHOD FOR THE SYSTEMATIC LITERATURE REVIEW

We performed a structured literature review in order to identify the different approaches and methods used in entrepreneurship education. The literature review consisted of a structured literature search in ISI Web of Science; we sought articles or reviews focusing on entrepreneurship education in higher education. Research on entrepreneurship education has different foci, and since research on programmes, schools and courses were all of interest, we included combinations of different terms and definitions in the search. The words connected to the context were Entrepre* Educat*, Entrepre* Program*, Entrepre* School* and Entrepre* Course*. We also included the words Undergrad*, Bachelo*, Master*, High* Edu*, Universit* and Stude*. The terms and their combinations were limited to titles, abstracts and keywords, and we included articles with 'entrepre* educat*' in the title. This initial search resulted in over 300 articles. We limited the article language to English and selected the database's research areas: Business Economics, Education Educational Research, Engineering, Public Administration, Social Sciences Other Topics, Operations Research, Management Science and Psychology; this narrowed the total pool of articles to 279.

In our first article scan, we focused on the abstracts. We read each article's abstract and excluded those without a focus on education, those focusing on lower educational levels, those exploring co-curricular activities or those focusing on executive education. Based on the abstract screening, we selected 132 articles to read fully; however, of the 132 articles identified, we were unable to obtain the full text version of ten. Thus, we read 122 articles in full. We constructed a protocol that included all 122 articles. In a Microsoft Excel spread sheet, we took notes on each article in columns based on the country where the studied entrepreneurship education was located, the method that was used in the paper, the type of entrepreneurship education (mainly, the programme or course) that was studied and the level of entrepreneurship education (mainly, undergraduate or graduate). We also added other comments such as 'part of engineering education' or short

summaries of the main points of the article. The document was 34 pages long and provided an overview of all the articles.

Out of the 122 articles we read, 41 contained descriptive information about 42 programmes or combinations of courses. Among the articles that did not provide a description of a programme or combination of courses, entrepreneurial intention was the most common theme under investigation. Most of the other articles focused on specific elements in the entrepreneurship education, such as learning from failure, learning via apps, learning to generate business ideas, entrepreneurial skills, psychological ownership and social capital among the students as well as analyses of the curriculum. Some of the articles described entrepreneurial campuses, contextual differences, mapping entrepreneurship education in certain countries or students' interest in entrepreneurship education.

We further analysed the 41 articles describing entrepreneurship educations in a second Excel document. We used Fayolle and Gailly's (2008) teaching model framework to compare the different programmes and courses we had identified. This education-level framework evaluates an entrepreneurship education programme or course using five questions: 'why', 'for whom', 'for which results', 'what' and 'how'. The answers to these questions are, respectively, the entrepreneurship education's objectives or goals, its target or audience, the evaluations and assessments it uses, which contents and theories it applies and the methods and pedagogies used in the entrepreneurship education. We also added 'where' to help set the context of the education whenever this information was available. We then answered all of the questions in Fayolle and Gailly's (2008) framework for all 42 entrepreneurship educations, identifying the different choices that each programme made at the didactical level. When investigating the questions across programmes, we identified the 'how' question as being the most important in distinguishing one programme from the others. Therefore, the answers given across educations in the 'how' column formed the starting point for constructing the new typology. We tested the typology using descriptions of programmes and courses in conference papers from the European Council for Small Business and Entrepreneurship (ECSB) Entrepreneurship Education Conference in order to ensure that it was also useful for programmes that had not been part of the analysis leading to the construction of the typology.

We are aware that the articles include a potentially skewed selection of described entrepreneurship educations – they are commonly educations at the universities of the authors of the reviewed papers. If the people involved in the entrepreneurship programmes or courses are simultaneously researchers in entrepreneurship education, there is a chance that they will make more informed decisions when constructing their own programmes; therefore, these programmes might not be representative of entrepreneurship education in general. Another danger of describing entrepreneurship programmes or courses in the researchers' own universities is that they may have incentives to describe these entrepreneurship educations favourably. Therefore, the typology should also be applied to empirical data from other entrepreneurship education programmes.

3. TRENDS IN THE ENTREPRENEURSHIP EDUCATION LITERATURE

When examining the articles from our systematic search, we identified three potential reasons for the fragmentation in the field. First, the field of entrepreneurship education is relatively young. The 122 articles that we reviewed ranged from the early 1990s until 2016 when we did our search. The majority of the articles were written after 2010, which also confirms that entrepreneurship education is a growing field of research. Second, the majority of the studies were conducted simultaneously in a wide range of countries such as Australia, Brazil, Canada, China, Croatia, Egypt, Estonia, Finland, France, Germany, Iran, Israel, Italy, Malaysia, the Netherlands, Norway, Pakistan, Romania, Scotland, South Africa, Spain, Sweden, Taiwan, Tanzania, Tunisia, Uganda, the UK and the USA. Third, these countries provide very different contextual conditions for entrepreneurship education, as entrepreneurship educations have developed along different paths into what they are today. To illustrate this point, we use the examples of the USA and Spain. Entrepreneurship education began early in the USA (Katz, 2003). After the Bayh–Dole Act, there were efforts to improve American entrepreneurship education, such as the founding of the Kern Entrepreneurship Education Network (KEEN), which focuses on fostering an entrepreneurial mind-set and streamlining the education across universities (see Oswald Beiler, 2015). In contrast, in Spain, the main motivation for entrepreneurship education was to encourage students to become entrepreneurs, or at least to become self-

employed, in order to improve the national unemployment rates (Díaz-García et al., 2015).

Our literature review confirms the need for scholars to describe what kind of entrepreneurship education they are studying in order to facilitate comparisons. Very few articles actually provide a thorough description of the course or programme under study. Even though we found 41 articles with enough data about particular courses and programmes to enable further analysis, there were only a few articles that primarily focused on the description or the initiation of the programme (e.g. Phan, 2014; Harmeling and Sarasvathy, 2013; Pardede and Lyons, 2012; Stone et al., 2005). This lack of description could be due to three tendencies that we identified in our literature review. The first tendency is to map a certain aspect of entrepreneurship education in a country, such as the teaching practices used by entrepreneurship lecturers in Finland (Seikkula-Leino et al., 2015), the extent to which entrepreneurship is taught in universities in Tanzania (Fulgence, 2015) or the entrepreneurship education programme descriptions on the websites of Australian universities (Maritz et al., 2015). A second tendency is to describe entrepreneurship education elements as part of other educations or as a sub-area of research focusing on the interface between entrepreneurship and other areas. For example, there are articles that describe entrepreneurship education as part of engineering (e.g. Yemini and Haddad, 2010; Täks et al., 2016; Oswald Beiler, 2015; da Silva et al., 2015; Zappe et al., 2013; Souitaris et al., 2007) and articles that only focus on social entrepreneurship education. Social entrepreneurship education was even the focus of a special issue of the *Academy of Management Learning and Education* in 2012; this is reflected in our collection of articles (e.g. Howorth et al., 2012; Mirabella and Young, 2012; Kickul et al., 2012; Smith and Woodworth, 2012).

The third and most common tendency is to conduct studies that evaluate programmes or courses. These papers focus on the effects, results and outcomes of the programmes rather than on the programmes themselves, and many of the evaluations involve a pre- and post-test design in order to measure a change in the students. However, in terms of cumulative research, these articles use different methods and approaches when conducting their evaluations, making comparisons across studies difficult. The measured change is based on theories of planned behaviour (e.g. Karimi et al., 2016; Chen et al., 2015; Fretschner

and Weber, 2013; Souitaris et al., 2007), action regulation theory (e.g. Gielnik et al., 2015), regulatory focus theory (e.g. Piperopoulos and Dimov, 2015), the Durham University general entrepreneurship test combined with a test to determine brain side dominance (e.g. Kirby and Ibrahim, 2011) or competences identified through the Delphi method (e.g. Morris et al., 2013). Some articles are interested in the long-term change in the students; therefore, they distribute questionnaires before, directly after and six months after the course (e.g. Díaz-García et al., 2015). Others want to capture the change process as it unfolds and collect daily reflections from the students (e.g. Lans et al., 2013). Another example of this is the work by Robinson et al. (2016), who used an ethnographic design and included different approaches to learning in their theoretical foundation: behavioural, social learning, situated learning and existential learning. It is rare to include the results that the students achieve in the course, such as grades on practical assignments (e.g. Swart, 2014), assessments of the business plans they created (e.g. Chang and Lee, 2013) or evaluations of the business opportunities they developed (e.g. Munoz et al., 2011). It is even more unusual to let the students contribute to the evaluation conducted as part of the study by, for instance, letting them fill out a student evaluation on educational quality in entrepreneurship (e.g. del-Palacio et al., 2008) or asking about their satisfaction with the course (e.g. Okudan and Rzasa, 2006). Thus, as previous research has also found, we find the literature fragmented, as there is less focus on thorough descriptions of the entrepreneurship educations explored in the research.

4. TOWARD A TYPOLOGY

The 41 articles that describe the entrepreneurship programmes or courses investigated confirm that entrepreneurship education contains endless variations of designs and systems; we chose to analyse this sub-group of articles further. To create and develop a new typology, we answered Fayolle and Gailly's (2008) call (among others) and used their framework as a basis for the development of the new systematisation. Their framework does not offer a means of differentiation on an overarching level when it comes to programmes or courses (which is not its intention); however, Fayolle and Gailly (2008: 586) state that their work could be used as a 'theoretical ground for further taxonomies of entrepreneurship education programs'.

The framework contains the questions 'why', 'for whom', 'for which results', 'what' and 'how'. Table 7.1 lists the groups of the identified offerings among the 42 described entrepreneurship educations in the literature review and illustrates the differences between them. Since the literature review revealed two different objectives responding to 'why', we created two overarching groups of educations – those focusing on the micro-level objectives and those focusing on the macro-level objectives, either alone or in combination with micro-level objectives. The micro level focused on the students' development of skills, mind-set, experience and awareness. The macro level focused on the creation of new ventures, development of an industry or region, increasing self-employment or an entrepreneurial career among graduates and developing established firms. Further, we organised the educations based on which audience they focused on by responding to 'for whom', creating four new sub-groups: business students, engineer students, other groups of students (e.g. publishing students) and educations for all students. Hence, we identified eight groups in total to analyse. Further, the eight 'indicators for impact assessment' (Mwasalwiba, 2010: 34) were the basis for the question 'for which results'. The nine 'most common subjects taught in entrepreneurship programs' (Mwasalwiba, 2010: 29) were the basis for the 'what' question. Lastly, 'teaching methods' (Mwasalwiba, 2010: 31) were used as a basis to investigate 'how' to teach entrepreneurship. Based on our findings in the reviewed articles, we added internships, peer-learning, reflections and feedback from faculty and mentors to the list and split real venture creation into two groups: pre-set duration and no pre-set duration. Finally, we split discussion and group work into two groups instead of one group.

We identified some important findings from our analysis of the different educations, illustrated in Table 7.1. Regarding the question 'for which results', it was clear that most of the educations focused on the students' academic results. Even though a few of the articles' educations focused on the awareness, interest, intentions and attitudes in entrepreneurship, they did this in combination with the students' academic performance – thus, the question 'for which results' was not included in the typology. When it comes to the question 'what', all of the educations in the table except for two cover mostly the same contents and overlap extensively – 'what' was also excluded from the typology. However, when we investigated the question 'how', we discovered that the different

examples from the literature varied not only between the different groups, but also within the different groups. Fayolle and Gailly (2008: 579) conclude that '[t]here appears to be no universal pedagogical recipe regarding how to teach entrepreneurship'. The other questions in the teaching model framework have some defined limitations and classifications that the 'how' question lacks, and since the other questions are somewhat connected to the 'how' question, a better understanding of this question itself is required.

We also excluded the question 'for whom' from the typology. Even though different students start at different levels of knowledge or prior experience, our findings show that there are no clear differences between the identified groups of educations for the different students. Thus, the answer to the question 'for whom', is students in higher education. Regarding the objectives of entrepreneurship education, the 'why' question, we identified several different answers: to increase entrepreneurial intentions and contribute to regional development (Lackéus and Williams Middleton, 2015), to increase awareness and give attention to entrepreneurship as a career option (Hills, 1988), to increase entrepreneurial competencies and intentions for self-employment (Sánchez, 2011) and to increase entrepreneurial skills in industries with knowledge gaps and to prepare the students for such careers (Faherty, 2015). However, all of these objectives seek to educate students to contribute to the greater good, either through new businesses or through developing existing enterprises, where both can contribute to increased regional or national value. We argue that an increase in intentions is different from an increase in awareness, but as both courses aim to produce graduates with entrepreneurial attitudes exploited in some way to create value, we find that the 'why' question on an overarching level is of less interest. However, while the 'why' question alone is of less interest, the questions 'why' and 'when' in combination are more interesting. Thus, in terms of a new typology, we do not ignore the 'why' question, but we rather add the element of time and ask 'when'.

Table 7.1: Comparison of articles' education from literature review

Why?	For whom?	What?	How? — Activities	Article example	Other articles in group
Micro	Business	Resources marshalling and finance; idea generation and opportunity discovery; organisation and team building; new venture creation; SME management	Lectures; cases; teamwork/ group work; study visit	Phan (2014)	Kirby and Ibrahim (2011)
			Lectures; venture creation (pre-set duration)	Neck and Greene (2011)	
	Engineers	Resources marshalling and finance; marketing and salesmanship; idea generation and opportunity discovery; business planning; organisation and team building; SME management	Assignments; lectures; guest lectures; simulations (business simulations, games, role plays)	Antonaci et al. (2015)	Al-Atabi and Deboer (2014); Ohland et al. (2004); Radharamanan and Juang (2012); Pardede and Lyons (2012); Hamilton et al. (2005)
			Discussions; lectures; cases; teamwork/group work; study visit	Oswald Beiler (2015)	
	Other	Resources marshalling and finance; marketing and salesmanship; idea generation and opportunity discovery; business planning; organisation and team building; new venture creation	Assignments; lectures; presentations; study visit; business plan creation	Karimi et al. (2016)	Nielsen and Stovang (2015)
			Venture creation (pre-set duration)	Oosterbeek et al. (2010)	
	All	Resources marshalling and finance; idea generation and opportunity discovery; business planning; organisation and team building; new venture creation; SME management	Mentors; lectures; internships	Stone et al. (2005)	Levie (2014); Collins et al. (2006); Munoz et al. (2011); Harkema and Schout (2008); Díaz-García et al. (2015); Morris et al. (2013)
			Feedback from faculty; assignments; cases; teamwork/group work; guest lectures	Lans et al. (2013)	

Macro				
Business	Organisation and team building; new venture creation; SME management	Business plan creation	Fayolle and Gailly (2015)	
		Assignments; cases; readings; study visit	McMullan and Gillin (1998)	
Engineers	Resources marshalling and finance; idea generation and opportunity discovery; organisation and team building; SME management; risk and rationality	Assignments; teamwork/group work; venture creation (pre-set duration); reflections	Täks et al. (2016)	Nichols and Armstrong (2003)
		Lectures; cases; venture creation (pre-set duration)	Yemini and Haddad (2010)	
Other	SME management	Assignments; teamwork/group work; internships; peer-learning	Faherty (2015)	
All	Resources marshalling and finance; marketing and salesmanship; idea generation and opportunity discovery; business planning; organisation and team building; SME management	Feedback from faculty; mentors; internships	Premand et al. (2016)	Hills (1988); Sánchez (2011); Klofsten et al. (2010)
		Mentors; lectures; venture creation (no pre-set duration)	Lackéus and Williams Middleton (2015)	

5. A TYPOLOGY FOR ENTREPRENEURSHIP EDUCATION

In terms of 'how', we separated the learning approaches into three different classes of student involvement: passive, participative (input/output focused) and self-driving (method focused). Mwasalwiba's (2010) conclusion that teaching models can be separated into two groups – active and traditional teaching – formed our base. Traditional teaching is about controlled learning rather than independent learning and development, where lectures, case studies and group discussions are the most common methods (Mwasalwiba, 2010). Our literature review showed that this approach is the most common. The students attend classes with lectures, discussions and case studies, and they prepare through completing readings and assignments. The assignments and work are often theoretical and analytical – the students might reproduce things from the lectures and their previous work, developing this into their own settings. Knowledge is the focus in this class rather than skills, and we label this approach 'passive'.

In the more active methods, the teacher acts as a facilitator and encourages the students to learn through role playing, games, projects and teamwork (Bennett, 2006). However, learning from active methods can vary. For example, an innovation project intended to improve a product or service could be a part of an entrepreneurship course, but the focus could be on the product output rather than on the methods used. The design of such courses might be a result of an objective to increase the attention and knowledge about entrepreneurship as well as how engineering knowledge and skills could be used in the future (e.g. Ohland et al., 2004), but not necessarily on teaching the students the skills and techniques that Neck and Green (2011) advocate in teaching entrepreneurs. Therefore, we argue that active learning in entrepreneurship could be divided into two groups. In the first group, the 'participative' approach, the focus is more on including the students, allowing them to participate in the different tasks and assignments and giving them opportunities to obtain new skills. This approach might include project work, real-life and theoretical case solving, prototyping and mentoring, but the activities all focus on the output or given inputs. The faculty's goal is to receive a deliverable and an output, giving the students the right methods to achieve this output rather than letting them discover and learn the different methods themselves. In the other group, the 'self-driving' approach, the students are more responsible for the inputs and outputs, and the methods

used are the learning itself, which gives the students the analytical and practical skills necessary to perform entrepreneurship in different situations. The methods used are a result of combinations of knowledge, experience and practice to achieve the desired outcome, which can be known prior to or discovered during the work. Examples of content in these approaches are venture creation, advanced simulation and games and implementing products or solutions in the market.

However, when separating the learning activity in entrepreneurship education into passive, participative (input/output focused) and self-driving (method focused), there are still differences in the various activities that cannot be identified in this three-type classification. One difference lies in the impact of the different educations and is connected to 'when'. In our typology, we include educational impact and define this impact as outcome(s) from the education affecting someone or something other than the students themselves and their teachers for an indefinite lifetime (thus, not a pre-set duration). The objective for entrepreneurship education is to create some sort of value for the society, either through new ventures, educating policymakers with insights in entrepreneurship or through employers with an entrepreneurial mind-set pushing for innovation in their work situations; however, when this occurs might vary. Some educations have a longer-term vision that their graduates will be change agents in terms of innovative mind-sets and sometime in the future make an impact. We labelled such educations that have no intention to affect other stakeholders during their duration as 'student-centred impact'. The second impact, the 'contextual impact', has in addition to affecting the students, educational activities that intentionally seek to affect externals for an indefinite lifetime with effects occurring during the educational pathway. As an example differentiating the two impact types; some entrepreneurship educations intend student start-ups to only be a time-limited start-up (e.g. Oosterbeek et al., 2010), while others intend the start-up to become the students' future work (Lackéus and Williams Middleton, 2015). Hence, the impact from the two different approaches differs in terms of lifetime, and the students' approach, attitude, risk perception and intention might vary in the two educations. Another example is internships, often with given tasks, where the work performed in these businesses is intended to help the internship business for an indefinite lifetime (and would therefore qualify as extended impact). For students creating

new solutions to a given problem and presenting the solutions in a report or business plan without creating a business or pursuing the work beyond the given task, the approach is a form of participative learning, but the solution's impact is time limited. Thus, we argue that there are two classes in the different learning approaches: 'learning with student-centred impact' and 'learning with contextual impact'. We do not claim that one of the two approaches on the vertical axis is better than the other, and the design needs to be aligned with the education's objective. This completes our six-class typology.

The difficulty with previous classifications in entrepreneurship education is how to fit the different educations into these classes. As discussed previously, whether an education is 'about', 'for' or 'through' might be hard to decide, and whether entrepreneurship can be assessed as only one type is uncertain. The idea behind our new systematisation is to simplify the classification in the research and assessment of entrepreneurship education and to present a way to compare different educations. However, to put an education in one box might be as difficult as saying that entrepreneurship education is 'about', 'for' or 'through'. Entrepreneurship education programmes often consist of several courses in combination, all with different focuses and approaches – even these courses might have different approaches during the course. This makes it difficult to classify the programmes; however, all programmes have an objective and overarching goal, and using different courses to obtain this objective might be necessary. To exemplify the use of the typology, we have identified three papers presented at the ECSB Entrepreneurship Education Conference in 2016. We sorted and inserted the typology of the three papers' descriptions of entrepreneurship educations as illustrated in Figure 7.1, in addition to Oosterbeek et al. (2010), which has a good example of an entrepreneurship course where the students are self-driven, but also with student-centred impact. This illustration shows us how the typology can be used both for individual entrepreneurship courses as well as for entire programs, but then with the programmes' individual courses combined.

Ramsgaard and Østergaard (2016) describe an entrepreneurship course that uses lectures, team activities and site visits in addition to internships. As internships are situations where the students participate and are given tasks or assignments that the business might benefit from for an indefinite time, we placed this education in both the participative contextual impact in addition to the passive student-centred impact groups. The latter is due to the

education's lectures, team activities and site visits. Frederiksen (2016) describes an entrepreneurship module as a part of a programme where the students are engaged in lectures or discussions as well as group work, where the latter involves activities in which the students have given inputs and need to reach an output based on these inputs. We placed this module in the traditional and participative group, where both have a student-centred impact, as this education appears to focus on the students and not affect someone or something outside the educational setting. Hägg (2016) describes an entrepreneurship programme where the learning is focused around an actual start-up situation; here, the students' work in this start-up is intended to lead to a viable business. In addition, Hägg (2016) describes traditional learning situations and group work where the students are working on given problems and need to use predefined inputs. Thus, this last programme is both traditional and participative in the student-centred impact classification, but it is also self-driving in the contextual impact classification, as the students work with real ventures that could affect someone or something outside the educational setting for an indefinite period.
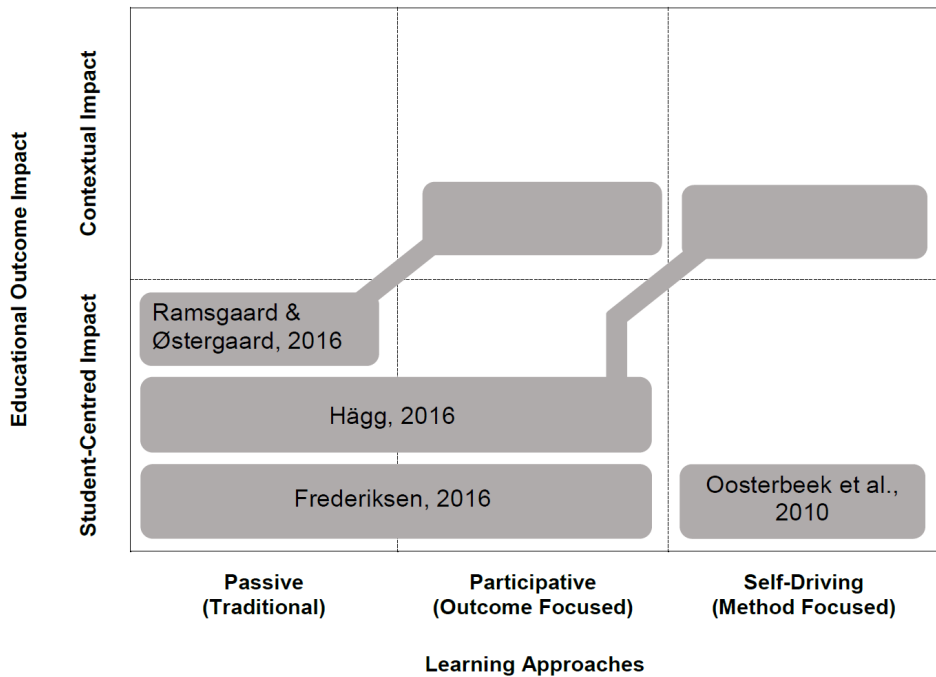
Figure 7.1   Examples of courses or programmes inserted in the typology

6. CONCLUSION, IMPLICATIONS AND FUTURE STUDIES

The objective of the present chapter was to identify a typology that allows for a more fine-grained systematisation of entrepreneurship education. Based on a systematic literature review and further analysis of the identified programmes using Fayolle and Gailly's (2008) framework, we constructed a typology consisting of a 3×2 matrix. The typology separates learning approaches into passive (traditional), participative (output focus) and self-driving (method focus), with the impact from the learning outcomes separated into student-centred and contextual.

Compared to the 'about', 'for' and 'through' framework (Hannon, 2005; Pittaway and Cope, 2007b; Robinson et al., 2016), our new typology allows for a more nuanced separation based on both the students' learning activity and the educational impact in terms of time and external contact and influence. Compared to prior classification, which unclearly focuses on the 'why' and 'how' at the same time, but also is somewhat teacher-centred, we move the focus to the students. Moreover, to contrast our typology with the 'about', 'for' and 'through', we see that, for instance, 'about' and 'for' could both be found in 'passive' *and* 'participative'. Students could learn 'about' entrepreneurship while being in the 'participative' class, and learn 'for' entrepreneurship in the 'passive' class; the latter by learning financials for entrepreneurs as an example. Thus, the typology is an alternative to the prior classification. Additionally, it is also possible to use the typology both at the programme level and at the course level in order to illustrate a more detailed profile of entrepreneurship educations; hence, the typology can distinguish between variations within entrepreneurship education.

The main implication from the present chapter is that peer learning and sharing experiences between entrepreneurship courses and programmes will become easier, as it will be easier to see the similarities and differences between entrepreneurship educations. Furthermore, it will be easier to conduct evaluations and assessments of entrepreneurship courses or programmes since it is now possible to ensure, for instance, that the programmes being compared are similar; it will also be possible to isolate dimensions where the programmes differ. This enables cumulative research in the growing field of entrepreneurship education. Finally, the framework can be used to create a map of the different offerings at a university, illustrating the university's ecosystem.

As mentioned in the method section, future studies should apply the new typology to empirical data from programmes that were not part of the literature review to ensure that it can also be used for programmes that are not designed by authors of entrepreneurship education literature. These studies should also develop the typology in the view of different learning theories (e.g. Robinson et al., 2016) and try to include this literature in the model. Furthermore, future studies should explore the boundaries of the entrepreneurship education concept. As presented in the introduction, universities offer co-curricular activities and students' clubs – these initiatives may produce similar activities and include similar learning projects as the present entrepreneurship education, but they do not normally include teacher and student assessments. These elements are not explicitly mentioned in the typology. Future studies should therefore investigate whether these elements are important enough for the typology to be extended to include differences in these activities, or whether co-curricular activities should be organised in an independent typology.

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Research Paper 2:

An Entrepreneurship Education Taxonomy Based on Authenticity

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An Entrepreneurship Education Taxonomy Based on Authenticity

As part of engineering education, entrepreneurship provides opportunities for more hands-on, action-based, real-life learning situations. In this paper, to capture the varying degrees of risk and complexity and the designs of various learning situations, we introduce 'action realness', based on authentic learning situations, as a classification dimension added to the classes of educational approaches, i.e. 'teacher-directed', 'participatory' and 'self-directed.' This strategy will aid in discriminating, for instance, amongst simulations, internships and real venture creations.

We explore and combine different models of entrepreneurship education offered by ten Nordic technical universities. Through this exploration, we identify three categories of 'action realness', which we label 'pretence', 'authentic' and 'real,' adding to the three classes of educational approaches.

Our paper contributes to the fields of entrepreneurship education and engineering education by creating a taxonomy based on authenticity in educational approaches. The taxonomy may be used for further development of entrepreneurship in engineering education.

Keywords: entrepreneurship education; taxonomy; case study; classification; action learning

Introduction

Today's engineers are expected to develop both social and economic value in their engineering efforts (Yi and Duval-Couetil 2018; Beiler 2015), and entrepreneurship education is considered one of the most important ways of educating innovative individuals in engineering departments (Huang-Saad and Celis 2017; Ling and Venesaar 2015). Thus, entrepreneurship education has become increasingly present and important in engineering faculties (e.g. Nichols and Armstrong 2003; Beiler 2015; da Silva, Costa, and de Barros 2015; Souitaris, Zerbinati, and Al-Laham 2007; Standish-Kuon and Rice 2002; Täks, Tynjälä, and Kukemelk 2016; Yemini and Haddad 2010; Zappe et al. 2013). With this increase in popularity, several discussions have emerged on entrepreneurship education in engineering (Kazakeviciute, Urbone, and Petraite 2016), and different designs and ways of educating engineers in entrepreneurship have evolved (Duval-Couetil, Shartrand, and Reed 2016), for example through the use of problem-based learning (Chau 2005) and real-life cases and projects (Creed, Suuberg, and Crawford 2002). However, there are still calls for further development of entrepreneurship education in engineering (Beiler 2015), with further investigation of engineering students' views on entrepreneurship (Täks, Tynjälä, and Kukemelk 2016) and better understanding and exploration of different pedagogical approaches (Costello 2017; Herman and Stefanescu 2017; Huang-Saad and Celis 2017).

Regarding the designs of entrepreneurship engineering education, some argue for more action-oriented approaches (Elia et al. 2012), while others seek more balance in applying traditional teaching with hands-on activities (Ling and Venesaar 2015; Mäkimurto-Koivumaa and Belt 2016). Mäkimurto-Koivumaa and Belt (2016) further argue that action-oriented activities should be included in the students' first years of study, while knowledge about entrepreneurship should be included later in the students' educational pathway. Others argue for the inclusion of more real cases and not only action-based learning activities (Ollila and Williams Middleton 2011; Creed, Suuberg, and Crawford 2002). On the other hand, Herman and Stefanescu (2017) emphasise that engineering education already includes many practical activities and that entrepreneurship education and engineering curricula should be better aligned than is the case today. But while Mäkimurto-Koivumaa and Belt's (2016) work provides new theoretical and practical

implications for entrepreneurship in engineering education, a discussion of the different educational activities in entrepreneurship education, ranging from the classroom to the real world, appears to be missing.

Hence, while there seems to be agreement in engineering education that entrepreneurship should be included, the educational designs are still underexplored, and Mäkimurto-Koivumaa and Belt (2016) have found that there is a need to explore and organise different types of entrepreneurship education in the engineering field. While entrepreneurship education classification often focuses on the individual student's learning situation and objectives (Mäkimurto-Koivumaa and Belt 2016), practical activities should also be considered (Herman and Stefanescu 2017; Duval-Couetil, Shartrand, and Reed 2016). For instance, Creed, Suuberg and Crawford (2002) argue that the use of entrepreneurship while students work with industry partners is a way of letting the students obtain real-life experience beyond the traditional co-op or internship. As such, entrepreneurship is not only a study field that gives students learning and practice in the field of engineering, but it also provides learning situations that are more authentic and real. However, while the literature presents several examples of different types of entrepreneurship education, including examples where the design offers real-life experience and real-world learning opportunities, an overview or systematisation of what entrepreneurship education could be is still missing. Therefore, in this paper, we answer the following research question: How are students engaged in real-world learning opportunities through entrepreneurship education in technical universities?

Specifically, this implementation is undertaken by creating a taxonomy of entrepreneurship education based on authenticity. To do this, we first investigate the literature on entrepreneurship education classifications. We then empirically verify the theoretical model before we explore the authenticity of the different types of education, and based on the latter expand the model.

The remainder of the paper is organised as follows. In the next section, we expand on and systematise some of the most common and well-cited classifications used in entrepreneurship education. We then explore authentic learning and entrepreneurship education. In the fourth section, we present the methods used to collect and analyse our

empirical data, gathered from entrepreneurship education programmes offered by ten technical universities. In the fifth section, we introduce the empirical results and present the taxonomy. Finally, we provide the conclusion and suggestions for future research.

Classifications of Entrepreneurship Education

To develop a taxonomy for entrepreneurship education research, we first explore some of the most common models applied to entrepreneurship education. Later, we summarise and organise these different classifications in Table 1. The last column in that table illustrates the distinctive characteristics of each classification, while the other columns compare some of the similarities.

Throughout this paper, we also use the phrase 'educational approaches' to entrepreneurship rather than 'pedagogy' or 'teaching' alone. We base this terminology on Richardson's (2005) work on learning and teaching in higher education. He distinguishes between learning and teaching, stating, for example, that teaching approaches could be differentiated between teacher-centred and student-centred types. These teaching approaches could also be influenced by the context. Similarly, he mentions that the context of learning would influence the students' learning. Hence, the phrase 'educational approach' is intended here to encompass pedagogical approaches as well as the learning context, shifting the focus from only teachers and classrooms to also include the students and the context.

About, For, In or Through Model

One of the most well-known classifications of entrepreneurship education is the 'about, for, in or through' model. Having evolved for more than three decades, this model has been applied and discussed frequently in the literature and at conferences in recent years (e.g. Blenker et al. 2011; Gibb 2002; Hannon 2005; Hoppe, Westerberg, and Leffler 2017). One stream of the literature focuses on the different subcategories as objectives under this model, as illustrated in Mwasalwiba's (2010) review of entrepreneurship education. In this definition, the education's focus is on attaining the objective of teaching either *about* entrepreneurship or *for* entrepreneurship. Another objective is teaching *in* entrepreneurship, which is explained as making individuals more innovative or entrepreneurial *in* their workplace or firm (Mwasalwiba 2010).

In another literature stream (e.g. Blenker et al. 2011; Hoppe, Westerberg, and Leffler 2017; Pittaway and Cope 2007), the model is thought of more as constituting approaches to entrepreneurship education, and it thus holds a broader meaning than those of the words themselves. This view of 'about, for, in or through' is perhaps the most applied understanding of the model; however, this literature stream also reveals differences. Pittaway and Cope (2007, 215) define *about* entrepreneurship as education in which 'courses tend to focus on explaining entrepreneurship using traditional techniques,' a definition shared by other researchers. The same coherence applies to education *for* entrepreneurship, which is often regarded as preparing students for the future as entrepreneurs, thus equipping them with the necessary skills and competencies. However, the approaches to education *for* entrepreneurship might vary in how they are executed. For instance, while Pittaway and Cope (2007) refer to skills or competencies acquired through learning by doing, Hoppe and colleagues (2017) focus less on student action in this approach.

Many scholars also combine the idea of education *in* and *through* entrepreneurship. For example, Pittaway and Cope (2007, 215) state that this is one approach where students 'try to emulate the way entrepreneurs learn through their practice'. In contrast, Hoppe and colleagues (2017) separate the two, where *in* is an 'approach [that] handles entrepreneurship as an acted practice' (753), while *through* is an approach in which 'entrepreneurship is chiefly a complementary didactic tool for attaining learning goals that can be hard to reach in other ways' (754).

Pittaway and Cope (2007) further focus on entrepreneurial learning and how simulating entrepreneurship through experiential learning and reflective practice could be beneficial for students. However, their view appears to end in simulations of and reflections on the real world by setting 'a scene' for students. On the other hand, Hoppe and colleagues (2017) vary the definitions of *in* and *through* education such that they are not limited to simulation. While education *in* entrepreneurship regards entrepreneurship as an acted practice, and the *through* definition could be questioned as entrepreneurship education, since this is defined as a didactic tool, Hoppe and colleagues (2017) have developed a new model based on whether the education focuses on businesses from a narrow view or on outcomes in a broader sense. In this model, the educational approach is divided into

the traditional *about* plus a combination of *in* and *through* on one axis, while the other axis ranges from a business focus to a broad focus (intrapreneurship, business development, etc.). This excludes education *for*, as this is thought to be present in both *about* and *in/through*.

Traditional – Action-oriented Education

Rasmussen and Sørheim (2006) present a model based on students' involvement, in which they differentiate whether the education has an individual-centred focus or is action-oriented, with an emphasis on learning by doing. They introduce the individual-centred model as the more traditional way of educating students in entrepreneurship, placing students in a passive classroom setting. Thus, this should not be compared with student-centred education, where the educational approach shifts from a teacher-led to a student-led design (Lea, Stephenson, and Troy 2003; Richardson 2005). The individual-centred design is less frequently applied in the explored types of education (Rasmussen and Sørheim 2006), and the types of education today appear to have shifted from this design, although some still follow this approach (Mwasalwiba 2010).

Rasmussen and Sørheim (2006) also discuss how involved the students are in their education in terms of idea development and quality. In their model, 'University strategies for entrepreneurship education' (187), they separate students into 'passive', 'active' and 'project owners', depending on each student's involvement. They also introduce an axis describing the focus on the business idea, whether this has an 'individual focus', a 'low-potential' or a 'high-potential'. Mwasalwiba (2010) also presents a similar but simpler definition.

Worlds of Entrepreneurship Education

Neck and Greene (2011) present three known 'worlds' of entrepreneurship education. They also illustrate 'the method world' as the fourth world; this builds on entrepreneurship action and practice, where the idea is to create lifelong learning among students, and entrepreneurship is emphasised as a method. The three other worlds focus more on 1) the individual, somewhat similar to the previously mentioned individual-centred learning (Rasmussen and Sørheim 2006); 2) the process world, where

entrepreneurship is presented as a linear activity, and prediction is a central assumption; and 3) cognition, that is, creating an entrepreneurial mind-set.

Neck and Greene (2011) argue that a shift to the method world is needed, and such an approach to entrepreneurship education should be implemented by all types of education — not only those focusing on entrepreneurship education in terms of new ventures.

Continuum of Entrepreneurship Education

A more recent model is the 'continuum of entrepreneurship education' developed by Neck and Corbett (2018). In the different classes in the continuum model, the most prominent differences are the instructional approach — pedagogy, andragogy or heutagogy — and the student–teacher roles. The latter difference is explained in terms of whether the students are self-directed, thus taking on responsibility for their learning, and whether the teacher is more of a facilitator or a lecturer. In this model, the responsibility is shifted more to the students in the 'ideal' type of entrepreneurship education. In the 'old school' approach, the students are primarily passive, and the teacher lectures rather than coaching or facilitating learning, while the education labelled 'likely today' lies in the middle of the three educational forms.

Table 1. Overview of entrepreneurship education classifications.

Article	Educational Classes			Other dimensions
Hannon (2005)	**About** Study entrepreneurship as an academic field	**For** Prepare individuals for enacting an entrepreneurial life or immediate opportunity through the creation of a new business or venture	**Through** Entrepreneurship learned through other subjects	'No real entrepreneurship possible' Need to emulate entrepreneurship, but involves a number of simulations close to the real world; discusses students' ownership of the ideas
Pittaway & Cope (2007)	**About** Explain entrepreneurship through traditional techniques	**For** Acquisition of entrepreneurial skills through learning by doing	**In/Through** Try to emulate how entrepreneurs learn through entrepreneurial practice; focus on reflection, (re)conceptualisation and action	
Mwasalwiba (2010)	**About** Obtain a general understanding about entrepreneurship as a phenomenon	**For** To educate entrepreneurially means to create an entrepreneur, i.e. an individual who is destined to start a new venture; providing tools to start a business	**Through** Educators use new venture creation to help students acquire a range of both business understanding and skills or competences — **In** Help individuals become more entrepreneurial (innovative) in their existing firms or place of work	**Objective vs. approach** The article explains 'through' as a teaching method within the 'for' approach rather than an objective in itself; thus, it cannot be compared as equal to the others; presents teaching methods as a separate classification (see below)
Hoppe et al. (2017)	**About** Education as an analytical approach, traditional	**For** Competence focus, but not as action-oriented as 'in'	**Through** Entrepreneurship as a didactic tool used to learn other subjects — **In** Entrepreneurship as an acted practice	**Narrow vs. broad** Narrow business focus in the education or broad focus on entrepreneurship, e.g. in established businesses and similar
Rasmussen & Sørheim (2006)	Individual-centred Focus on the individual student becoming entrepreneurial after the education		Action-based Focus on letting the students be involved in idea development	While the article focuses on traditional and action-based approaches, the illustration of their model includes students being project owners as an additional class; they also discuss the focus on business in the education—whether it is on the students alone and no business ideas or there are some low- or high-potential ideas involved in the education

About-for-in-through

Traditional – Action-based

174

Theme	Author					Comment
	Mwasalwiba (2010)	Traditional/passive Methods in which students are passive in the learning situation, e.g. lectures, case studies and group discussions			Action-based/innovative Defined as methods that require the instructor to facilitate learning; less control, but enables students to obtain self-discovery based on their activities	*Mwasalwiba favours the more action-based methods as these are better fitted to the development of new ventures as outcomes from the education; the traditional methods enable students to work for an entrepreneur, not to become one*
The worlds of entrepreneurship education	Neck & Greene (2011)	Entrepreneur World Focus on the individual in terms of traits and creating a hero of the activities of entrepreneurs; lecturing, business basics and exams	Cognition World Focusing on the individual but with intention to create an entrepreneurial mind-set among students; uses case teaching and simulation	Process World Focus on the new venture creation process and on describing this as a linear and predictable process; uses cases, business plans and business modelling	Method World Focus on lifelong learning and introduction of learning to learn; presentation of methods to be applied in entrepreneurial situations; focus on action, practice and reflection	
The continuums of entrepreneurship education	Neck & Corbett (2018)	Old School Traditional; students are largely passive and the teacher lectures; focus is therefore on the teacher; pedagogy is the primary approach and awareness is the main outcome	Likely Today In this design, the students simulate entrepreneurship and the teacher acts more as a coach than a lecturer; thus, the learning centre is divided between teacher and students; the desired outcome is a mind-set among the students		Ideal In this approach, the centre of learning has shifted to the students, and the teacher is more a facilitator than a coach; students in this approach are active and perform entrepreneurship; the desired outcome from the education is start-ups	Motivation and readiness to learn *In the article, the model's classes are divided based on the students' or educator's motivation and the students' readiness to learn, which is an important aspect of the model as students in their late teens or early twenties might not have the motivation to start their own ventures; the model is also defined as education that has a new venture as its primary objective/outcome*

Identifying Educational Approach Categories

All the previous classification models summarised in Table 1 present *one* class or type of education, which can be referred to as traditional, passive or old school. Such education uses the most common academic approach to learning, where the students are in a classroom and the teacher lectures, imparting her or his knowledge to the students. The activities in this approach might include lecturing, case studies, group discussions and exams. The objective here could be to learn about entrepreneurship, create awareness or gain an understanding of entrepreneurship. We label such education the *teacher-directed* approach.

The middle section of the table shows a new group, which includes the educational approaches labelled 'for' and 'through', 'cognition world' and 'process world' and 'likely today'. As described by Hannon (2005, 108), these approaches will 'prepare individuals for enacting an entrepreneurial life or immediate opportunity through the creation of a new business or venture'. Although students are more active, their activities are still influenced by the teacher, and the approach utilises assignments with given inputs or outputs. Therefore, we label this approach *participatory*.

The last group in the table, identified based on the differences shown in the right-most column of 'Educational Classes', contains 'in' entrepreneurship, 'action-based' entrepreneurship, the 'method world' and the 'ideal' entrepreneurship education. In this group, action, reflection and student-centred learning are central. Mwasalwiba (2010) states that in this approach, which he calls the action-based or innovative approach, the teacher is less in control; however, he also notes that this is a source of learning for the students. Neck and Greene (2011) mention lifelong learning and note that students should learn methods that can be applied in the entrepreneurial world. We label this group *self-directed*.

Authenticity

While the different classifications identified here overlap to some degree, the right-most column in Table 1, as mentioned, consists of the distinctive characteristics of each classification. And while these characteristics differ, they also introduce the idea of closer connections to the real world. For instance, Pittaway and Cope (2007) strive towards the

real world while stating that it cannot be reached; Neck and Corbett (2018) focus only on the types of education whose objective is to create new ventures, thus aiming at real-world initiations. Rasmussen and Sørheim's (2006) work offers the clearest example of different connections to the real world. The students are distinguished as passive, active or project owners of their new ventures, according to their degree of involvement in the activities. The question of whether their ideas have business potential is also addressed. Thus, these classifications, as such, discuss the authenticity of the types of education. The concept of authentic learning, as Macht and Ball (2016) state, is often discussed, although without using the term 'authentic learning', though there are exceptions in the work of Nab and colleagues (2010) and, more recently, Kassean and colleagues (2015).

Authenticity and situated learning focus on assigning to students those activities that are coherent, meaningful and purposeful and that reflect the activities conducted in the social context where they usually occur (Brown, Collins, and Duguid 1989). As such, the students are able to understand how different professions and social contexts operate, how people in these contexts obtain their knowledge and how this knowledge could be used to solve contextual problems. Different definitions of an authentic learning situation have evolved since Brown and colleagues' (1989) seminal work (e.g. Borthwick et al. 2007; Gulikers, Bostiaens, and Kirschner 2004; Herrington and Herrington 2006; Herrington and Oliver 2000; Herrington, Reeves, and Oliver 2014; Rule 2006; Stein, Isaacs, and Andrews 2004). Herrington and Herrington (2006) summarise the literature under nine characteristics of authentic learning: an authentic context, authentic activities, access to expert performances, encouraging different perspectives, collaboration, reflection, articulation, coaching and scaffolding, and authentic assessment. However, they also admit that there are numerous views on and different definitions of authentic learning. For instance, Rule's (2006, 2) literature review summarises the descriptions of authentic learning under four themes:

1. the activity involves real-world problems that mimic the work of professionals in the discipline with presentation of findings to audiences beyond the classroom;
2. open-ended inquiry, thinking skills, and metacognition are addressed;
3. students engage in discourse and social learning in a community of learners; and

4. students are empowered through choice to direct their own learning in relevant project work.

While these definitions differ to some degree, they overlap substantially. Nonetheless, in the remainder of this paper, we apply Rule's definition.

In their work, Nab and colleagues (2010) stress that entrepreneurship education should strive to achieve an authentic learning situation such that the students are able to experience the entrepreneurial behaviour in an uncertain and unpredictable environment. The same view is supported by Kassean and colleagues (2015), who argue for 'real-world experience, action, and reflective processes to engage students in authentic learning, which should lead to greater entrepreneurial abilities and propensity' (701). Through authentic learning, the students will be able to learn the tacit knowledge connected to entrepreneurship (Nab et al. 2010; Kassean et al. 2015), that is the knowledge that is acquired through learning by doing (Kassean et al. 2015) and where 'emotional as well as intuitive dimensions of entrepreneurship are experienced' (Haase and Lautenschläger 2011, 157). The students should also feel more ownership of the projects, which will influence their learning (Nab et al. 2010; Rasmussen and Sørheim 2006). However, Nab and colleagues (2010) remark that the learning situation will never be perfectly real, as risk and financial risk cannot be achieved, and that students should be protected against 'too risky and unsafe environments'. Nab and colleagues (2010) also introduce a more holistic view of authentic learning in entrepreneurship education, where context, students and other parties (teachers, entrepreneurs, peers) as well as the task are included in the learning situation. On the other hand, Kassean and colleagues (2015) focus more narrowly on hands-on and action-based activities in general.

Thus, several frameworks, classifications and studies to some degree discuss authentic learning situations in students' work, but the definitions of authenticity in these cases are unclear or might be missing. Hence, no clear characteristics of different types of education, identified through an authenticity lens, are presented in the literature. As such, we must turn to the various types of existing entrepreneurship education to explore their differences and understand how these could be organised and included in our current understanding of authentic learning in entrepreneurship education.

Methods

The present study is a case study of entrepreneurship education in the Nordic countries, with an embedded single-case design (Yin 1994), where ten embedded case studies of entrepreneurship education at technical universities are included. The insights, which the cases are intended to provide (see Siggelkow 2007), are variations in how entrepreneurship education is conducted in technical universities. The embedded case studies were therefore chosen to provide a broad view within the shared context.

Context and Data Collection

The educational system is quite similar across the five countries, although contextual differences exist in terms of industry, economy and policy (see e.g. Smeby and Stensaker 1999). These factors might influence the creation and design of entrepreneurship education (see e.g. Faherty 2015; Premand et al. 2016). The selection of the various types of entrepreneurship education considered here was based on Guleva's (2015) report on the types of entrepreneurship education in 27 technical universities in the Nordic countries. In both Norway and Iceland, only one university verified the information (presented in the report) regarding its educational offerings. For these two countries with missing information regarding their universities' educational offerings in entrepreneurship, additional information was gathered through a search of the universities' official websites. The universities included in the study are summarised in Table 2. To ensure interviewee anonymity, the different universities are hereafter randomly labelled using a phonetic alphabet code word ranging from Alpha to Juliet.

Table 2. Overview of the included entrepreneurship education at 10 Nordic universities.

Country	University	Entrepreneurship courses included in the study	Entrepreneurship programmes included in the study	Organisation
Denmark	Aalborg University	4-day interdisciplinary workshop; courses as part of bachelor programme	2-year master programme	Several departments involved; collaboration; "hub" organising activities
	Aarhus University	Summer course; courses as part of bachelor programmes		Mostly one department delivering courses to other departments
Finland	Aalto University	Two minors as part of other programmes; courses as part of other programmes		One department provides 50% of the courses; other departments offer related courses; student "hub" organising activities
	Technical University of Tampere	Minor and courses as part of other programmes		Collaboration between three universities; "hub" organising activities
Iceland	University of Iceland	Courses as part of other programmes	3-semester master programme	Collaboration primarily between two departments
	University of Reykjavik	3-week interdisciplinary course; minor as part of master programme		Courses organised primarily by one department
Norway	Norwegian University of Science and Technology	Courses as part of master programmes	2-year master programme	Programme and courses from one department; student "hub" organising activities
	Arctic University	Courses as part of master programmes	2-year master programme with two tracks	Programme and courses from one department in collaboration with semi-internal lab
Sweden	Chalmers University of Technology	Courses as part of master programme	2-year master programme with four tracks	Programme and courses from one department; "hub" organising activities
	Lund University	Courses as part of master programmes	1-year master programme	Programme from one department; collaboration with science park

We explored the various universities' entrepreneurship education approaches, designs and objectives via semi-structured interviews with teachers and course managers. On each site, three to four teachers or course managers were interviewed individually. In total, 32 interviews were conducted with teachers or course managers, resulting in approximately 31 hours of recorded interviews and over 330 pages of transcribed data. The topics in the interview guide included the role of entrepreneurship education in the university; how the teachers worked on the various courses in terms of the course designs; details about the lectures, with emphasis on tools and exercises; and finally, how the courses were evaluated, developed and updated. Prior to the interviews, descriptions of the various

courses and programmes were gathered from web resources. These data included course descriptions, assessments, curricula, course credits, teacher information, learning outcomes, recommended prior knowledge, requirements and schedules. For the programmes, we also gathered data regarding enrolment requirements, programme designs, faculty presentations, stories from prior students and visions for the programmes. This information was later used to triangulate the information provided by the interviewees (Yin 1994). The interviews lasted approximately an hour each, and both authors participated in all but two interviews. Before the analysis, the interviewees were given the opportunity to validate the transcripts, which is in line with the evaluation criteria for research suggested by Guba and Lincoln (1989).

Coding and Analytical Approach

We investigated the educational approaches and authenticity with different foundations; as such, somewhat different approaches were applied. While the data collection was the same, the data analysis followed two different paths for the educational approaches and authenticity, and while the analysis of the educational approaches used deductive reasoning, the analysis of authenticity followed inductive reasoning. Hence, the different universities' educational approaches were coded according to the theoretical development, and their inherent themes were searched and identified across the different universities. Furthermore, when investigating the authenticity question, the data sets *within* the different codes of the educational approaches were investigated. This design thus followed a thematic analysis, as described by Braun and Clarke (2006), but with different approaches for the educational approaches and authenticity.

The interviews were coded using NVivo 11 software, and the coding was performed in steps, going back and forth from data to theory, but with two overarching steps that formed the analysis. The data were first coded according to the subjects in the interview guide, using the following first-order categories: content, objectives, overarching design and development. For example, a course on Lean Start-up (content) might include lecturing and business plan writing (approach), with the aim of offering students insights into the entrepreneurial world (objectives). In this round of coding, these codes were applied to single courses as well as to entire programmes, so that differences could be

identified. We then discussed the various codes and the identified themes in the first coding and refined the coding scheme.

This round of coding identified that courses and programmes were often inseparable in the interviewees' answers and that the exploration of the learning design was too coarse to identify clear differences between the cases. Therefore, we merged the course and programme coding and created subcategories to clarify the differences in the learning design. The latter categories were based on overarching trends in the data but included inspiration from the literature and the three-class educational approach differentiation identified in the theory section. The scheme then split the learning design into four categories: theory learning, tool learning, mind-set activities and process learning. The fourth category contained the three former educational approaches as applied in a systematic learning situation, but should not be compared with Neck and Greene's (2011) 'process world'. The themes generated from these codes were then reviewed across the different universities. After coding the educational approaches, the authenticity view of each type of education was explored *within* the data sets, separated as educational approaches in the previous step. The review of the different themes of authenticity was then conducted not only across the different universities but also across the different educational approaches.

One of the authors and a research assistant performed the coding independently, and the coding was discussed before being finalised. The coding performed by the two parties had an overall average agreement of 97.5%. However, the interrater reliability of the coding was rather low, just below a moderate agreement strength (Landis and Koch 1977). Further exploration and comparison of the coded data showed that the interrater reliability was often low due to coding preferences. In certain situations, one coder included half-sentences, while the other included entire sentences. Thus, both coders often saw the same information but coded it differently, which led to a good level of agreement but reduced interrater reliability in some cases. The different themes generated from the codes were further analysed across the data from the different universities. The resulting themes for educational approaches and authenticity are presented in the following section.

Findings and Analysis towards a Taxonomy

In Figure 1, the findings and the quotes from the different universities illustrate the connections amongst the different educational approaches, the hierarchical connections and the authenticity of each type of education. This depicts the themes emerging from the data, where the educational approaches — *teacher-directed, participatory* and *self-directed* — are found under the grey areas in the middle of the figure. On the left side of the figure, the second theme of authenticity points to the appropriate texts. The third theme, the hierarchical layout of the educational approaches, is illustrated on the right side of the figure.

Participatory build on Teacher-directed | **Self-directed build on Participatory**

Teacher-directed

Quote	Source
[The innovation management course is] more traditional in its design, it's lectures, and assignments, reflection and discussion. We have small classes so we have a lot of discussion going on in the class. I can probably say it's a traditional way in terms of teaching.	Faculty I, India
I introduced these articles here ... and that was because I wanted to increase the academic level in the course higher.	Faculty II, India
...we ask them to read entrepreneurship literature for the purpose of understanding what it is they go through.	Faculty I, Echo
The first course is a more traditional course, in that the students are going through, you know, lectures, they have online lectures that they are supposed to watch, and we have discussion in class. I lecture a bit and then we have discussions. We have traditional little assignments. And we also do a couple of cases, case discussions.	Faculty I, Golf

Participatory

Quote	Source
What I say is that "when we now discuss the syllabus, let us dig into the project work and discuss the problems the theory concerns, in the context you have defined [through the project]." Thus, through that work [the project] they obtain the practical foundation needed.	Faculty II, India
It is a variation of cases. Moreover, in this first course that I have, there we have many practical exercises, and it is a thought behind that they should enter into a "wow, that is another type of education", and they shall really work. They [the students] really enjoy that course; it is easy to enjoy that course. However, at the same time I focus and try to include time for reflection and applying the literature.	Faculty I, Delta
...the course consists of three lectures. First some basic terminology and that kind of stuff in entrepreneurship. Different kinds of tools, business models, conversation and that kind of stuff. Basic stuff for effectuation and that kind of stuff, with examples and how it relates to entrepreneurship. Then there are different kind of modules or activities. [...] they choose other kinds of events they go to, and they meet people and then they report what they have learnt. [...] there is one module that is workday in start-up. There are plenty of start-ups available here [...] so students need to be recruited to one of these start-ups. They work there for one day, and once again, they need to report what they have done there and learnt.	Faculty I, Foxtrot
So don't start a venture, it's a bit risky to start a venture, but do things that kind of mimic the starts of starting the venture. So I ask them to go out and do a flash mob, they have to interact with other people, they have to stakeholders on board, they have to persuade other people to take part in this flash mob, that's the criteria for passing the flash mob	Faculty II, Echo
[...] businesses hand over a case or a problem description and the students work on it for two-three months. And it is a long and heavy process for the students, and it is much harder when they need to take the business into consideration [...] then there are many actors the students need to consider and they need to behave as they often speak on behalf of the business	Faculty I, Juliet

Self-directed

Quote	Source
If we look at entire education, we call it a strategy-rocket. The first step is the first semester, and that is more simulation-oriented [...] Second [step] is the elective period [...] that is where they have taken the tool that I first introduced in the first semester and now have a real idea to apply this on [...] Then, the third step in the rocket is to work on the right idea. That is, to be responsible for it.	Faculty I, Bravo
I have mostly process courses. About course; theory about entrepreneurship, an introductory course – that is some form of practice in some methods. And process courses where the fundamental pedagogical philosophy is that one learn entrepreneurship by doing entrepreneurship. And I have mostly process through courses in entrepreneurship [...] But most that we do are process courses where the idea is to bring the students through many phases in entrepreneurship, such that they learn that it is not very difficult. When I say it is through course, it is of course a lie, because the way we design it [course/programme], through courses are always also about courses and always also training courses	Faculty III, Echo
We have an intro, try to get people on board. Spend a little week, doing that, and then focus on ideation in the first semester. To support this we have a, this is a three week workshop, where they get together with 150 other students, create teams, and three weeks of engaging in, usually, the outset is that it's a client problem. Design a new hospital bed, something, and then they work, and the product is actually a video pitch, animated video or something, a video, that's the outcome. So they sort of get their hands dirty at the beginning, and try what this is about and get a sense of the whole thing [...] And this course would kind of prepare them for, for this, third semester [...] It's actually mostly one big project [...]Some students will go abroad. Some will go internships. Some will even have a university, merit, or credits transfer, and many will work on their own start-ups in this semester. And there is a thesis, which is often a continuation of the third semester, so if they engage in their start-up, then they will continue to work on that.	Faculty I, India
The most important has been to obtain more connections to the real world and a real-world mode, such that they [the students] feel the pressure that might appear when they will pitch to a business or an investor in the future. Because the program is not only about creating businesses right now, but also to prepare them [the students], if they choose to create a business later, that they have gone through as many elements as possible and have learned as much as possible.	Faculty II, Delta

Left-side categories: Pretence — Authentic — Real

Figure 1. Illustration of quotes and findings from the universities organised after analysis.

Empirically Confirming the Educational Approach Criteria

In the different universities, some traditional lecturing was part of most of the different courses or programmes in some way. The examples that we found included guest lectures, case presentations and discussions, academic writing, video presentations, readings and lectures. While there were different reasons for the different topics introduced in the courses or the programmes, most of the institutions used this approach to increase the academic level of their educational offerings or to legitimise subsequent activities, as described by Faculty I at Echo University and Faculty II at India University (Figure 1). Thus, most of the teachers used traditional 'old school' teaching to create a foundation for the students and increase the latter's knowledge.

Furthermore, in some of the courses or the programmes, the students were active in their education to some degree, indicating a more action-based approach. The teachers often introduced tasks and activities intended to provide the students with some experience in entrepreneurial activities, tools or methods, as illustrated by Faculty I at Foxtrot University (Figure 1). The same case was found at Delta University, where the teachers guided the students in their work and thus functioned as coaches. Other examples of this educational approach included students working with canvases, patent exploitation simulation, audit exercises and internship work tasks.

In some of the educational offerings in the different institutions, we identified an approach where the students had to take action on their own, again illustrated by Faculty II at Delta University. In this case, the students needed to choose how to approach different issues, which tools to apply and which methods to use in their work. Faculty I at Bravo University underlined this, stating that students must '…work on the right idea. That is, to be responsible for it'. Both these universities had venture creation programmes, where the students were more self-driven and approached their tasks with both open-ended problems and solutions. However, other universities offered activities in which the students simulated their businesses and planning, which were subsequently evaluated by external stakeholders, but the students themselves had to plan all the 'actions' throughout the process.

The findings showed that the different types of education used different methods in their teaching, and none of the universities had identical views regarding which methods should be included. However, the various educational approaches could be grouped into three classes, as introduced through the different models in the theory section (Hannon 2005; Hoppe, Westerberg, and Leffler 2017; Neck and Corbett 2018; Neck and Greene 2011; Pittaway and Cope 2007). Hence, the empirical data confirmed the educational approach criteria identified from previous studies — teacher-directed, participatory and self-directed.

Identifying Authenticity Criteria

The connection to the real world varied in the different educational courses and programmes. For example, Faculty I at Delta University (Figure 1) used cases while introducing and applying different tools and methods. In contrast, the students at Juliet University worked together with external entrepreneurs on the latter's ideas and businesses. At this university, the students used tools and methods to create reports about the innovations of these businesses, similar to the case of Delta University explained above. However, at Juliet University, the students' collaboration with external entrepreneurs (i.e. stakeholders outside the classroom) made the students' work something more than just an academic assignment by tackling real-world problems with external stakeholders to mimic the authentic context.

The two prior examples illustrate the differences in the educational approach, where the tasks were somewhat given, and the tools and the methods to apply might be obvious. In other examples of courses or programmes, the students had to decide by themselves on the methods and the tools to use, but there were differences in how they interacted with external stakeholders. At Bravo and Echo Universities, the students had to apply their skills and knowledge in such a way that they solved the problems, but these problems appeared to miss authentic contexts. The same situation existed at Charlie University, where the students started imaginary companies and decided on various strategies for the companies' different phases. They also selected and used different tools and methods in the work and planning for these companies. The students were provided with guidance from experienced entrepreneurs but had no other stakeholders outside the classroom, thus lacking a fulfilled authentic context.

There were many examples in which the students were self-directed in their education while having some stakeholders in their work outside their classrooms, as presented by Faculty I at India University, for instance (Figure 1). The work that the students performed was of significant value for an outside start-up, and the students often needed to decide which problems to address and how to resolve the different issues. However, there were also situations in which the students started their own companies, which had the potential to continue growing after they graduated. These companies solved real problems and had external stakeholders outside the students' classrooms, but they were organised as the students' own companies and probably would not have been founded without their initiative. While the faculties at these universities stressed that the programme/course objective was to educate entrepreneurial individuals rather than to generate new ventures, they also found that these new ventures were nice by-products, and they encouraged the students to try to work on these ventures upon graduation. Thus, these programmes/courses not only mimicked the real world but also embraced it, and the students became professionals while still being in a learning situation. Through this type of initiative and activity, the students also experienced greater risk, as some of these ventures involved financial capital from external stakeholders but also from the students themselves. As such, the pressure became real, and the students could feel the risk, as explained by faculty II at Delta University. Examples of such types of education include those described by the faculties at Bravo, Delta and India Universities (Figure 1).

Based on the results of the analysis, from the point of view of authenticity, we suggest three classes of entrepreneurship education. We label the first class 'pretence'. Pretence may comprise traditional teaching, games, cases or similar situations with low authentic contexts, as illustrated above; the educational situation does not involve contact with any real problems or projects.

We label the second class 'authentic'. In such a class, some interactions occur with someone outside the educational context, that is, some stakeholder(s) other than the students themselves or their teachers, as explained by Faculty I at Foxtrot University (Figure 1). This fulfils Rule's (2006) definition in terms of authentic learning, although the level of authenticity might differ, especially in terms of the educational approach. Additionally, this level only includes 'participatory' and 'self-directed' classes, as

illustrated in Figure 1. The teacher-directed approach can teach students about the real world, but it does not involve any outside stakeholders, may miss open-ended inquiries and may not have an active student learning community; as such, it misses being an authentic learning situation.

The last class of action realness is labelled 'real'. Similar to the previous level, this has an authentic context but one that it does not mimic; this education operates in the real context. The students apply their efforts to their own projects, which have external stakeholders, but the students *are* the professionals. Hence, this level goes beyond what Rule (2006) defines as a mimic in terms of context. Moreover, the students in this situation experience the risk and 'feel the pressure' from being in charge and being the project owners. Thus, these situations go beyond Nab and colleagues' (2010) view on authentic learning situations in entrepreneurship education, as in fact, the students experience the risk and the real situation of being entrepreneurs. This level only includes the 'self-directed' educational approach; although the students are guided and receive feedback on their work, they have a strong ownership of the projects and operate these. The projects also appear to go beyond the ownership definitions presented by Gulikers and colleagues (2004) and Nab and colleagues (2010), as these could be 'by-products of the education' and potentially the future graduates' jobs. In addition, with the high ownership level, the students also choose to a higher degree which activities and strategies to apply and follow. As the 'self-directed' approach requires the students themselves to decide on how to solve various problems, which is not an element of the other educational approaches, the 'real' level appears to be reached only in the 'self-directed' educational approach, as also illustrated in Figure 1.

The three classes identified in the analysis from the point of view of authenticity are collectively labelled the education's *action realness*. While authentic learning is found in the types of entrepreneurship education in this study, and as such argues for labelling the second axis as 'authenticity', the class 'real' goes beyond our and others' definitions of authenticity. While 'real' also has many similarities with Barab, Squire and Dueber's (2000) co-evolutionary model of authenticity, it could be argued that the 'real' class has a connection to the real world such that authenticity does not emerge 'through meaningful relations', but rather that the situations *are* authentic (as in Barab, Squire and Dueber's

definition), and as such, in our definition, are real. Further, Barab, Squire and Dueber's (2000) simulation and participation modes are intertwined in the 'authentic' class identified in this study, while 'pretence' might involve more of a simulation mode or even non-authentic situations.

Hierarchical Design of the Taxonomy

The last identified theme shows that the various educational approaches are hierarchical in the sense that they require a theoretical foundation connected to the students' application of their knowledge. This is especially illustrated by Faculty III at Echo University (Figure 1). Hence, to achieve a 'participatory' design, the faculty must introduce the 'teacher-directed' design. This does not mean that the faculty must shift from the 'teacher-directed' *to* the 'participatory' approach but that the education using the 'participatory' approach must also include some elements of the 'teacher-directed' approach. The same holds true for the 'self-directed' approach. To attain this level, the education must include the 'participatory' approach and, thus, also the 'teacher-directed' approach. Again, the educational approaches and the overarching design do not require a sequential order.

The educational approaches and the action realness categories are illustrated in Figure 2. This finalises the taxonomy of entrepreneurship education, including six classes, with the hierarchical design of the educational approaches on the horizontal axis and action realness based on authenticity on the vertical axis.
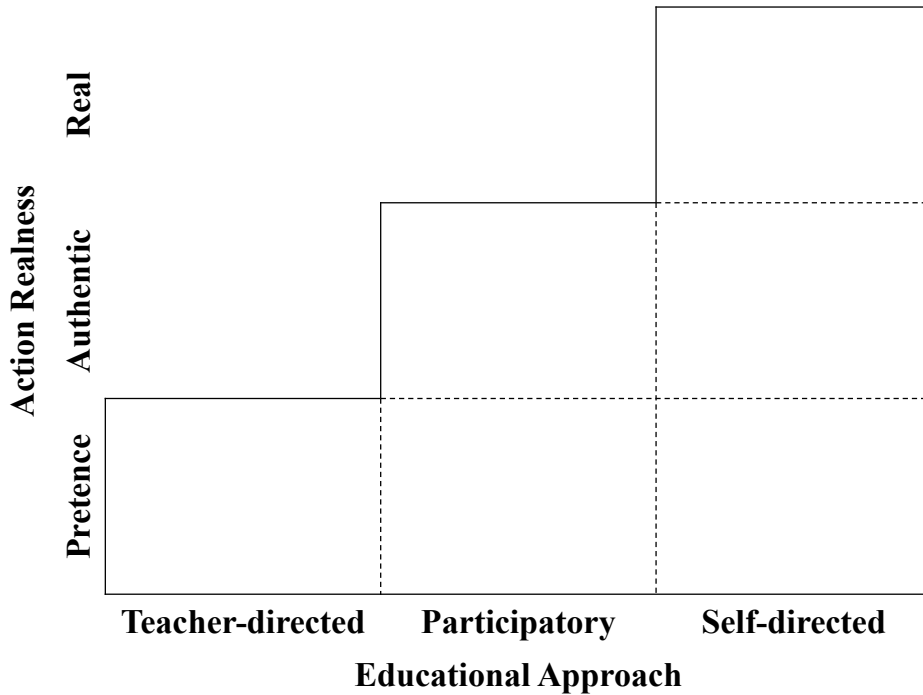
Figure 2. The taxonomy based on authenticity of entrepreneurship education.

Discussions and Conclusions

In this paper, we have created a taxonomy of entrepreneurship education that allows differentiation in authenticity, spanning all educational approaches in entrepreneurship education. Using authenticity as the foundation, we have identified the action realness categories — 'pretence', 'authentic' and 'real' — from our empirical data. Our data have also confirmed the educational approaches — 'teacher-directed', 'participatory' and 'self-directed' — which we have identified in previous classification studies, but the findings also indicate that these educational approaches are hierarchically organised. When connecting action realness and educational approaches, the result is a two-dimensional taxonomy with six classes. This allows better comparisons between educational approaches and programmes in entrepreneurship education and engineering education.

In previous classifications of entrepreneurship education, the more action-oriented learning designs (e.g. Hägg 2017; Neck and Corbett 2018; Neck and Greene 2011;

Rasmussen and Sørheim 2006) have been denoted as 'through' education in the frequently used 'about, for, in or through' model (Gibb 2002; Hannon 2005; Hoppe, Westerberg, and Leffler 2017; Pittaway and Cope 2007). In an attempt to differentiate the 'through' types of education, Macht and Ball (2016) created a new framework based on authenticity (Gulikers et al. 2004; Rule 2006; Stein, Isaacs, and Andrews 2004) and constructive alignment (Biggs 1996), dividing entrepreneurship education between academia and the real world. Our paper contributes to this literature stream by providing a more fine-grained separation of action realness based on authenticity and connecting it to the educational approaches. The action realness dimension enables evaluations of entrepreneurship education to capture the varying degrees of risk, complexity and design with respect to the learning situations connected to authenticity. The findings also show that education in entrepreneurship could include activities that entail risks that are beyond what has previously been introduced and defined as authentic in the literature. Hence, being a central part of entrepreneurship, it is possible to introduce experience with risk, as felt by the practitioners — the entrepreneurs — into entrepreneurship education, yet not without designing the education to include 'real' action realness.

The taxonomy further enables a more nuanced discussion about identifying different mechanisms for facilitation and scaffolding, depending on the differences in the types of action realness and the educational approaches. As such, the use and requirements in terms of resources and contextual characters could be identified in the different types of education, as some of the different types could be more demanding in that regard. This would also be of interest and would be an important implication for course managers seeking more student-directed types of education, for instance; these course managers should not ignore the other educational approaches yet should they also obtain insights into the investments necessary to initiate and run such types of education. The introduction of types of education that are 'authentic' or 'real', in particular, appear to demand more from both faculty and students.

For entrepreneurship education in the engineering discipline, the findings in this study support Mäkimurto-Koivumaa and Belt's (2016) view that action-based approaches should be introduced together with more traditional approaches, even though a specific order of the approaches is not identified. The research also contributes to engineering

education by creating a taxonomy identifying different types of entrepreneurship education, which might be applied in engineering education. As such, through this classification, new education in entrepreneurship could be adapted more easily into engineering curricula, as called for by Herman and Stefanescu (2017), helping less practical engineering education to apply more authentic education and, thus, more self-directed entrepreneurship education. The taxonomy also contributes to engineering education research by introducing a classification which could be applied in assessment research on entrepreneurship education in engineering education, which could meet the call for identification of the best methods when introducing entrepreneurship into engineering departments (Costello 2017; Herman and Stefanescu 2017; Huang-Saad and Celis 2017). Thus, this paper contributes to entrepreneurship education literature and engineering literature, opening a path to further research in both disciplines.

One limitation of this paper is that the data come from ten technical universities in the Nordic countries. The use of technical universities means that the taxonomy likely consists of categories that are particularly relevant for the literature stream focusing on entrepreneurship education as part of engineering (e.g. Beiler 2015; da Silva, Costa, and de Barros 2015; Souitaris, Zerbinati, and Al-Laham 2007; Täks, Tynjälä, and Kukemelk 2016; Yemini and Haddad 2010; Zappe et al. 2013). However, the Nordic countries may constitute a special case in terms of having a large variety of learning situations where industry and society participate in different ways. For instance, in Sweden, collaboration with industry and society has historically been considered part of the 'third task' of universities, in addition to teaching and research, and such collaboration has been supported through policies and evaluations (Fogelberg and Lundqvist 2013).

Future research should use classifications in a more systematic way when describing the investigated types of entrepreneurship education to facilitate comparison and further development. Finally, as mentioned, we suggest that the taxonomy may be a starting point for developing suitable methods of assessing students' learning in the different combinations of action realness and educational approaches.

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Research Paper 3:

Learning from Venture Creation in Higher Education

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Haneberg, Dag Håkon and Torgeir Aadland (forthcoming) Learning from Venture Creation in Higher Education. *Industry and Higher Education.*

Learning from Venture Creation in Higher Education

Introduction

This paper aims to enrich and further the understanding of learning through venture creation in higher education by using a novel qualitative method that provides rich empirical data to explore how the existence—or, more accurately, lack of existence—of a student-led venture may influence students' learning process in an entrepreneurship-education programme.

Scholars and practitioners have shifted toward more experiential and action-based entrepreneurship education, offering students the opportunity to experience entrepreneurship by being entrepreneurs, rather than just learning about the topic (Kassean et al., 2015; Neck and Corbett, 2018; Neck and Greene, 2011; Pittaway and Cope, 2007; Rasmussen and Sørheim, 2006). Prior research has identified numerous ways to design such entrepreneurship education (Aadland and Aaboen, 2018; Mwasalwiba, 2010), introducing real venture-creation activities as an approach to facilitate students' learning (Brentnall et al., 2018; Neck and Corbett, 2018; Rasmussen and Sørheim, 2006). In such cases, commonly referred to as 'action-based' entrepreneurship education, student ventures' existence throughout the education programme might be essential for students' learning.

However, while faculty may plan and execute an education programme, the entrepreneurial venture-creation process involves challenges, uncertainty and potential failure for reasons beyond faculty and students' control (Chang and Rieple, 2013; Corbett, 2007; McMullen and Shepherd, 2006; Reymen et al., 2015). Therefore, the process that a realistic venture-creation process follows likely lies beyond what a traditional programme's curriculum and educational design can otherwise predict or control (cf. Lockett et al., 2017; Matricano and Formica, 2017). As a result, using real ventures as an educational approach may lead to different learning experiences between students in the same cohort, as students are part of different venture-creation processes. To illustrate this challenge and this paper's research agenda, a feasible short story about two students is presented below:

Linda and Ted enrol in an entrepreneurship-education programme. The two-year programme has followed recent developments and employs an action-based approach in which students start their own ventures during the programme (cf. Lackéus and Williams Middleton, 2015; Rasmussen and Sørheim, 2006). Linda and Ted each form a new-venture team to commercialise a business idea they believe in, a process supported by the programme's curriculum, which includes learning about different tools and methods. In addition, their curricular work is supported by their venturing activities as class discussions and course exams encourage students to use their own experience. Linda and Ted's stories are quite similar thus far. However, the two teams encounter different situations as they approach graduation. Linda's venture has reached the market through financial support from a local angel investor. Linda has learned many things in the programme that she will use in her career as an entrepreneur. Meanwhile, Ted and his team experienced serious financial issues. Although they designed equipment that pilot users praised, they have not been able to finance the production of their first batch of ski bags. With only seven months left in the programme, Ted does not see any opportunities to be able to work on his company full-time, and the team stops its venture-creation efforts. Therefore, he applies for and accepts a job as a business developer in a regional bank.

In prior research on entrepreneurship education, Linda represents the common notion that students following an action-based approach learn through their own experience from venture creation, providing them with the mindset, skillset and practice that enable future venturing (Klapper et al., 2015; Neck and Corbett, 2018; Pittaway and Cope, 2007). Ted represents another path: Although he went through the exact same programme, he exited his venture, effectively removing the 'learning vehicle' from his education process (Lackéus and Williams Middleton, 2015). The venture is expected to provide additional value to the learning process (Pittaway et al., 2017), powerfully transforming students into entrepreneurs (Lackéus and Williams Middleton, 2015). However, little is known about how students who choose to abandon venture creation during an action-based entrepreneurship-education programme perceive their learning process. Therefore, this paper's purpose is to investigate differences in students' learning process in an action-

based entrepreneurship-education programme with a holistic view, thereby distinguishing students who pursue venturing throughout their education – like Linda – and those who do not – like Ted.

The research design applied to address this purpose started with an inductive investigation providing a holistic view of students' perceptions of their entrepreneurship education. The empirical approach – introduced in the methods section – provides extraordinarily rich data. Since the research focus is students' *learning* process in *entrepreneurship* education, a theoretical frame of reference is developed on which to focus the analysis and interpretation of the empirical data. The theoretical frame of reference is introduced in the next section and builds on previous research on entrepreneurial learning.

Students' Learning in Action-Based Entrepreneurship Education

Learning through entrepreneurial action is at the core of action-based entrepreneurship education, and previous research on action-based entrepreneurship education largely has built on Kolb's (1984) model of experiential learning to conceptualise students' learning from action (Hägg and Kurczewska, 2016; Pittaway et al., 2017). Moreover, scholars have adopted Kolb's model to understand what is referred to as *entrepreneurial learning* and how it occurs through new-venture creation in entrepreneurship education (Cooper et al., 2004; Rae, 2013; Williams Middleton and Donnellon, 2014).

Entrepreneurial Learning Through New-Venture Creation

Entrepreneurial learning assumes that learning entrepreneurship occurs through action, experience and reflection in new ventures (Cope and Watts, 2000; Deakins and Freel, 1998; Pittaway et al., 2017; Wang and Chugh, 2014). Pittaway and Cope (2007: 212) define *entrepreneurial learning* as 'learning that occurs during the new-venture creation process', which often is conceptualised as a series of *events* that each facilitate experiential learning (Cope, 2003; Heinrichs, 2016; Johannisson et al., 1998). Combined, all events in the new-venture creation process – and, thus, the entrepreneurial learning process – develop the entrepreneur's 'stock of knowledge' (Politis, 2005; Reuber and Fischer, 1999). In addition to suggesting how students in action-based entrepreneurship education learn experientially through new-venture creation events, extant literature on entrepreneurial learning also informs on what is actually learned, such as how to identify

and act on *opportunities* (Corbett, 2005), as well as how to handle the inherent *uncertainty* in the new-venture creation process (Politis, 2005). Also, entrepreneurial learning is about *identity* development (Fletcher and Watson, 2007), as well as continuously developing one's 'stock of knowledge' to be applied in further situations (Politis, 2005). Along these lines, Cope (2005) emphasises that entrepreneurial learning is also about learning to adapt to all kinds of situations, including how to learn from different events. Therefore, in this view, the way that an individual learns is not static, but develops based on prior experiences.

In other words, extant literature on entrepreneurial learning suggests that a lack of a venture in action-based entrepreneurship education may impede students' learning and that the impeded learning may be – among other things – about opportunities, uncertainty and identity development. For example, if a student – such as Ted in the introductory story – no longer has a new venture, there will be no more events to facilitate learning from the venture. A consequence of this is a significant difference in how learning occurs and what learning entails between individuals involved in new-venture creation and those who are not. However, it also should be noted that while extant literature on entrepreneurial learning suggests that students who cease working on their new ventures may lose some learning aspects, the events that caused their exit or the failure of a new venture may lead to learning processes that continuing student entrepreneurs will not (yet) experience (Cope, 2011; Pittaway et al., 2017).

Situated and Social Entrepreneurial Learning

Although research on entrepreneurial learning often mainly considers the individual learner (Pittaway et al., 2017), entrepreneurial learning through new-venture creation is not a purely individual process, and researchers have emphasised its social and collective aspects (Lockett et al., 2017; Pittaway and Cope, 2007; Pittaway and Thorpe, 2012; Wang and Chugh, 2014). Taylor and Thorpe (2004) complement Kolb's (1984) model of experiential learning by suggesting that relations between individuals also are important to entrepreneurial learning. Karataş-Özkan (2011) further argues that while entrepreneurial learning may be considered at the micro-level (individuals), it also may be considered at the meso-level, which involves what is referred to as 'venturing communities', comprising teams or networks of individuals participating in new-venture

creation. This means, for example, that learning about opportunities is a social effort involving several interacting individuals (Corbett, 2005). Also, Harrison and Leitch (2005) emphasise that learning should not be separated from its context since entrepreneurial learning depends on the given situation in addition to specific actions that entrepreneur(s) take.

The concept of *communities of practice* (Lave and Wenger, 1991) is a perspective on how interactive and contextual factors play a role in learning, encompassing both situated and social aspects of learning (Mercieca, 2017) and providing a perspective to complement the commonly action-oriented individual-centred perspective on entrepreneurial learning (Pittaway and Cope, 2007). Essentially, learning in a community of practice means that individuals approaching such a community begin on the 'periphery', where they observe the action and get acquainted with the practice at the 'centre' of the community before gradually becoming part of the activity at the centre themselves (Handley et al., 2006). Thus, the concept of communities of practice means, in the context of entrepreneurial learning, that not only individuals' cognition, but also relations and interactions between individuals, shape learning and are dependent on the context within which learning occurs.

Extant literature on entrepreneurial learning has – at least conceptually (Pittaway et al., 2017) – recognised the situated and social nature of learning from new-venture creation. The inclusion of situated-learning theory and the concept of communities of practice inform about the importance of relations and interactions between individuals, e.g., within a venturing community, as well as the socio-cultural milieu around this community (Karataş-Özkan, 2011). For the present paper's purposes, this implies that students in action-based entrepreneurship education also interact with each other and learn from and with each other when they are part of a venturing community involved in new-venture creation. In addition, the emphasis on context fits well with previous contributions regarding action-based entrepreneurship education that have stressed that it is highly context-dependent (Blenker et al., 2012; Lackéus and Williams Middleton, 2015; Rasmussen and Sørheim, 2006). However, extant literature on entrepreneurial learning does not provide sufficient insight into how context may play a role in students' learning regarding the present paper's purpose. Thus, what remains to be known is what happens

to individuals who, at some point, are no longer involved in venturing activities – a central activity in a 'venturing community'. To sum up, previous research suggests that students' learning in action-based entrepreneurship education depends not only on students' own involvement in new-venture creation, but also on their peers' activities in new-venture creation, as well as other possible factors in social relations, interactions and contexts within which they operate.

Frame of Reference

Based on the insight from extant research on entrepreneurial learning, as well as related concepts – such as experiential learning, situated learning and communities of practice – some points to guide the empirical investigation can be summarised as follows:

- New-venture creation provides an arena for action, experience and reflection through learning events. While absence of a venture is expected to impede learning, other learning events may also emerge from exiting new-venture creation.
- Students' learning through new-venture creation may include learning to identify and act on opportunities, handle uncertainty and develop an entrepreneurial identity.
- Entrepreneurial learning occurs at the individual level, as well as in relations, interactions and networks involving several individuals.
- Individuals involved in new-venture creation may be part of a 'venturing community', and participation in such a community of (entrepreneurial) practice is expected to influence students' learning.

Method

Given the lack of prior research addressing the present paper's objective, the authors found it appropriate to apply an exploratory, inductive and metaphor-based research design. This enables an inclusive and holistic understanding of a new venture's influence on the entire learning process, which may involve many different aspects of the student's life. Furthermore, the theoretical frame of reference is applied to understand and discuss the inductive investigation's results.

To explore and understand students' interest, perceived learning process and possible outcomes from their entrepreneurship education, the Zaltman metaphor elicitation technique (ZMET) was applied (Zaltman and Coulter, 1995). At its core, ZMET is about eliciting and characterising individuals' mental models, with an emphasis on using metaphors to explain interviewees' unconscious processes (Christensen and Olson, 2002). Zaltman and Coulter (1995: 40) describe ZMET as being useful for 'understanding consumers' images of brands, products and companies, brand equity, product concepts and designs, product usage and purchase, experiences, life experiences, consumption context and attitude towards business'. In previous research, ZMET has been adopted in research on services (Lee et al., 2003), tourism (Khoo-Lattimore and Prideaux, 2013) and products (Van Kleef et al., 2005), in which interviewees are asked about their experiences or views about a product, service or brand. The method itself is said to be especially powerful when investigating issues that have not been examined thoroughly (Catchings-Castello, 2000), and as such, investigating a venture's effect in an entrepreneurship-education context could boost the method's reputation. Other methods, such as structured interviews, also could be applied, albeit with the possibility of a reduction in the 'richness of the responses' (Calder and Aitken, 2008). ZMET also has been applied to university students in other contexts to gain an in-depth understanding of students' views on their education (e.g., Voss et al., 2007), as well as in research exploring doctoral students' views on their research training and research culture (Piercy et al., 2005). Thus, as our research is an explorative study on students' experiences with their education, this method is fitting as a study design.

The Zaltman Metaphor Elicitation Technique

Zaltman and Coulter (1995) present a detailed description of the ZMET method, which comprises seven distinct and consecutive parts that end in an overview of the interviewees' mental models or mental maps. The method uses individuals' mental maps to create a consensus map from several participants, and in the following paragraphs, the different methodical steps to reach these maps are explained. However, in the present study, parts six and seven of the ZMET method were excluded. The sixth part explores how many individual participants are needed to reach the same constructs in the map, thereby investigating the consensus among participants. This part was excluded because

Zaltman and Coulter (1995) illustrate, through their work, the number of interviews needed to reach consensus across the relationships of different mental maps and included constructs. The final step visualises the findings with participants to illustrate the different connections and the most important relations and end values. This part of the method is optional and is conducted to illustrate a relationship between different images to be utilised in advertising.

Selection of Research Context

The specific action-based entrepreneurship-education programme selected for this paper is a venture-creation programme (VCP), a type of action-based entrepreneurship-education programme that aims to bridge university student entrepreneurship education and the commercialisation of technology (Lackéus et al., 2016; Lackeus and Williams Middleton, 2015). In particular, Lackéus and Williams Middleton (2015) define VCPs as programmes that use a new venture as a vessel for learning, thereby arming students with the tools and skills needed for the new-venture creation process, such as resources and networks. It can be argued that student ventures are particularly integrated and instrumental to such programmes' course curricula. Thus, with VCPs, entrepreneurship is used as a method for learning (Neck and Greene, 2011; Rasmussen and Sørheim, 2006), and students have the opportunity, and are encouraged, to continue working on their new ventures after graduation (Lackeus and Williams Middleton, 2015).

Definition of Interviewee Groups and Selection of Interviewees

Students in their final semester of a two-year VCP in Scandinavia were recruited for the study. The programme is a full master's degree, and about half the students continue working with their new ventures after graduation. Each class comprises approximately thirty-five students, and both years of the programme share the same new-venture incubation space, which is exclusively for VCP students. At the time of the interviews for this study, students had five months left in the programme.

Previous research has shown that many graduates—and in some studies, most graduates—of entrepreneurship education pursue career paths other than new-venture creation, involving, for example, corporate entrepreneurship and intrapreneurship (Åstebro et al., 2012; Dahlstrand and Berggren, 2010). To separate students who pursue

venturing throughout the programme from those who do not, the authors differentiate between the groups by clarifying that those pursuing venturing plan to continue to do so post-graduation and that the other group has chosen to pursue other options. This avoids possible limitations regarding students who may exit one venture, but later start another during the programme or at the time of graduation. In this paper, the authors ask what an action-based entrepreneurship-education programme means, in terms of thoughts and feelings, for two groups of students as defined below:

Established-company group:

- Students who have terminated their ventures midway through the programme, i.e., about one year before graduation.
- They have also accepted a job offer to work at an established company after graduation.
- They have also not had any engagement in a new venture since terminating theirs, nor have they started a second venture after their first try.

New-venture group:

- Students who are working on their new ventures.
- They are also planning to continue with their ventures after graduation.

To ensure further that no differences existed between students in the two groups regarding their motivations to enter the programme, the students' admissions applications were read. The authors used faculty and peers to identify students who fulfilled the criteria for the two groups, and the selected participants did not know why they were included other than for 'investigating students' view on the programme'. Therefore, the communicated research topic was the programme itself, rather than this paper's objective. Among the students in the cohort, six fulfilled the criteria for the established-company group and six fulfilled the criteria for the new-venture group. Although this sample of twelve students is somewhat smaller than presented by Zaltman and Coulter (1995), they also illustrate that the method can reach a consensus with an average of six participants. In addition, previous researchers using the method also have limited their samples to more appropriate numbers given their selection criteria (e.g., Lee et al., 2003). Among the students in the

new-venture group, four were working on their first venture, while two had started a second venture. All the students' ventures comprised more than one individual, and two or more of the individuals working in each venture were students at the time of the interviews. Three of the students with new ventures worked in the same venture. All participants were between 24 and 27 years old at the time of the interviews, and of the twelve, five were female and seven were male.

Data Collection Process

Seven days before the interviews, the selected students were asked to choose five pictures that represented their thoughts and feelings about their entrepreneurship-education programme. The use of images is a tool to explore important metaphors about study participants' education and, through them, help interviewees reach deep and rich insights in the interview context (Zaltman and Coulter, 1995). The students could use the pictures to explain one or more important constructs, revealing their mental models (Christensen and Olson, 2002).

The interviews were performed one-on-one with one of the authors and a student, lasted from one- to two-and-a-half hours each and were audio-recorded. The interviewees first were asked to share their thoughts and feelings about their entrepreneurship education and, thus, had the opportunity to speak openly about their education, which is the first step in the ZMET interview process (Zaltman and Coulter, 1995). The students then were asked to present the different pictures that they had brought. Under these two steps, the interviewers noted the constructs that the interviewees presented and, during the next step, the interviewers elicited the different constructs by digging deeper into means-end relationships with the interviewees. This 'laddering technique' has a 'goal of determining sets of linkages between the key perceptual elements across the range of attributes (A), consequences (C) and values (V)' (Reynolds and Gutman, 1988: 12). The technique uses questions such as, 'Is that important to you?' and 'Why is that important to you?' to understand and explore new constructs that are important to the interviewees. At the end of the interviews, the interviewees were asked to position the images in groups to identify whether any overarching metaphors existed in the images about the VCP. Some of the students also talked about what their education was not, or were asked to reflect on what their education was not.

Data Analysis Process

The audio files for the twelve interviews resulted in 228 pages of transcribed data. The transcribed interviews were imported into NVivo 11 software, in which the data were coded using a grounded-theory approach (Corbin and Strauss, 1990). Both authors performed the coding together, thereby agreeing on the different terms and definitions. The coding process consisted of first identifying subcategories in the transcripts through open coding, then the different subcategories were combined into overarching categories through axial coding. The latter procedure focussed on the relationships in the initial categories, combining categories based on similarities in conditions, context, strategies and consequences (Corbin and Strauss, 1990). For example, the category 'Teamwork' emerged from combining the subcategories 'Ambition in the Team', 'Demanding Team Situation', 'Team as Safety Net', 'Teamwork' and 'Team Composition in the Education'. The open coding resulted in 294 individual subcategories, and the axial coding resulted in seventy-three categories representing the key constructs among the 294 subcategories.

After identifying the key constructs, the interview transcripts were reread, and the authors then identified relations between the different constructs or 'paired-construct relationships'. Here, a *paired-construct relationship* is defined as 'the casual relationship between two constructs' (Zaltman and Coulter, 1995: 44). This process focussed on identifying which constructs led to or influenced other constructs in what is referred to as the 'means-end technique'. The means-end theory describes how means are used to reach end-values, or terminal values, among a group of people, and these values are assumed to be created by a person's environment and through one's personal beliefs (Gutman, 1982). Thus, the values – or constructs, as Zaltman and Coulter (1995) label them – are organised in a hierarchical order, in which originator constructs influence and lead to connector constructs, *means* and, ultimately, destination constructs, or *ends*. Originator constructs do not lead from other constructs, and destination constructs do not lead to any other constructs. An example of how the coding was conducted is presented in Figure 1 below, in which a student talks about his or her learning outcomes, experiences and personal motivations. The figure illustrates the student presenting how different 'learning outcomes' lead to 'positive experiences' (both connector constructs), which again influence his or her 'personal motivation' (a destination construct). The far-right column

in the figure shows how these paired-construct relationships are represented in the results, and the arrows indicate the 'paired-construct relationship', i.e., how two connection constructs lead to the destination construct.

Figure 1. Coding example and paired-construct relationship.

When all the means-end relationships were identified, consensus maps for each of the two groups of students were constructed. Zaltman and Coulter (1995) stress that two criteria are used to include different constructs in consensus maps: 1) a certain number of participants must talk about the different constructs, and 2) a certain number of participants connect two constructs together. When building the map, a cut-off level for the constructs to be included was set. This cut-off level needs to be set carefully: If it is too high, the consensus map is reduced to an uninterestingly low number of constructs and connections, while not setting a cut-off level will include all constructs, which might make the consensus map too complex and confusing. Christensen and Olson (2002) recommend that between one-third to a quarter of the number of participants be used as a cut-off level. Thus, in the present study, one-third of the participants was set as the cut-off level, resulting in the requirement that two or more students must have talked about constructs and paired the same constructs before these were included in the map. A customised computer-based model then was used to calculate which constructs should be included in the model, and from this, consensus maps were created. Through this process, the number of constructs was reduced from seventy-three to twenty-five for the

established-company students and to thirty-two for the new-venture students. Tables 1 and 2 illustrate the different frequency of connections between the constructs, in which row elements lead toward column elements. For example, the construct 'PERSONAL DEVELOPMENT' (construct 18) leads to the constructs 'CREATING OPPORTUNITIES', 'FUTURE VISIONS' and 'PERSONAL MOTIVATION' (constructs 17, 21 and 25, respectively) in Table 1. The numbers in the tables represent how many individuals mentioned that specific connection. The tables also identify originator constructs and destination constructs or end-values.

The consensus maps for the two student groups were built based on Tables 1 and 2. When creating the maps, the originator constructs were organised at the bottom of the map, and the destination constructs were placed at the top. The different constructs also were organised hierarchically in the map. In this way, the consensus maps were created so that the constructs lead to the top, and the relationships mostly influence or lead to the constructs above (illustrated with arrows on the maps). In addition, redundant relations were removed; these are direct relationships between two constructs that also are connected through a third construct (for indirect and direct connections, see Reynolds and Gutman, 1988). Finally, the map was organised so that different 'ladders' were placed in lines vertically. In addition, in some cases, some of the constructs are closely interconnected and, in turn, lead to each other. These are labelled 'dyads', and a construct dyad is illustrated in the maps when direct connections exist between two constructs going in both directions. Moreover, when examining the consensus map, an interesting feature is that not all connectors follow the ladders up (solid arrows) toward the destination constructs. Some connectors (dashed arrows) lead back to connector constructs lower in the map, and these connectors often create 'loops' in the consensus maps. A dyad could be regarded as a loop between only two constructs, so the loops elaborated here comprise at least three connector constructs.

Table 1. Connection frequency between the constructs for the established-company group.

	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	
1 THE STUDENTS	2			1	3			1	1															1
2 UNCERTAINTY													2											2
3 EXPECTATIONS AMONG STUDENTS			2	1		1	1	2				1		1	1					1		1		3
4 CULTURE																1								4
5 CULTURE FOR SHARING				1		1		1									1							5
6 CARING AND SUPPORTING MILIEU	1			2								1				1	2	1				1		6
7 CHALLENGES														2	2		4	2		1	1	2	2	7
8 SOCIAL MILIEU	1						1	1	1		1				1		2	1				1		8
9 EXPECTATIONS TO WORK IN A NEW VENTURE							1			1		1			1				1					9
10 SHARED MENTALITY									1	1							2	2						10
11 TEAMWORK										1	3			1			1							11
12 NETWORK														2				1						12
13 IMMERSIVE EXPERIENCE															1	1				2				13
14 MAKING CHOICES														2		1		1						14
15 LEARNING APPROACH														5		3		1	1			1	1	15
16 LEARNING OUTCOMES															2	3		1	2		2			16
17 CREATING OPPORTUNITIES				1											1		1	1		1				17
18 PERSONAL DEVELOPMENT															1			2				2		18
19 COMMUNITY																		1						19
20 POSITIVE EXPERIENCES																		1						20
21 FUTURE VISIONS																								21
22 DEMANDING PROGRAMME																								22
23 CULTURE FOR PRIORITISATION																								23
24 DARING TO ACT																								24
25 PERSONAL MOTIVATION																								25

Table 2. Connection frequency between the constructs for the new-venture group.

	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	
1 THE STUDENTS		4		1						1	1	1	1	1				1	3	5	1				2	1		1
2 IMMERSIVE EXPERIENCE	1	1	2																					1				2
3 PHYSICAL SPACE		2	1															1						1				3
4 NETWORK						1						2							1			1	1					4
5 DESIRE TO CONTRIBUTE											3																	5
6 PERSONAL NEEDS		1		1											1		1			1		2						6
7 SOCIAL MILIEU	1					1	1											3	1		1			1		1		7
8 WORK-LIFE BALANCE																		2				1						8
9 EXPECTATIONS AMONG STUDENTS							1											2										9
10 CARING AND SUPPORTING MILIEU										2	1						1	3		1						2		10
11 EXPECTATIONS TO WORK IN A NEW VENTURE							2								1		1		1		1		1		1			11
12 NEW VENTURE CREATION								1							2				1		1							12
13 UNCERTAINTY									2	1				1			1		1	1								13
14 CHALLENGES										1									2			1	1		1			14
15 TEAM SPIRIT								1		1					1										1			15
16 CULTURE FOR SHARING	1							1				2					2	1				1	1					16
17 CREATING OPPORTUNITIES				1	1							1	1	3	1		1	2	1	2	1	2	1					17
18 TEAMWORK																	2											18
19 SHARED MENTALITY															1					1	1							19
20 LEARNING APPROACH																	2	2			1		1					20
21 CULTURE FOR PRIORITISATION																	1	2			1							21
22 CHOOSING AND PURSUING OPPORTUNITIES		1															2	1	2	1	1							22
23 SPLIT COMMUNITY		1																		1								23
24 COMMUNITY																				1								24
25 LEARNING OUTCOMES									1											1								25
26 PERSONAL DEVELOPMENT																			1	1	1	1						26
27 FUTURE CAREER																				1								27
28 FUTURE VISIONS																				1		1			2			28
29 POSITIVE EXPERIENCES																								2				29
30 INSPIRATION																								1				30
31 INCENTIVE TO BE PRESENT																												31
32 PERSONAL MOTIVATION																												32

Findings

The method led to a consensus map (Figures 2 and 4 below) for each group. As mentioned, the maps represent 'ladders', in which the originator constructs lead toward the destination constructs. In the following section, each of the consensus maps for the two student groups is explored in detail to provide insight into the learning processes.

Findings for the Established-Company Group

The consensus map for the established-company group reveals twenty-five constructs, including two originator constructs and two destination constructs. Originator constructs are 'THE STUDENTS', which include students' characteristics and skills, and 'UNCERTAINTY', which includes working under uncertainty and finding solutions under uncertainty. The destination constructs are 'DARING TO ACT', including the courage to pursue opportunities and make untraditional choices, and 'PERSONAL MOTIVATION'. In addition, some 'incomplete destination constructs' are at the top of the consensus map. These constructs are connected to other constructs that have been removed due to the cut-off set in the method, but are, as such, not destination constructs. The connecting constructs are referred to by their numbering, which is presented in Figures 2 and 4.
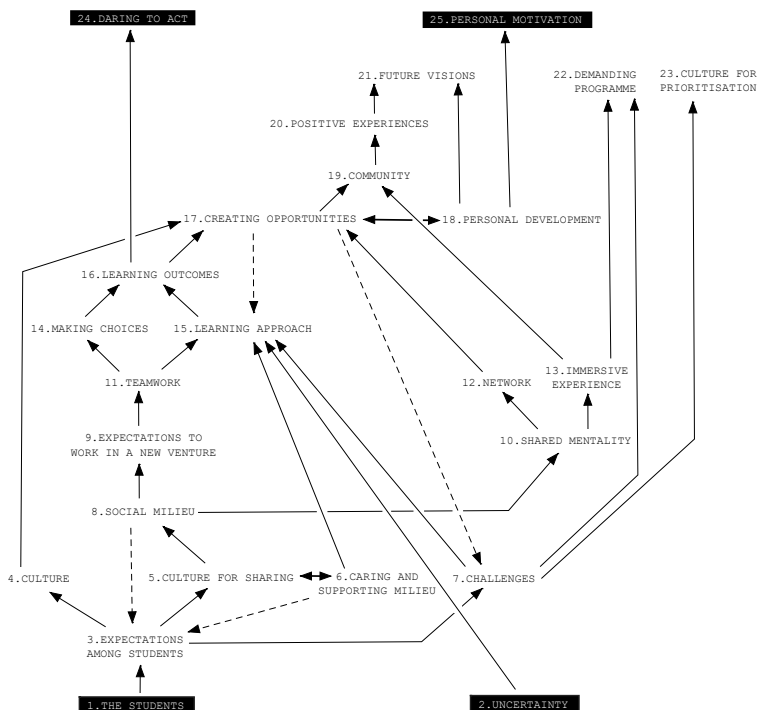

Figure 2. Consensus map for the established-company group.

Dyads

The consensus map in Figure 2 reveals two construct dyads. The first dyad comprises 'CULTURE FOR SHARING' and 'CARING AND SUPPORTING MILIEU'. The sharing culture includes coopetition at pitch competitions and helping others with their challenging tasks, such as sharing templates for financial reporting. The caring and supporting milieu includes cheering on others' success and having empathy for others in challenging situations. A second dyad comprises 'CREATING OPPORTUNITIES' and 'PERSONAL DEVELOPMENT'. Creating opportunities is about the opportunities that the programme provides for starting ventures, travelling and engaging in activities. Personal development is about students becoming more comfortable, socially proactive and self-conscious.

Ladders

The twenty-one connector constructs' structure reveals four ladders leading from the originator constructs to the destination constructs. The first, and possibly most pronounced, ladder leads from 'THE STUDENTS' to 'DARING TO ACT', including constructs 3, 5, 8, 9, 11, 14, 15 and 16. Generally, this ladder illustrates how students build expectations for each other that drive learning through a social milieu and a sharing culture. In turn, the outcomes from this learning lead to increased courage. A second ladder leads from both 'THE STUDENTS' and 'UNCERTAINTY' to 'LEARNING APPROACH' and includes constructs 3, 5, 6 and 7. This ladder illustrates how students' expectations, on one hand, and uncertainty, on the other, underpin the learning approach. In this ladder, student expectations lead to caretaking, sharing and support, but they also introduce challenges. A third ladder leads from 'SOCIAL MILIEU' to 'COMMUNITY' and includes constructs 10, 12, 13 and 17. This third ladder illustrates how the VCP students' social milieu, by leading to a shared mentality, provides opportunities for new-venture creation, travelling and engaging in activities. Finally, the fourth ladder starts with 'LEARNING OUTCOMES' and leads to 'PERSONAL MOTIVATION' and 'FUTURE VISIONS', including constructs 17, 18, 19 and 20. This fourth ladder illustrates how students' learning outcomes lead to opportunities and personal development, which, in turn, provide personal motivation for the students. In addition, 'CREATING

OPPORTUNITIES' and 'PERSONAL DEVELOPMENT' branch out, eventually leading to students contemplating their future careers and lives.

Loops

For the established-company group, two loops were identified (Figure 3). The first loop is about culture and milieu. This loop connects the expectations among students and culture for sharing through two sub-loops that include the social milieu and the caring and supporting milieu. Generally, this loop describes how students' expectations of each other lead to their culture, which again leads to both their social milieu and supportive milieu. 'SOCIAL MILIEU' concerns the students' social engagement with each other and their social way of working, while the 'CARING AND SUPPORTING MILIEU' is more about how the students cheer each other's successes and have empathy when dealing with challenging situations. Both lead back to the students' expectations for each other. The second loop is about learning, and it connects 'LEARNING APPROACH', 'LEARNING OUTCOMES' and 'CREATING OPPORTUNITIES'. The learning approach in the programme leads to learning outcomes, further creating opportunities for the students. In turn, these opportunities contribute to the learning approach in the VCP.
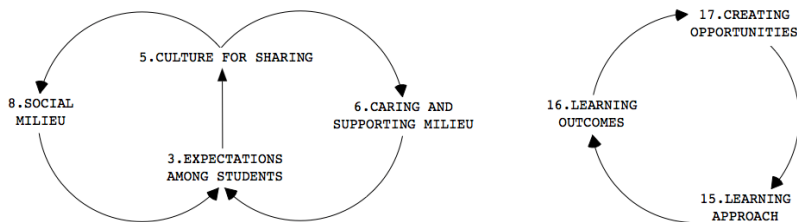

Figure 3. The two construct loops identified for the established-company group.

Findings for the New-Venture Group

The consensus map for the new-venture group (Figure 4) reveals thirty-two constructs, including five originator constructs and two destination constructs. Only one originator construct and one destination construct coincide with the established-company group. Originator constructs for the new-venture group are 'IMMERSIVE EXPERIENCE', which focuses on how the programme influences all aspects of students' lives; 'PHYSICAL SPACE', i.e., the programme's physical premises; 'NETWORK', which is

about the network's relevance and value (e.g., alumni) that the programme offers; 'DESIRE TO CONTRIBUTE', which is about how students wish to contribute to others in the programme; and 'THE STUDENTS'. Destination constructs are 'INCENTIVE TO BE PRESENT', which is about how the students feel at home in the programme and get motivation from this, and 'PERSONAL MOTIVATION'.

Dyads

The consensus map in the new-venture group reveals four construct dyads. The first comprises 'PERSONAL NEEDS' and 'SOCIAL MILIEU'. The students' personal needs, such as social needs and preferred working habits, are highly interconnected with the social milieu that the students are part of, including social engagement with each other and their social way of working. A second dyad pairs 'SOCIAL MILIEU' with 'SPLIT COMMUNITY'. Therefore, the social milieu is also highly interconnected because the community in which it exists is split between different groups of students. The third dyad includes 'TEAM SPIRIT' and 'CULTURE FOR SHARING'. Students' collective goals and responsibilities in their communities are highly interconnected with the sharing culture. The fourth dyad comprises the constructs 'FUTURE CAREER' and 'FUTURE VISION'. Although the two constructs are similar and may be connected naturally, they differ in that the future vision regards students' thoughts for their future lives beyond their professional careers.
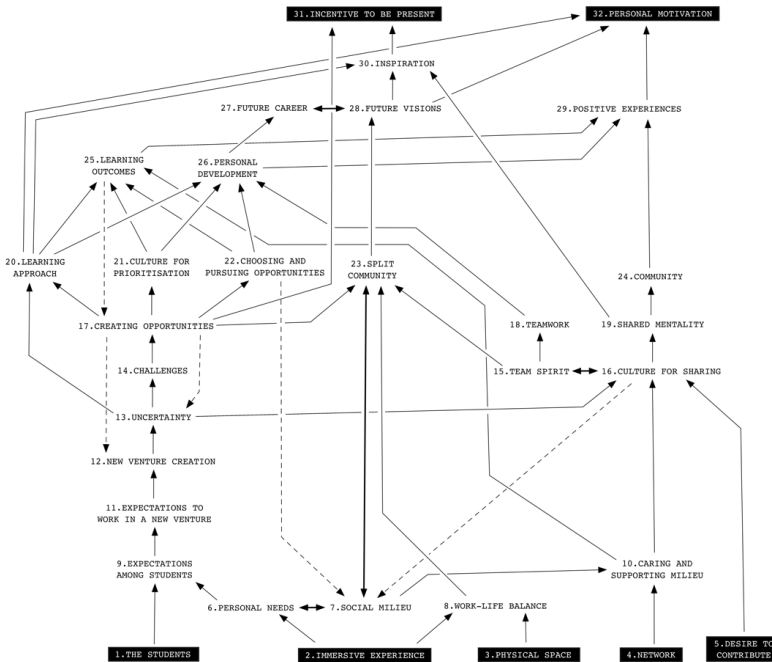
Figure 4. Consensus map for the new-venture group.

Ladders

The structure of the twenty-five connector constructs in Figure 4 reveals three ladders going from the originator constructs to the destination constructs. The first ladder leads from 'THE STUDENTS' to 'LEARNING OUTCOMES' and 'PERSONAL DEVELOPMENT', including constructs 9, 11, 12, 13, 14, 17, 20, 21 and 22. This ladder leads from the students, including their expectations of each other, toward working in a new venture and in new-venture creation, then further to challenges and uncertainty, which are part of the new-venture creation process. Furthermore, experiencing this process leads to learning approach, opportunities and the need for the students to prioritise. At the end of the ladder, the three constructs result in learning outcomes and personal development for the students. A second ladder leads from 'NETWORK' and 'DESIRE TO CONTRIBUTE' to 'PERSONAL MOTIVATION', including constructs 10, 16, 19, 24 and 29. Starting with the two originator constructs, this ladder leads through the caring and supporting milieu within the VCP, moving toward a sharing culture, and the community toward positive experiences and personal motivation. The third ladder

does not resemble a straight ladder, but rather a tripod, starting with the constructs 'SHARED MENTALITY', 'LEARNING APPROACH' and 'SPLIT COMMUNITY'; this goes through students' thoughts about the future and their inspiration, leading to 'INCENTIVE TO BE PRESENT'. In other words, a broad range of constructs leads to one of the two originator constructs.

Loops

For the new-venture group, two construct loops were identified by examining the consensus map (Figure 5). The first loop is about the culture and milieu and includes constructs 7, 10 and 16. This loop connects the students' social milieu with a caring and supporting milieu, which again supports a sharing culture in the VCP. In turn, this sharing culture further contributes to the social milieu. The second loop is built of three interconnected loops related to new-venture creation, opportunities and learning, and includes constructs 12, 13, 14, 17, 20, 21, 22 and 25. The lower sub-loop connects students' new-venture creation with uncertainty and challenges, leading to opportunities for the students. These opportunities, in turn, contribute to the students' new-venture creation efforts. The left sub-loop connects students' learning with the creation of opportunities. The right sub-loop connects students' prioritisation, choosing and pursuit of opportunities to learning outcomes. Overall, the three sub-loops together describe how new-venture creation, creation and selection of opportunities, and learning are interconnected for the new-venture group.
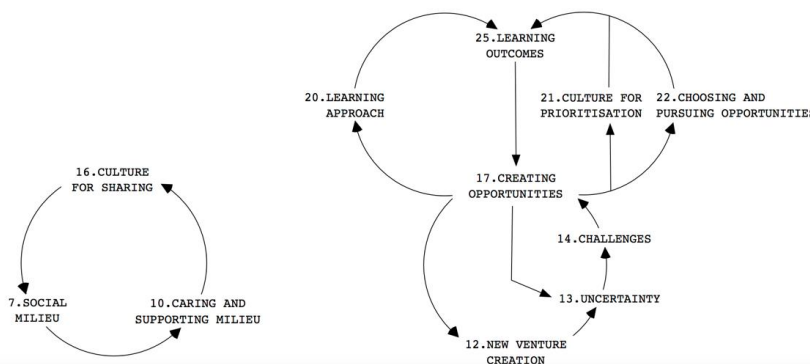

Figure 5. The two construct loops identified for the new-venture group.

Comparing the Two Groups' Consensus Maps

Similarities and differences can be found in the two consensus maps, with some overlapping constructs and others exclusive to one group. The consensus map for the established-company group includes four exclusive constructs, of which one is a destination construct, and three are about students being in challenging situations. 'DEMANDING PROGRAMME' shows that the VCP is time-consuming and requires sacrificing other aspects of life, 'MAKING CHOICES' is about students needing to make choices for their personal lives and for their new-venture project in the VCP and 'DARING TO ACT' concerns the courage to pursue opportunities and make nontraditional choices. The latter implies that the students do not feel comfortable pursuing opportunities and making nontraditional choices in the first place. For the new-venture group, exclusive constructs involve those specifically relevant to the new-venture creation process in the VCP, such as 'NEW-VENTURE CREATION', 'PHYSICAL SPACE' and 'TEAM SPIRIT'. In addition, other constructs exclusive to this group relate to personal preferences, such as 'PERSONAL NEEDS' and 'WORK-LIFE BALANCE', as well as constructs relating to the students' presence in the community, such as 'SPLIT COMMUNITY' and 'INCENTIVE TO BE PRESENT'.

Discussion

As expected, the ZMET method provided very rich results. Consequently, the data offer insights on a broad spectrum of constructs and connections relevant to action-based entrepreneurship education. However, to be able to process the results, this section discusses them with guidance from the theoretical frame of reference to focus on the present paper's objective.

For both groups interviewed, students' learning and social milieu and culture are the most central aspects of the action-based entrepreneurship-education programme. These two themes generally are prominent in several dyads, ladders and loops found in the consensus maps, as well as through comparisons of the two groups. Referring to the frame of reference, this finding is in line with previous conceptions of the central position of learning from new-venture creation in action-based entrepreneurship education (Cooper et al., 2004; Rae, 2013; Williams Middleton and Donnellon, 2014), and this type of

learning also is situated and social (Lockett et al., 2017; Pittaway and Cope, 2007). Common to both groups is also that learning outcomes and personal development are sources of personal motivation, making personal motivation via personal development and learning stand out as a common value for students in the programme, regardless of whether they are working in a new venture. Thus, the results here support the idea that outcomes from entrepreneurship are broader than merely producing new ventures (Neck and Corbett, 2018) and also entail personal development. Moreover, for the group of students who accepted a job offer to work at an established company, the findings underpin this point, as these students focus on their future careers and lives, rather than immediate challenges and situations, which, in general, likely would be related to new-venture creation efforts. This is illustrated by the destination constructs (including the 'incomplete' destination constructs) from the two consensus maps, in which the established-company group focuses on more future-oriented constructs, while the new-venture group focuses on constructs that are of a more contemporary relevance. This further supports the methodological assumptions and selection criteria of the two groups of participants and, as such, the study's objective.

Comparing the two loops regarding learning (right sides of Figures 3 and 5), the new-venture group emphasises new-venture creation, as well as opportunities and uncertainty in how they perceive their learning process. This is very much in line with previous research on entrepreneurial learning (e.g., Cope, 2003; Corbett, 2005; Politis, 2005). Interestingly, the learning loop for the established-company group is far less sophisticated. New-venture creation and uncertainty are no longer present, hinting that the learning process is different for students who choose not to pursue venturing during their education. It is not surprising that the students in the established-company group focus less on new-venture creation when it comes to their learning process, and up to this point, the results are aligned with what research on entrepreneurial learning suggests regarding learning from new-venture creation events. However, while uncertainty is not present as a construct on the established-company group's learning loop, it is still not out of the equation altogether. In the consensus map in Figure 2, uncertainty is shown to lead to the programme's learning approach. Considering that a notion of opportunity creation

is part of both groups' learning loops, central elements of entrepreneurial learning are, thus, present for both groups, however differently they are configured.

One example of the configuration difference is how the network that the programme offers (construct 12 in Figure 2) led to creation of opportunities for the established-company group, while the creation of opportunities for the new-venture group more expectedly build on new-venture creation and uncertainty. Thus, the available networks may provide opportunities in the absence of what a new venture can offer. As the network builds on social milieu and culture in the programme, the findings emphasise the relevance of relations, (social) interactions and networks for entrepreneurial learning in the case of the established-company group (Karataş-Özkan, 2011; Lockett et al., 2017; Taylor and Thorpe, 2004). The finding of opportunities for learning in the established-company group is also interesting, as the students obviously are attentive to opportunities, but not in the view of pursuing them in terms of new ventures. It is also interesting that these opportunities *are* necessary for personal development and further motivation. This could be a result of students' prior activity with opportunities in terms of new ventures, and that their 'stock of knowledge' and personal identity development have made them more observant, watching for opportunities to further their personal development. For example, this can be travelling abroad as part of a research-collaboration project to gather data for that research, while simultaneously experiencing the culture and being part of and working with a research team.

However, even clearer distinctions between the two groups are evident when comparing the construct of *ladders*, leading to the constructs that are part of the learning loops. Where the students' learning in the new-venture group again builds on new-venture creation, opportunities and uncertainty, students' learning in the established-company group is not only related to – but actually builds from – the social milieu and culture (e.g., constructs 5, 6 and 8 in Figure 2). While this supports the existing notion of situated and social entrepreneurial learning (Corbett, 2005; Pittaway et al., 2017), the findings extend common conceptions by showing that learning also *originates from* the social milieu and culture that define the environment – or rather context – in the action-based entrepreneurship-education programme. On one side, the established-company group learns from the context, which is facilitated by the new ventures, while the new-venture

group learns from its venturing activities, which the context facilitates. These differences between the learning ladders are illustrated conceptually in Figure 6 below.
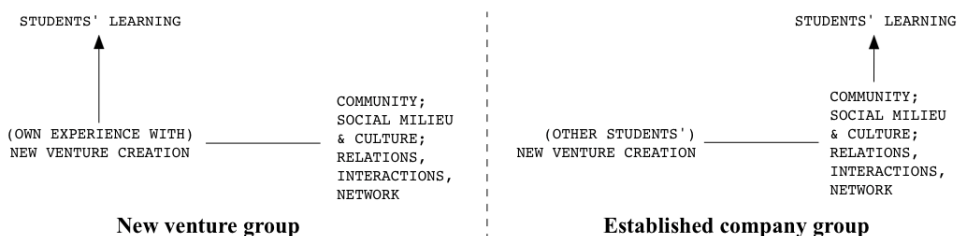

Figure 6. Conceptual illustration of differences in learning ladders between the new-venture group (left), which aligns with the frame of reference, and the established-company group.

Thus, the findings suggest that the social milieu and culture are not only relevant for – and contribute to – students' learning, but also are a rather fundamental factor in students' learning in the established-company group. For students who pursue venturing throughout the programme, social milieu and culture may be considered to be running alongside their learning process, while for the established-company group, social milieu and culture play an integrated role in students' learning (illustrated by the first ladder in Figure 2). This suggests that the absence of a venture may either amplify the role of the social milieu and culture, or make the social milieu and culture more pronounced and perhaps important in the absence of a new venture. Constructs regarding social milieu and culture in the consensus maps broadly correspond to relationships, interactions and networks from the frame of reference. The frame of reference suggests the existence of a 'venturing community' (cf. Karataş-Özkan, 2011), in which students participate due to their new-venture creation, and findings support this assumption by showing that students' expectations of each other are fundamental to their learning in both groups. Specifically, it is construct 3 in Figure 2 and construct 9 in Figure 4 that connect the characteristics of the students in the programme with students' learning.

From the perspective of communities of practice (Lave and Wenger, 1991), the findings indicate that students in the established-company group are more peripheral than students in the new-venture group when discussing new-venture activities. Since Lave and Wenger (1991) suggest that individuals move closer to the centre of the community as they learn, it is perhaps more likely that the new-venture group has moved even further

toward the 'centre', leaving the established-company group behind, rather than students in the established-company group moving back to the periphery while lacking a new venture. Building on Pittaway and Cope's (2007) suggestion of using 'communities of practice' to understand the social aspects of action-based entrepreneurship education, this paper elaborates that learning in a community of (entrepreneurial) practice may be particularly impactful for students who are within a 'venturing community', but are not involved directly in entrepreneurial action themselves.

As illustrated in the established-company group's consensus map, and through the aforementioned ladder leading to personal motivation and future vison, the social milieu and network examples show how these could influence students through being peripheral in the 'venturing community'. In other words, findings from the present paper illustrate how the 'venturing community' in the programme may develop a larger role for students' learning when they exit their ventures during the programme. It is important to keep in mind that students in both groups have venture-creation experience from their programme, but the extent of their experience differs between the two groups, as indicated by the interviewee-selection criteria. Therefore, the findings generally suggest that the learning and venture-creation processes of others in the programme directly impact the learning process. This means that students' activities as a whole play an important role in the learning that the programme can offer. For action-based entrepreneurship-education programmes, this implies that in addition to experiential learning from new-venture creation, relations and interactions among students are very important for learning. Therefore, programme curricula and overall organisation should ensure that students interact on a regular basis, e.g., by being co-located and not distributed around the university.

Conclusions, Implications and Further Research

The present paper is the first to pinpoint, specifically, the learning impact from venture creation in action-based entrepreneurship education in higher education by empirically studying students who did and did not pursue venturing throughout their education. While the learning by students who pursue venturing is in line with previous research, the present paper reveals how students who choose to exit their new ventures learn based on

their community of practice and how the social milieu and culture in that community impact their learning.

Students' learning and social milieu and culture are interlinked and configured differently for those who have terminated their ventures during the programme, compared with those still working on their ventures. This indicates that students without ventures shift their learning toward a model that builds on the community of practice within the entrepreneurship-education programme. Students without ventures in particular utilise the context to explore opportunities (not necessarily in terms of venturing ideas), which is a facilitator for their personal development and motivation in the programme. This might be a result of their prior work with opportunities in general and in new ventures, and as such, is imparted in their identity, building from their 'stock of knowledge'. Therefore, the existence of such a community enables a learning process with elements similar to those found in entrepreneurial learning for students without ventures. However, this learning is dependent on at least some students continuing to pursue venture creation in the programme, in addition to being in a strong community.

This means that students' learning in action-based entrepreneurship education should be understood as being influenced not only by students' own venturing, but also by other students' venturing activities. The present paper demonstrates empirically what previous conceptual contributions (Karataş-Özkan, 2011; Pittaway et al., 2017; Pittaway and Cope, 2007; Politis, 2005) have suggested: that researchers should view situated and social learning as an integral element in how students learn from venture creation. For practice, the present paper's findings imply that entrepreneurship-education programmes, in which students learn through venture creation, should be organised in a way that makes students establish relationships and interact with each other on a regular basis.

The research design applied in the present paper involved an inductive investigation that elicited students' thoughts and feelings about their entrepreneurship-education programme. Therefore, the results offered an understanding of students' learning process, as well as a broad spectrum of topics related to the programme. The analysis, guided by the frame of reference, showed that much of the insights gained could be understood through common conceptions of entrepreneurial learning. However, interesting results

emerged as the open and inductive approach in the research design enabled insight into the programme's social milieu and culture. This insight could have been impeded if a 'narrower' research focus had been applied in the empirical part of the study. Although the present paper examines only one specific education programme, it offers new understanding in terms of the learning impact from venture creation in higher education. The authors encourage similar studies of other programmes in other contexts.

Based on the importance of social milieu and culture in the learning process, the authors also suggest that future studies on action-based entrepreneurship education focus on these aspects to better understand the factors that influence students' learning beyond entrepreneurial action, experience and reflection. Furthermore, although the current paper provides insights into how the learning process may differ depending on the existence of a student venture, the question could be reversed, asking how the students and their choices may influence the programme itself.

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Research Paper 4:

Career Characteristics of Entrepreneurship Education Graduates

Torgeir Aadland and Dag Håkon Haneberg

Status: working paper

Career Characteristics of Entrepreneurship Education Graduates

Introduction

Entrepreneurship education has extensively evolved in terms of number of educations and educational disciplines where it has become included in the curricula (Aadland and Aaboen, 2018; Katz, 2003; Kuratko, 2005; Samwel Mwasalwiba, 2010). Entrepreneurship education is often referred to as a source for future economic growth (Henry, 2013; Hoppe, 2016), where innovative individuals (Beiler, 2015; Täks et al., 2014) and new venture creation (Åstebro et al., 2012; McMullan and Long, 1987) are two expected outcomes. Following the increase in programmes and courses, and thereby increase in resources allocated to entrepreneurship education (Fayolle et al., 2006), calls for assessment has been made. Different types of assessment studies have been conducted (Duval-Couetil, 2013; Fayolle et al., 2006; Rideout and Gray, 2013), although with varying results.

Previous research addressing outcomes from entrepreneurship education has measured for instance students' entrepreneurial intentions (Fayolle and Gailly, 2015; Nabi et al., 2010; Rauch and Hulsink, 2015), self-efficacy (Chen et al., 1998; Kubberød and Pettersen, 2017) and students' motivations and inclinations to pursue an entrepreneurial career as such (Menzies and Paradi, 2003; Oosterbeek et al., 2010). In general, results for the effect of entrepreneurship education from this large body of studies are ambiguous (Liñán and Fayolle, 2015; Piperopoulos and Dimov, 2015), which may be accounted to using pre-graduation or time-of-graduation data (Elert et al., 2015). Using pre-graduation or time-of-graduation data disregards the fact that a majority of the individuals who decide to pursue entrepreneurship do so later in their careers (Burton et al., 2016; Marshall and Gigliotti, 2018), and also that the connection between intention and action is still under-researched (Meoli, 2018). A different body of research has to some degree addressed the last issue through using firm-focused entrepreneurial measures such as the number of students starting new ventures post-graduation (Åstebro et al., 2012; Roberts and Eesley, 2011), including econometric measures such as survival and performance of these ventures (Elert et al., 2015). While these studies show that a significant number of graduates do pursue entrepreneurship and pinpoints the survival and economic performance of the graduates' ventures, they do not provide details about the different

activities graduates as individuals may undertake over time. Moreover, while calls have been made for more research on entrepreneurship education graduates' careers (Pittaway and Cope, 2007), few studies have answered. Therefore, the purpose of this paper is to investigate the entrepreneurial *careers* of graduates from an entrepreneurship education, and as such explore the effect of entrepreneurship education programmes.

Different people decide to be entrepreneurs at different stages in life for different reasons (Burton et al., 2016; Hurley-Hanson et al., 2013; Katz, 1994) and the present paper applies a theoretical frame of reference based on entrepreneurial careers to focus on how the graduates from entrepreneurship education as individuals pursue entrepreneurship rather than how their entrepreneurial ventures perform. Dyer (1994) suggests performing longitudinal studies to understand how entrepreneurial careers develop over time, and the present paper uses panel data from individuals that graduated from an entrepreneurship education program over a twelve-year period. The unique dataset contains information about all the work positions, including entrepreneurial ventures, which graduates from an entrepreneurship education programme have had during their career. Scholars have also repeatedly suggested that studies should include a control group (c.f. Martin et al., 2013; Rauch and Hulsink, 2015), and the present paper uses a research design that involves an appropriate control group while also to some degree resolving the self-selection problem common to studies of entrepreneurship education (c.f. Piperopoulos and Dimov, 2015).

The rich empirical data and the robust quantitative design offers the opportunity to characterise the careers of graduates, and compared to previous studies, the present paper provides a more fine-grained understanding of individual-level outcomes of entrepreneurship education. The results both support and contrast existing beliefs and demonstrate how early careers of entrepreneurship education graduates compare to early careers of similar individuals that did not receive entrepreneurship education. Thus, by using an objective measure on the graduates' careers, the paper contributes to the assessment literature through demonstrating the effect of an entrepreneurship education on individuals' entrepreneurial venturing. It further contributes to entrepreneurship literature by investigating entrepreneurial careers and individuals' activity and motivation for new venture activities.

The rest of the paper is structured as follows. The next section introduces entrepreneurial careers as a way to understand post-graduation outcomes from entrepreneurship education, and we there develop our hypotheses. The third section introduces the method with sample and analytical models. Thereafter the results are presented, before they are discussed and concluded.

Theoretical Framing & Hypotheses

Early career research was dominated by an inter-organizational view which assumed that individual career development were bounded by the career opportunities the organisation offered, following a linear process of development (Arthur, 1994; Rae, 2005; Super et al., 1957). Developments in linear career models include Schein's (1978) 'career anchors' as a way to understand individuals' career preferences when advancing step-by-step within an organisation. Later research continued the focus on individuals' preferences through for example arguing that careers should – and even must – be directed by individuals and not organisations (Arthur, 2008; Sullivan, 1999). Also, scholars argued that the linear career models are unable to describe individuals that choose to pursue alternative career paths such as entrepreneurship, which may rather be characterised as non-linear and dynamic (Rae, 2005). Entrepreneurial careers are more often defined as careers of individuals which have multiple new ventures or failures (Hurley-Hanson et al., 2013), and a number of new career models emerged in order to explain why some individuals pursue entrepreneurship rather than a more 'traditional' career.

Entrepreneurship as a Career Decision: Boundaryless and Kaleidoscope Careers

The amount of research that has addressed entrepreneurial careers specifically has been rather limited (Burton et al., 2016; Feldman and Bolino, 2000; Hurley-Hanson et al., 2013). However, during the last two decades, a significant body of relevant research apply 'boundaryless' and 'kaleidoscope' career models to understand career decisions (Costa et al., 2016).

A boundaryless career involves job opportunities that spans across different employment settings (Defillipppi and Arthur, 1994), and where it is the individuals' competencies and knowledge developed through experience that defines further career opportunities (Bird, 1994; Heilmann, 2011). In terms of entrepreneurship, the concept of boundaryless careers

resembles how prior entrepreneurial experience defines if and how entrepreneurial opportunities are pursued (c.f. Politis, 2008), and previous research has also shown that confidence and competence from corporate work is useful for a later entrepreneurial career (Sullivan et al., 2007). Furthermore, scholars have argued that careers are not either bounded or boundaryless, but a co-existence of the two guided by for example the individuals' developing identities and values (Rodrigues et al., 2016; Sommerlund and Boutaiba, 2007). A career view that encompasses personal identity and values is the kaleidoscope career model (Arthur, 2008; Mainiero and Sullivan, 2005).

The kaleidoscope as an optical instrument is used an analogy for how three career decision parameters; 'authenticity', 'balance' and 'challenge', influence career decisions (Mainiero and Sullivan, 2005). During a career, the individual will base career decisions on the relative importance of needs for authenticity – aligning behaviour and attitudes with personal values; balance – equilibrium between work and non-work aspects such as personal relationships and family roles; and challenge – advancement possibilities and stimulating work (Sullivan et al., 2007). The concept of kaleidoscope careers is in particular used for understanding careers of women, including why women may 'opt' into entrepreneurship sometime in their career (August, 2011), where entrepreneurship has been shown to be an opportunity for the individual to create a work environment that reflect their personal needs (Sullivan and Mainiero, 2008). While the need for challenge has often been viewed as a driver for entering into entrepreneurship, previous research has shown an increased need for authenticity and balance for later generations when entering into entrepreneurship (Meoli, 2018; Sherry et al., 2009).

Boundaryless and kaleidoscope careers bear many similarities in terms of acknowledging the individual control of career development (Heilmann, 2011), while they differ in which factors that influence decisions. Boundaryless careers regard 'external' influences on career decisions such as an entrepreneurial opportunity or being dismissed, while kaleidoscope careers rather focus on internal influences such as values, family and aspiration. Thereby, a boundaryless career may be argued to build on previous knowledge and competence depicting a kind of incremental career development, while a kaleidoscope career instead involve individuals that decide to enter into entrepreneurship due to personal motives, which in particular has been demonstrated for female

238

entrepreneurs (c.f. Mainiero and Sullivan, 2005). The present paper takes both career models into account and thus builds on prior developments in the research field by acknowledging that individuals take career decisions based on external and internal needs or forces (Costa et al., 2016).

Entrepreneurial Outcomes as a Result of Context, Experience and Motivations

Entrepreneurship is commonly referred to as pursuing entrepreneurial opportunities (Venkataraman and Shane, 2000; Vogel, 2017), which – with reference to the text above – the individual may choose based on external or internal factors. However, there may also be more negative reasons why individuals decide to pursue entrepreneurship and entrepreneurship may not be the preferred career option (Baruch and Vardi, 2016; Thébaud, 2016). Following a development towards reduced job stability and predictability, alternative paths such as entrepreneurship has increasingly been considered an option for individuals facing challenges such as redundancy and unemployment (Kirkwood, 2009). Such events may arise due to economic downturns and the introduction of new technologies (Arthur, 2008) and represent contextual factors that may influence entrepreneurship. Also, individuals entering into entrepreneurship during their careers are found to have a reduced conception of risk and being overconfident when evaluating the implications of entrepreneurial failure or exit (Baruch and Vardi, 2016; Marshall, 2016), and may thus want to go back into corporate employment.

Scholars have often divided between pull factors, such as a desire for independence and opportunities for monetary benefits, and push factors, such as redundancy, unemployment and challenges balancing work and family obligations, as influencing for why individuals enter into entrepreneurship (Kirkwood, 2009). The push vs. pull terminology is further described as 'necessity entrepreneurship (push) or opportunity entrepreneurship (pull)' (Nabi et al., 2015, p. 483). The motives for entering into entrepreneurship has been found important for the entrepreneurial success (Hytti, 2010), and is thus an important factor when studying entrepreneurial outcomes. The present paper builds on prior research through treating the *context* (e.g. entrepreneurial opportunities, job insecurity), *experience* (competence and knowledge previously developed through an entrepreneurial and/or corporate career) and *motivations* (pull or push factors influencing the

entrepreneurial motivations) as important for <u>why</u> individuals decide to pursue entrepreneurship in their careers.

Dyer (1994) developed a theory of entrepreneurial career by building on previous career theory and suggests that researchers may take both a 'subjectivist' and an 'objectivist' approach to understand entrepreneurial careers. In order to discuss the career decisions of graduates from entrepreneurship education the present paper first address <u>what</u> graduates do in terms of entrepreneurship and employment during their careers ('objectivist'), and then use this to discuss <u>why</u> they may do so ('subjectivist'). Therefore, the next sub-section introduces an 'objectivist' framework to characterise entrepreneurial careers through a longitudinal study.

Characterising Entrepreneurial Careers

Katz (1994) developed suggestions for how to analyse entrepreneurial careers using six variables, three of which he based on Schein's Career Anchor Theory (Schein, 1978). These suggestions imply an 'objectivist' approach studying a set of variables characterising entrepreneurs' career trajectories. Katz (1994) started off with the career variables provided by Schein (Schein, 1978), being *Hierarchy*, which is where the individual is in the organizational hierarchy, *Function* which is the type of tasks and responsibilities the individual has in the organisation, and *Centrality* which means how close the individual is to the core activities of the organisation. As these variables were developed on the early conception of established organisations which were defining individuals' careers, Katz (1994) elaborate on Schein's (1978) categorisation of career anchors in order to provide a conceptualisation better suited for individuals deciding to enter self-employment and entrepreneurship. Therefore, the three anchors developed by Katz (1994) is chosen for the present paper.

The extended model of career anchors for entrepreneurial careers introduced the three variables: *Multiplicity*, meaning working on multiple projects simultaneously; *Duration*, meaning the period entrepreneurs are working with each project; and *Emergence*, meaning that individuals enter entrepreneurship to pursue opportunities. Katz (1994) describe these variables for self-employed individuals and entrepreneurs as presented in Table 1.

	Autonomy (self-employed)	**Entrepreneurship**
Multiplicity	**Less** likely to pursue **multiple projects**. Individual usually owns firms serially.	**More** likely to pursue **multiple projects**. Individual usually owns multiple firms simultaneously.
Duration	Individuals are within self-owned firm(s) for a **longer duration**.	Individuals are within self-owned firm(s) for a **shorter duration**, or until multiplicity occurs.
Emergence	**Less** likely to first and foremost consider **market pressures or opportunities for wealth** in the decision to start a firm.	**More** likely to first and foremost consider **market pressures or opportunities for wealth** in the decision to start a firm.

Multiplicity

Multiplicity is by Katz (1994) referred to working in multiple jobs simultaneously, and in the case of entrepreneurial activity it represents the extreme case of entrepreneurship-anchored individuals. 'Multiplicit' entrepreneurs are also referred to as a 'habitual entrepreneurs', defined as an individual that have '… established, inherited and/or purchased more than one business' (Ucbasaran et al., 2003, p. 207). 'Habitual entrepreneurs' is further used on 'serial entrepreneurs' and 'parallel entrepreneurs' (Alsos and Kolvereid, 1998), indicating whether an individual entrepreneur is involved in self-employed positions and/or owns new ventures serially or in parallel, respectively (Westhead et al., 2005). Multiplicity is in this paper defined as parallel entrepreneurship activity, similar to what is termed 'portfolio entrepreneurship' in prior research (Carter and Ram, 2003), and has been found as a way individuals ensure increased growth of their entrepreneurial activity and also offers a way of risk reduction. Portfolio entrepreneurs are found to be more likely to pursue demonstrate a higher level of entrepreneurial activity (Westhead et al., 2005), and Alsos and Kolvereid (1998) found that parallel entrepreneurs outperform other entrepreneurs. This fact is interesting given the research focus on entrepreneurial outcomes of the present paper.

A term related to portfolio entrepreneurs which also closely resembles Katz' definition of multiplicity is 'hybrid entrepreneurs' (c.f. Folta et al., 2010), combining self-employment with paid employment in order to for example reduce risk in the entrepreneurial process or gain flexible working hours. Although being two different terms, hybrid entrepreneurs can, within the frames of the present paper, be said to be multiplicit. Thus, a multiplicit individual can be termed a hybrid entrepreneur. Moreover, young individuals entering into entrepreneurship have been found likely to experience a

portfolio career where they combine paid-employment and self-employment (Henderson and Robertson, 1999), relating to recent changes in the work environment as mentioned in sub-section 2.2. In some entrepreneurship education, for instance those with action-based designs, students might have entrepreneurial activities simultaneously as they are conducting academic activities (see e.g., Ollila and Williams-Middleton, 2011; Rasmussen and Sørheim, 2006), which could be compared to a portfolio work-life. Therefore, building on this and the assumption that graduates from entrepreneurship education are more entrepreneurial and may therefore be characterised by the entrepreneurship career anchor, the following hypothesis is stated:

Hypothesis 1: Graduates from action-based entrepreneurship education show a higher level of entrepreneurial multiplicity compared to graduates from higher education that applied for, but did not get enrolled in, the action-based entrepreneurship education.

Duration

Duration is by Katz (1994) defined as the time an individual is self-employed, and for an entrepreneurial-anchored individual it is expected that she or he has shorter durations in different positions compared to autonomy-anchored individuals. Katz (1994) argues that experiences or failure both will influence the career trajectory, and that these reasons stand central in an entrepreneurial career. This is aligned with DeTienne's (2010) view on entrepreneurial exits, where exits in the early stages often are connected to alternative, calculative, or normative 'forces'. These forces are explained as other (better) opportunities or activities, evaluation of the chances and the current situation, and the influence of family and friends, respectively. Moreover, in regard to the opportunities do Ronstadt (1988) explain the exploration of new and other opportunities through the corridor principle, where going into business in the first place will reveal further entrepreneurial opportunities that the entrepreneur thus discovers. Further, Politis (2008) and Politis and Gabrielsson (2009) show that entrepreneurs with prior entrepreneurial experience have more positive attitude towards failure, and as such might end their work in new ventures at a higher pace when estimates and probability is not in the entrepreneur's favour. Hence will a first activity and involvement in a new venture increase the possibility for shorter but continuous entrepreneurial activities, which is an argument for individuals anchoring in the entrepreneurial sphere (Schein, 1978).

Regarding the performance of new ventures, Politis (2008) concludes that entrepreneurial experience could improve venture performance or chances of survival. Parker (2013) later illustrated that the performance by an entrepreneur in one venture influenced the performance in subsequent ventures, but that the effects diminished over time. Moreover, Plehn-Dujowich (2010) propose in his work on serial entrepreneurs that the more skilled the entrepreneur, the more frequent he or she will start and close firms until a profitable business occurs, while the less skilled entrepreneurs will close their venture, and enter into paid employment. However, in light of survival rates, there are no conclusive results supporting serial entrepreneurship as an influencing factor. Nevertheless, some studies find that the venture success rate increases with prior experience as an owner (Headd, 2003).

Based on the above, it is expected that graduates with an entrepreneurial education which includes experiences with starting up a firm, such as action-based entrepreneurship education, will be more frequently involved in new ventures, and compared to those without such an entrepreneurial career have shorter duration in their post-graduation entrepreneurial ventures. Hence, the following hypothesis is stated:

Hypothesis 2: Graduates from action-based entrepreneurship education are working for a shorter time in each entrepreneurial occupation compared to graduates from higher education that applied for, but did not get enrolled in, the action-based entrepreneurship education.

Emergence

The last variable Katz (1994) introduce in his model is emergence. Intentionality, resources, boundary and exchange influence this variable, and the properties of these are further described by Katz and Gartner (1988). For a self-employed individual, all these properties influence emergence, but the autonomous-anchored individual will be most influenced by the intentionality and boundary properties, while resources or exchange properties will influence an entrepreneurial-anchored individual. In terms of the latter, Katz (1994) states that pull factors such as opportunity-recognition and wealth-creation are central reasons for entering into entrepreneurship. Regarding the financial objective, Nabi et al. (2015) found that wealth creation was only a reason for entrepreneurship if the

previous job did not have sufficient salary level or was not prestigious enough. Thus, this implied a push into entrepreneurship, rather than a pull, illustrating a form of external motivation to become an entrepreneur.

Regarding opportunities, it has been proposed that prior knowledge influence the recognition of new opportunities (Ardichvili et al., 2003), and several later studies have identified a connection between opportunity recognition and prior knowledge, like customer knowledge (Shepherd and DeTienne, 2005), technological knowledge (Siegel and Renko, 2012), and prior entrepreneurial knowledge (Fuentes et al., 2010). Thus, having an experience with entrepreneurship will influence an individual to explore more and diverse opportunities. Moreover, having an aim at wealth creation and a higher chance to recognise opportunities will be aligned with an emergence for entrepreneurial activities. That is, an external motivation for change (wealth creation) and an internal initiation of the change (opportunity recognition). The third hypothesis is therefore as follows:

> *Hypothesis 3:* Graduates from action-based entrepreneurship education show higher levels of entrepreneurial emergence compared to graduates from higher education that applied for, but did not get enrolled in, the action-based entrepreneurship education.

The next section introduces the methods used to test the hypotheses. Then, the following section discussed the results in light of the theoretical frame of reference about entrepreneurial careers.

Method

Sample and Context

To test the hypotheses, the authors collected information about students that had applied for a venture creation programme. A venture creation programme uses new ventures actively in the education (Lackeus and Middleton, 2015), and the students need to try to start their own venture during the two-year, 120 ECST entrepreneurship programme. The design of the programme is that the students work with feasibility studies and market assessment the first semester, and actively business planning in their second semester, where most of the courses in the programme are connected to the new venture's activities.

The last two semesters, the students work on developing their concepts and ventures. Hence, where the first semester is about testing many different business ideas and opportunities during the semester, the rest of the programme focus on (normally) one new venture at a time, based on the tested ideas in the first semester. The students also have their own incubator at the university campus, which holds all of the 70 students in the programme (35 in each cohort). Some of the students fail their new venture during the education and enter into payed employment at graduation. Others fail once but start again and end up in their own venture upon graduation, while some also work in their new venture throughout the three last semesters and start in their own new venture when graduating. On average do fifty percent of the programme's students continue in their own venture when graduating.

Thus, this study's sample are students that applied, and were interviewed for, a venture creation programme. These students had written a letter of motivation prior to the interview, and as such, all the students in the population are expected to have a high motivational level for entering the programme. As only some were selected (approximately 50 percent of the population) to the programme and some were not, this allows for estimating the average treatment effect with a 'treatment group' (those that were selected after the interview) and a 'control group' (those that were not selected after the interview) (c.f. Wooldridge, 2010). The information about the former applicants was collected during the summer of 2018, and to ensure that the subjects had some work experience, students that graduated in 2017 and earlier were included in the study, thus only including the applicants in the years 2003 (programme's first year) until 2015. The information about the applicants were collected from multiple sources. The university's archive provided the authors with contact information about all applicants in the mentioned period. A total of 2345 former applicants was identified, and of these, 536 had attended an interview for enrolment in the programme and as such being this study's population. In the population of 536, a total of 260 were later enrolled in the programme. The entire career history was collected for the 536 interviewed individuals by using LinkedIn and proff.no (a Norwegian open access web site with information about individuals' positions in boards and as CEOs) and entered into a database. The individuals were then telephone interviewed to confirm their career history and to add additional

information about the different business or organisational relationships. While being phone interviewed, the former students were also asked to participate in a survey[1] about their post-graduation activities. Of the 536 former applicants in the interviewed population, 44 were removed as they missed central information, did not wish to participate, were deceased, or of other reasons were erroneously included in the database. In the remaining sample, 178 were both telephone interviewed and finalised the survey about their careers (108 programme alumni; 70 non-programme alumni), and thus the sample used for analysis.

For the two groups (phone interview and survey response, vs. not included in study), Chi-squared tests on the variables 'programme alumni', 'gender', and 'educational background' were conducted, in addition to t-tests on 'age at application', 'years since graduation', and 'last year applying for the programme'. These tests show that there was a significant difference in terms of programme alumni or not, where more programme alumni participated ($\chi^2 = 16.57$, $p < 0.05$), and a significant difference on age at application, where participants with lower age at application participated (t(485) = 2.24, $p < 0.05$). With these results, a t-test on the current age among the participants was also performed, which showed no significant differences (t(485) = 1.62, $p > 0.05$), a result which could imply that younger students are enrolled in the programme. As there was a difference on programme alumni and not programme alumni that participated in the study, tests on the samples used in the different models were conducted. For the sample used in the duration model, no significant difference were found for the enrolled vs. not-enrolled groups, while the sample in the multiplicity and emergence models had differences between the groups in terms of year since graduation (t(176) = -2.09, $p < 0.05$), last application year (t(176) = 2.32, $p < 0.05$) (however not surprising since these almost perfectly correlate), and grades above average ($\chi^2 = 0.0067$, $p < 0.05$). Thus, it appears that alumni from the programme report their grades as better than the control group. The difference on 'years since application' between enrolled alumni and not enrolled alumni could be explained with the increase in popularity of the programme. In the early years of the programme a larger proportion of the applicants were enrolled

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[1] The survey data was also entered into and a part of the entrepreneurship programme alumni survey (EPAS) database where survey-collections from alumni from VCPs at Chalmers University, Lund University and the Norwegian University of Science and Technology are collected.

compared to the later years. To test if the results hold for groups with no difference on the mentioned control variables, early cohorts were removed from the sample until no difference occurred (individuals with last application year < 2012 were removed), and the results for multiplicity had only minor changes in the results and significance levels.

Measures

Multiplicity

Multiplicity is as formerly defined as the number of activities, in addition to her main occupation, than an individual has in new ventures. To measure multiplicity, we adopt the definition by Folta et al. (2010, p. 257) on hybrid entrepreneurs:

> *'(1) their primary classification is "employed," (2) they have a secondary classification (the number of secondary classifications is unlimited) where they are "self-employed" or "self-employed in incorporation" or report self-employment losses, and (3) they are "employed" in the same firm as they were in the prior year.'*

While Folta et al. (2010) define hybrid entrepreneurs as a nominal construct, multiplicity is on the other hand defined as a ratio, and the second point in their definition is here replaced with the number of new ventures, and multiplicity is thus the number of additional initiatives (at the same time the individual is employed) in new ventures each year. The measure was derived from adding the main employment and initiatives in new ventures for all individuals for each year, which was gathered from the database consisting of confirmed career trajectories from the telephone interviews. However, as this study involves panel data with varying years since graduation among the individuals, this measure was averaged over the number of years the individual had of work experience, i.e. the number of years since graduation. An individual that worked in her new venture at the same time she had a payed employment over two years, would then have an average multiplicity of one. On the other hand, another individual that worked in a new venture while also having payed employment for one year, but not the next, would have an average multiplicity of one half over the two years. A limitation of this measure is that multiplicity is averaged over all years since graduation so differences in multiplicity between career phases are more difficult to pinpoint, suggesting that further research should bring the time dimension more into the equation in the analysis.

Duration

Duration is defined as the average number of years an individual worked in a new venture. As working in a new venture could imply to be employed, work on the individual's spare time, or be part of the board of directors, which could be an active and important service role in a new venture (Knockaert et al., 2015), the interval of the involvement is measured at an yearly basis. While prior research has used months as the measure of their dependent variable, these have often focused on self-employment as the main (and only) occupation, which would be an important change in someone's life if the main occupation changed, and as such would be easy to remember. However, as the present paper applies a broader definition of working in new ventures, and since some of the activities happened several years ago, duration in new ventures is measured over years as this would be a better measure for e.g. gliding transitions from idea to employment in own new venture. The total duration in new ventures were collected from the database on each individual's (Millán et al., 2012; Praag, 2003a; Taylor, 1999), and averaged over the number of new ventures that the individual was involved in to cope with the panel data design in the database.

The measure only investigates those individuals with new venture work, and thus, for this measure, individuals without duration in a new venture was excluded from the sample. This left 80 individuals in the sample, however, as mentioned, no difference between those being enrolled in the programme and not in terms of the applied variables was identified. In addition, as the students in the programme have to start their own venture, they had to work in this new venture for an additional year after graduation for this to be included in the calculations. Thus, as many of those who continue in their own new venture upon graduation have ended their efforts one year after graduation, the first year is not included as this could be seen as 'mandatory' among some of the students.

Emergence

Emergence is here defined as having an external motivation for change (wealth creation) and an internal initiation of the change (opportunity recognition) when entering into entrepreneurship. To be able to measure this, data collected from the telephone interviews were used as the individual respondents were asked whether they entered into their new

venture because of an external or inner motivation, and if it was initiated by themselves or by external factors, as defined by Katz (1994). This way of collecting this information is similar to van Praag's (2003) work on sucsess of young small business owners and their reason for the termination of their self-employment, where she uses a binary measure for voluntary versus compulsory termination. Thus, this measure consists of two binary variables. However, to have emergence into a new activity, both the mentioned variables need to be present (external motivation and internal initiation) to represent emergence into a new venture. This is then averaged over the number of new ventures the individual has engaged in.

Control Variables

The models applied controlled for gender, age at application, years since graduation, and the last year the individual applied for the programme, which were all derived from the university's database and confirmed through the telephone interviews. Furthermore, from the collected survey data, variables about the individual's grades (self-reported level), whether they have entrepreneurs in their family, the educational level of their parents/guardians, and the individual's educational background were collected and included in the models. The three former variables from this database were coded as dummy variables, with grades above average being a binary measure, parents' educational level (which means if at least one of them had higher education) also a binary measure. The individual's educational background was divided into three categories; 'business education', 'STEM' and 'social sciences'.

Analysis

A problem with the assessment of entrepreneurship education is the fact that an individual's outcomes are forever unknown if the treatment did not occur, and the same applies for those that do receive the treatment – one cannot hold both a treated and untreated state. Another problem is the mentioned issue with self-selection into entrepreneurship education, but also the issue with the selection to be treated if the programme holds a limit in number of students. Both problems with unknown outcomes and programme selection are important issues for policy makers in assessment studies, but also for other stakeholders, however, with the potential of being handled with the

right equation models (Cattaneo, 2010). The potential-outcome model is a method that handles these issues, and especially the missing data problem (Rubin, 1974; Heckman, 1997; Imbens, 2004; Imbens and Wooldridge, 2009), but could also be applied to handle the treatment selection, e.g. through 'Wooldridge's double-robust' estimators (Wooldridge, 2007).

The potential-outcome models are individual-level models that estimate the potential outcome among individuals that have received different treatments. These models also handle the treatment assignment process, which could be of importance in an educational situation. To test our hypotheses we applied 'Wooldridge's double-robust' estimator (Wooldridge, 2007), or an inverse-probability-weighted regression-adjustment (IPWRA) estimator. The data process and analysis were conducted in STAT/MP 15.1 using the *teffects ipwra* function (StataCorp LLC, 2017a). The multiplicity and emergence variable were assumed to have nonnegative or Poisson distributions, while the duration was assumed to be linear, and this was specified in the functions. The EE (entrepreneurship education) alumnum vs non-EE alumnum was specified as binary and applied the Probit model in the treatment equation.

One important assumption with the applied model is that the outcomes are independent of other outcomes, that is, the students are not influenced by other students. However, as the different classes often have students that collaborate with others, this assumption is violated. The students in the different classes might also have different teachers, guest lecturers or mentors, although the program's content has been unchanged. In addition, national shocks might influence the outcomes for different cohorts. Thus, the observations in the different classes could not be assumed to be independent, and as such might influence the results to a high degree (c.f. Angrist and Pischke, 2008). To handle this, Angrist and Pischke's (2008) recommendation to cluster the variance-covariance matrix on the different classes is followed, which will allow for intragroup correlation, but still holding a robust estimate of variance within the different groups (c.f. StataCorp LLC, 2017b, section 20.22).

Results

The descriptive statistics and correlation of the different variables for the sample for Multiplicity and Emergence are presented in Table 2, while Table 3 presents the same but for the sample for Duration. Since the results from testing the hypotheses contrasted the theoretical frame of reference, the variable duration was included in Table 2 and the variable multiplicity in Table 3 in order to illustrate the correlation between the two. The implications of the positive correlation found between the two are discussed in section 5. To test the first hypothesis on multiplicity among prior applicants, the IPWRA model was applied on multiplicity with the outcome model based on gender, age at application, year since graduation, grades above average and entrepreneurs in family. For the treatment model, the variables gender, age at application, entrepreneurs in family, last year applying for the programme, if parents have higher education, and the alumnum's educational background were included. The same variables were also applied for the models on duration and emergence.

Table 2 - Descriptive Statistics and Correlation Matrix for Multiplicity and Emergence Sample

	Mean	SD	1	2	3	4	5	6	7	8	9	10
1 Gender	0.275	0.448	1.000									
2 Age at Application	24.169	1.662	-0.146	1.000								
3 Year Since Graduation	4.719	3.229	-0.213**	0.003	1.000							
4 Grades above Average	0.348	0.478	-0.028	-0.053	-0.017	1.000						
5 Entrepreneurs in Family	0.618	0.487	-0.007	-0.199**	-0.036	0.017	1.000					
6 Last Year Applying for EE	2011.281	3.307	0.165*	0.105	-0.960**	0.002	0.011	1.000				
7 Parent with Higher Education	0.837	0.370	-0.001	-0.185*	-0.124	0.003	0.029	0.075	1.000			
8 Multiplicity	0.258	0.482	-0.102	0.279**	0.041	-0.040	0.044	-0.028	0.091	1.000		
9 Duration	1.081	1.514	-0.140	0.092	0.140	-0.076	0.019	-0.129	-0.044	0.568**	1.000	
10 Emergence	0.093	0.356	-0.079	0.001	0.097	0.001	-0.111	-0.086	-0.140	0.099	0.097	1.000

** $p<0.01$, * $p<0.05$. Variable '6 Last Year Applying for EE' and '7 Parent with Higher Education' only applied in treatment equation with variables 1, 2 and 5.

Table 3 - Descriptive Statistics and Correlation Matrix for Duration Sample

	Mean	SD	1	2	3	4	5	6	7	8	9
1 Gender	0.238	0.428	1.000								
2 Age at Application	24.463	1.630	-0.123	1.000							
3 Year Since Graduation	4.700	3.320	-0.127	-0.044	1.000						
4 Grades above Average	0.313	0.466	-0.123	0.024	-0.020	1.000					
5 Entrepreneurs in Family	0.625	0.487	0.068	-0.146	0.125	-0.035	1.000				
6 Last Year Applying for EE	2011.375	3.339	0.087	0.045	-0.984**	0.005	-0.107	1.000			
7 Parent with Higher Education	0.813	0.393	-0.033	-0.021	-0.286*	-0.022	-0.041	0.257*	1.000		
8 Multiplicity	0.550	0.591	-0.083	0.363**	0.067	-0.004	0.040	-0.066	0.199	1.000	
9 Duration	2.405	1.382	-0.204	-0.087	0.344**	-0.057	0.022	-0.363**	0.008	0.269*	1.000

** $p<0.01$, * $p<0.05$. Variable '6 Last Year Applying for EE' and '7 Parent with Higher Education' only applied in treatment equation with variables 1, 2 and 5.

Table 4 shows the results from the multiplicity-model. The average treatment effect (ATE), that is the difference between potential-outcome mean for the treated and untreated group, shows that the programme's alumni have a significant higher level of multiplicity (ATE: $\beta = 0.189$, $p < 0.001$). The potential outcome mean shows a multiplicity among the untreated group of $\beta = 0.158$ ($p < 0.01$), which means that the programme alumni on average will have twice as much multiplicity as those that did not attend the programme. Exploring the treatment equations further, none of the other control variables has a significant influence on multiplicity among the untreated group. However, for the treated group, the age at application has a significant and positive influence on multiplicity ($\beta = 0.251$, $p < 0.001$), but grades reported above average has a significant but strong and negative influence on multiplicity ($\beta = -0.482$, $p < 0.001$). Regarding the treatment model equation, none of the variables has any significant influence, illustrating that the enrolment process has limited influence on the outcomes. The first hypothesis is supported.

Table 4 - IPWRA model for multiplicity

MULTIPLICITY	(1) Average Treatment Effect	(2) Potential-Outcome Mean	(3) Outcome Model Equation Untreated	(4) Outcome Model Equation Treated	(5) Treatment Model Equation
EE Alumnum (1 vs 0)	0.189***				
	(0.0485)				
Not EE Alumnum		0.158**			
		(0.0455)			
Gender			-0.653	-0.265	0.170
			(0.889)	(0.165)	(0.293)
Age at Application			0.236	0.251***	0.0448
			(0.202)	(0.0679)	(0.0512)
Year Since Graduation			0.104	-0.0156	
			(0.118)	(0.0476)	
Grades above Average			0.469	-0.482***	
			(0.417)	(0.138)	
Entrepreneurs in Family			0.145	0.547	0.0447
			(0.647)	(0.371)	(0.133)
Last Year Applying for EE					-0.0590
					(0.0500)
Parent with Higher Education					0.246
					(0.227)
2. STEM Background					0.255
					(0.250)
3. Social Science Background					-0.185
					(0.384)
Constant			-8.335	-7.309***	117.3
			(5.381)	(2.073)	(101.1)
Observations	178	178	178	178	178

Robust standard errors in parentheses
*** p<0.001, ** p<0.01, *<0.05

To test for duration, the same model as for multiplicity was applied, but only for the portion of sample that had some duration in a new venture. The results from this model are presented in Table 5. The ATE here are significant and positive ($\beta = 0.507$, $p < 0.01$), illustrating that alumni from the VCP have longer duration in new ventures, compared to those that did not enrol in the programme. The potential-outcome mean for the untreated group is also significant positive, showing that of those involving in a new venture that also applied for the VCP, had on average two years in a new venture ($\beta = 2.056$, $p < 0.001$). This means that those from the VCP had a half year longer in the new ventures on average. Regarding the control variables for the potential-outcome model, the results show that the untreated group's age at application significantly influences duration in new ventures negatively ($\beta = -0.385$, $p < 0.001$), and the same results is found for whether the untreated group have entrepreneurs in their family ($\beta = -1.764$, $p < 0.001$). Years since graduation do influence duration in new venture significantly ($\beta = 0.175$, $p < 0.001$), which is an expected result. For the treated group, none of the control variables have a significant influence on duration in new ventures. Regarding the treatment model equation, none of the variables influence significantly. The second hypothesis is rejected.

Table 5 - IPWRA model for duration

DURATION	(1) Average Treatment Effect	(2) Potential-Outcome Mean	(3) Outcome Model Equation Untreated	(4) Outcome Model Equation Treated	(5) Treatment Model Equation
EE Alumnum (1 vs 0)	0.507**				
	(0.178)				
Not EE Alumnum		2.056***			
		(0.264)			
Gender			-0.359	-0.607	0.277
			(0.259)	(0.365)	(0.330)
Age at Application			-0.385***	-0.0286	-0.0307
			(0.105)	(0.101)	(0.102)
Year Since Graduation			0.175***	0.147	
			(0.0123)	(0.0802)	
Grades above Average			0.276	-0.350	
			(0.259)	(0.249)	
Entrepreneurs in Family			-1.764***	0.217	-0.152
			(0.494)	(0.334)	(0.230)
Last Year Applying for EE					-0.0356
					(0.0548)
Parent with Higher Education					0.0409
					(0.402)
2. STEM Background					-0.0717
					(0.271)
3. Social Science Background					-0.0670
					(0.572)
Constant			11.75***	2.691	73.32
			(3.138)	(2.575)	(111.4)
Observations	80	80	80	80	80

Robust standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05

Our last hypothesis, about the alumni's emergence, we apply the same model on the same sample as for multiplicity. Table 6 show the results from this model. However, for this model, the calculations in STATA did not reach convergence, illustrating that there are too many gaps in the results, which is not surprising, as few individuals reported emergence into new ventures. The model did nevertheless produce results in STATA, which are presented here. The results show that the neither the ATE nor the potential-outcome mean for untreated is significant. Further, the control variables gender and grades above average are significant with negative factor influence for the untreated group (β = -15.57, β = -1.336, p < 0.001). No other variables in the model are significant and given the absent of convergence and no significant level for the untreated potential-outcome mean and average treatment effect, the results on our third hypothesis are inconclusive.

Table 6 - IPWRA model for emergence

EMERGENCE	(1) Average Treatment Effect	(2) Potential-Outcome Mean	(3) Outcome Model Equation Untreated	(4) Outcome Model Equation Treated	(5) Treatment Model Equation
EE Alumnum (1 vs 0)	0.0833 (0.0504)				
Not EE Alumnum		0.0338 (0.0214)			
Gender			-15.57*** (0.897)	-0.490 (1.183)	0.170 (0.293)
Age at Application			0.174 (0.114)	-0.145 (0.212)	0.0448 (0.0512)
Year Since Graduation			0.0134 (0.173)	0.105 (0.105)	
Grades above Average			-1.336*** (0.374)	0.0494 (0.551)	
Entrepreneurs in Family			-0.542 (0.564)	-0.776 (0.539)	0.0447 (0.133)
Last Year Applying for EE					-0.0590 (0.0500)
Parent with Higher Education					0.246 (0.227)
2. STEM Background					0.255 (0.250)
3. Social Science Background					-0.185 (0.384)
Constant			-6.844** (2.140)	1.283 (4.780)	117.3 (101.1)
Observations	178	178	178	178	178

Robust standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05

Discussion

At an overarching level, the results illustrate the diversity of careers that individuals from the same educational background may pursue. Not only do graduates opt in and out

between entrepreneurship and paid employment during their early careers but they do also take on several new ventures and jobs at the same time (Marshall and Gigliotti, 2018). This is in line with dynamic views on how individuals switch occupations during their lives (Arthur, 2008; Dyer, 1994). The results of the present paper thus provide a more fine-grained understanding of entrepreneurship education outcomes than the majority of previous research.

As anticipated from the hypothesis development, the results show how the career characteristics are significantly different between those that were offered entrepreneurship education and those who were not. Using the theoretical frame of reference based on the career anchors developed by Katz (1994), the career characteristics differ in terms of multiplicity and duration. As hypothesised, graduates from entrepreneurship education are more multiplicit, meaning that they combine more than one new venture and/or combine a new venture with paid employment(s). On the other hand, the results reject the second hypothesis through showing that the programme graduates are working in new ventures for a significantly longer time. The results were inconclusive testing the third hypothesis which regarded emergence.

Entrepreneurship Education and Multiplicity

There may be several explanations behind the higher multiplicity found for entrepreneurship education graduates. For instance, the increase in multiplicity might simply be explained by that entrepreneurship education graduates are more often purposefully pursuing a portfolio or hybrid entrepreneurship career, and thus vetting different opportunities in their early career. Such strategies may be communicated and shared between students and faculty within an entrepreneurship education programme. However, there are yet some interesting nuances to be observed based on the control variables. First, age at application (and thus in practice graduation) also influences multiplicity, suggesting that a portfolio strategy to an entrepreneurial career may increase with increasing age for example due to economic and relational obligations. It could further be that multiplicity depends on each individual's expectation for economic income and their prioritisation of for example non-professional relations (Costa et al., 2016; Sullivan et al., 2007). Paid employment is a way to mitigate the economical and future-employment risks for not being able to succeed in reach their expectations. It could also

be that their ventures have actually shown not to be providing sufficient economical income so that it was necessary for the individuals to seek paid employment in addition. However, this is contrasted by the result that duration is longer for entrepreneurship education graduates. A third suggestion is that entrepreneurship education graduates are more aware of their personal needs and find venturing a way to fulfil needs for authenticity and challenge if they also have paid employment. In that case, being multiplicit by combining paid employment and entrepreneurship may provide the "best of two worlds".

Entrepreneurship Education and Duration

Given the three hypotheses, the most surprising result regards duration, as the results reject our hypothesis. The theoretical frame of reference suggests that entrepreneurs more quickly identify if an opportunity is worthwhile to pursue or not, leading to a shorter average duration pursuing an entrepreneurial opportunity. This reasoning may both assume that evaluation of a new venture increased with experience (Politis, 2008), and that entrepreneurial individuals also are exposed to new opportunities when they already are working in another venture and therefore exit their venture to start another (Plehn-Dujowich, 2010). In that case, duration in each venture would be shorter while the duration in entrepreneurship may be longer.

However, the entrepreneurship education graduates show longer duration in each venture. In this paragraph, three areas that may lead to this contrasting result are discussed. First, if combining *experience* and *motivations* (Hytti, 2010; Kirkwood, 2009; Nabi et al., 2015), it could be that entrepreneurship education graduates are more insightful about their endurance, motivation and/or passion for entrepreneurial venturing, based on their experience with entrepreneurship during their education. Thus, of those that do enter entrepreneurship after graduation may take a more well-founded choice based on experience and motivation if they graduated from the entrepreneurship education programme. Second, regarding *experience*, it could also be that the higher duration is due to the training and experience they have already gotten in evaluating several business opportunities during their education (see section 3.2). This could relate to graduates' alternative, calculative, or normative 'forces' (DeTienne, 2010), and that their ventures in general have better foundations than nascent entrepreneurs' new ventures. Hence, that

the graduates with more ease calculate the options before pursuing an opportunity, and due to increased performance stay longer. If that is the case, the educational content also provides some experience guiding their career development. The third possible explanation regards *context*. The entrepreneurship education programme is hosted by a technical university, and the focus in the programme is on high-tech business ideas and opportunities. Therefore, graduates might focus more on high-tech businesses in their careers, compared to those that did not enrol in the programme. High-tech ventures are shown to demand longer development and market verification processes than 'low-tech' ventures (Reymen et al., 2016). Thus, graduates from the programme may stay in their new ventures for a longer time, as the potential technology development requires a lot of hourly resources for the different stages, and as such makes it longer to verify the technology and market potential.

There are also some interesting results from the control variables for duration. The factor of being a female is negative on duration among the graduates. This might be due to females facing greater challenges than males in high-tech new ventures due to lack of networks and financing, and due to their focus on the work-life balance (Xie and Lv, 2018), or that they are more risk averse than males (Eckel and Grossman, 2008; Jianakoplos and Bernasek, 1998; Xu and Ruef, 2004). These factors might therefore make females either fail faster or to avoid high tech new ventures that demand a long development period before being profitable. However, these findings deserve more focus and research to be thoroughly explained.

Conclusions, Implications and Further Research

The aim of this paper was to investigate the effect of an entrepreneurship education programme on its graduates, and as such being a measure of assessment for such programmes. Overall, the paper demonstrates how career characteristics of entrepreneurship education graduates differ in terms of higher multiplicity and longer duration in new ventures. In short, the results thus show that entrepreneurship education do have a significant effect on post-graduation entrepreneurial outcomes from entrepreneurship education on an individual level, and that these outcomes may be characterised by multiplicity and duration. Thus do the present paper contribute by empirically testing assumptions for entrepreneurial careers that have been around for

decades (Katz, 1994). Furthermore is the dataset used for the empirical analysis unique as it contains panel data for the entire post-graduation careers of the individuals involved. Having an individual-level focus, the results demonstrate that the career characteristics of entrepreneurship education graduates significantly differs from the control group - a very similar group of individuals that did not get entrepreneurship education. The present paper shows that entrepreneurship education graduates that pursue entrepreneurship are more multiplicit and that they have longer duration in each new venture they are involved in, illustrating that new ventures are a result from the education, and that these might contribute to economic growth (Henry, 2013; Hoppe, 2016; McMullan and Long, 1987). The results both support and contrast existing beliefs and demonstrate how entrepreneurship education do have an effect on individual-level post-graduation outcomes.

The findings of the present paper have implications for research, educators and policy makers. First, through its novel method, the paper emphasises that career-oriented studies of entrepreneurship education graduates provide. The findings motivate for further research on careers and (re)introducing career research into the conversation in entrepreneurship and entrepreneurship education journals. While the present paper goes deeper into entrepreneurship education outcomes than for example measuring entrepreneurial intentions, there is a potential to go even deeper by researching the specific activities and tasks graduates are performing in their positions during their professional careers. For example, it could be asked whether an entrepreneurship education gradates perform different types of activities and tasks even though he or she has the same overall employment position to graduates of other educational programmes. For educators, this paper shows that students that are encountered with new venture creation in their educational pathway might have more entrepreneurial activity later in their careers, and that an action-based education could germinate entrepreneurial careers. For policy makers, this paper illustrates that entrepreneurship education, and especially a programme that is resource demanding in design, produce expected results in terms of new venture activities.

While the current state of the research field may explain the results to some degree, there is a need for further research along several avenues in order to further develop the research

field, and the limitations of the present paper should also not be neglected which also motivates for further research along the same lines but in other programmes and contexts. Thus, the present paper motivates for six avenues of further research.

First, given the increased multiplicity, it could be an interesting for further research to investigate how two or more positions provide different value (economical, authenticity, etc.) for the individual in line with the kaleidoscope careers research stream (Mainiero and Sullivan, 2005; Sherry et al., 2009). Furthermore, the results show that higher-than-average grades negatively influences multiplicity. Intuitively, this could be explained by that these graduates will get more offers for attractive positions in paid employment which may make entrepreneurship comparatively less interesting. However, it is expected that entrepreneurship education graduates do have an interest or intention for entrepreneurship specifically, and further research should be done in order to clarify why graduates showing better than average academic results may incline towards paid employment over entrepreneurship. While the present paper focus on outcomes from entrepreneurship education on the individual level, it would also be interesting to perform further research in line with firm-oriented studies (Åstebro et al., 2012; Roberts and Eesley, 2011) and investigate if there are any firm-level differences between the groups compared in the present paper. In addition, while there is a range of studies regarding gender and careers (c.f. Hytti, 2010; Kirkwood, 2009; Petridou et al., 2009; Rosa and Dawson, 2006), future research could investigate if the differences found in prior research hold true for graduates from entrepreneurship education given the social milieu, the specific treatment during the programme and so on.

Furthermore, as the present paper addressed multiplicity, duration and emergence in isolation, they may not be independent, in particular within the same graduation year. The results showed positive correlation between multiplicity and duration, which contrasts the theoretical frame of reference. Graduates may encourage, and also perhaps expect, each other to be involved in entrepreneurial activities in a way that is more difficult in the control group, which went into many different MSc. programs and are likely to be unknown of each other. The implications of a social community in an entrepreneurship education programme could be an interesting avenue for further research given the differences revealed by the results of this study.

Finally, this study divides rather strictly between entrepreneurship and 'non-entrepreneurship'. In reality there are career options that may fall in between the two such as 'intrapreneurship' (c.f. Antoncic and Hisrich, 2003; Hisrich, 1990). Programme graduates (and those in the control group) may perform work activities that are similar to those in a new venture; that their job is to be an 'intrapreneur,' pursuing new market or technology opportunities within an established firm. They might thereby enter into jobs which provides them with more opportunities in terms of variation and promotion, and an avenue for future studies could be to investigate the role of intrapreneurship in the careers of entrepreneurship education graduates.

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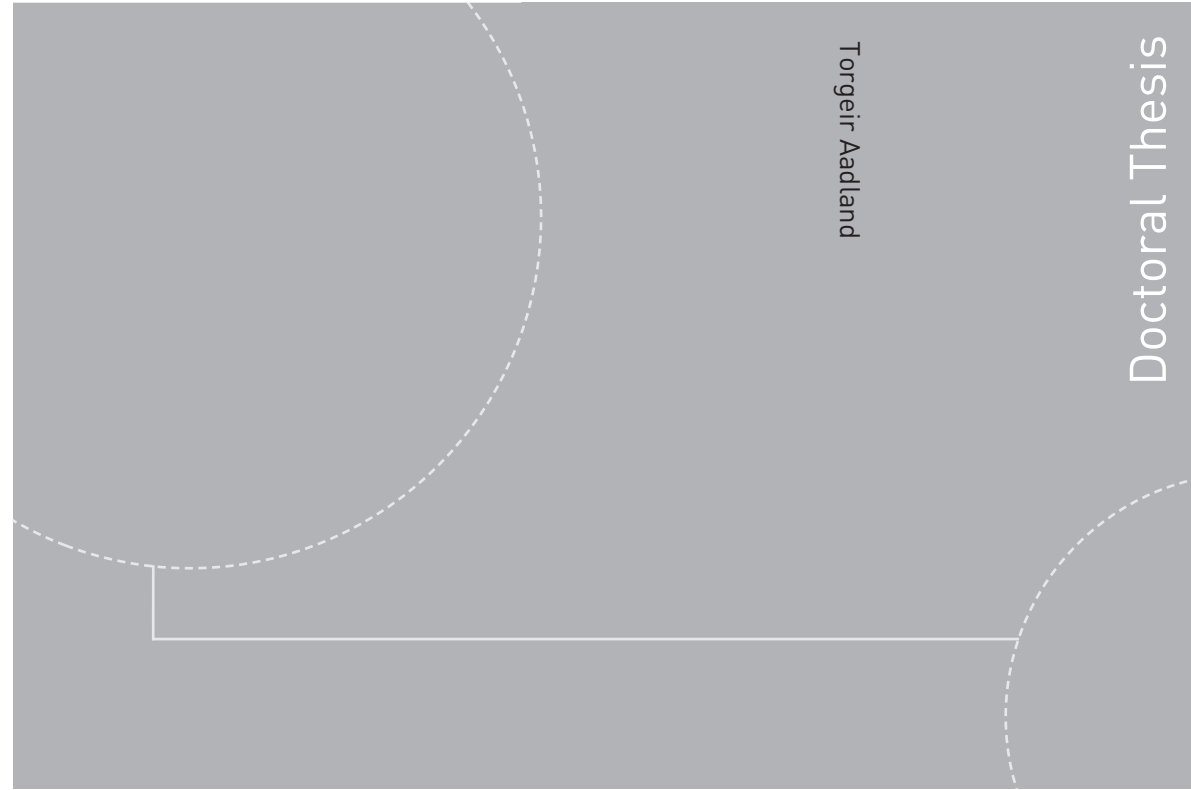
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