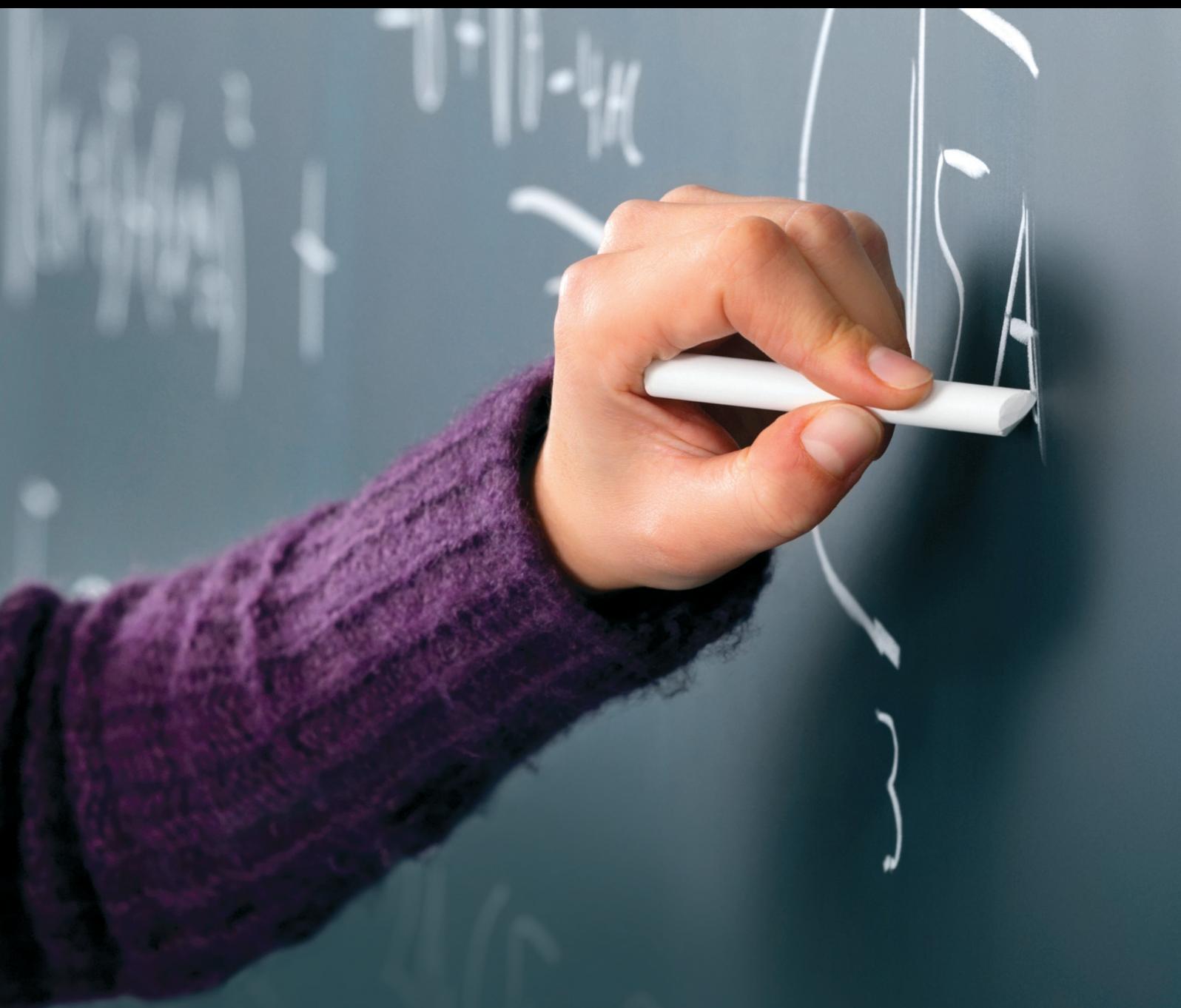


# Entrepreneurship Education with Impact: Opening the Black Box

Lead Guest Editor: Thomas Lans

Guest Editors: Päivi Tynjälä, Harm Biemans, Tiago Ratinho, and Saeid Karimi





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Education Research International

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# Contents

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**Entrepreneurship Education with Impact: Opening the Black Box**

Thomas Lans, Päivi Tynjälä, Harm Biemans, Tiago Ratinho, and Saeid Karimi  
Volume 2017, Article ID 7051795, 2 pages

**Complex Problems in Entrepreneurship Education: Examining Complex Problem-Solving in the Application of Opportunity Identification**

Yvette Baggen, Jakob Mainert, André Kretzschmar, Thomas Lans, Harm J. A. Biemans, Christoph Niepel, and Samuel Greiff  
Volume 2017, Article ID 1768690, 13 pages

**In Search of Alignment: A Review of Impact Studies in Entrepreneurship Education**

Uladzimir Kamovich and Lene Foss  
Volume 2017, Article ID 1450102, 15 pages

**Competence Models as a Tool for Conceptualizing the Systematic Process of Entrepreneurship Competence Development**

Uku Lilleväli and Marge Täks  
Volume 2017, Article ID 5160863, 16 pages

**Cross-Cultural Competences and International Entrepreneurial Intention: A Study on Entrepreneurship Education**

Shuijing Jie and Rainer Harms  
Volume 2017, Article ID 9042132, 12 pages

**Measuring Student Transformation in Entrepreneurship Education Programs**

Steven A. Gedeon  
Volume 2017, Article ID 8475460, 12 pages

## Editorial

# Entrepreneurship Education with Impact: Opening the Black Box

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Entrepreneurship education (EE) has become globally widespread. Governments, universities, and private institutions increasingly deploy resources dedicated to fostering entrepreneurship competencies amongst entrepreneurs as well as in society at large. However, this exponential growth of initiatives did not go hand in hand with a similar development of scholarly research, hence hindering our understanding of the impacts of EE.

Is it nowadays uncontroversial that EE is more than “just” training entrepreneurs to create more start-ups. In addition, the persistent nature-nurture discussion is moving towards a scholarly consensus that, like in any other profession, talent helps, but there is a lot to be learned to be able to engage in entrepreneurial thinking and acting. At the same time, the common message from EE scholars is that a further research is needed to provide a more scientifically grounded approach to EE in terms of contents and intended outcomes. As several of the articles in this special issue conclude, EE practice seems to be ahead of educational studies, both conceptually and empirically. For instance, entrepreneurship educators have widely adopted in the past decades heuristics-based approaches to EE such as Ries’ Lean Start-up Method, Sarasvathy’s effectuation principles, or Osterwalder’s Business Model Canvas. However, educational research further investigating these practices from well-known theoretical lenses like problem-based, project-based, or cooperative learning remains scarce.

This promise of EE as well as the work that still needs to be done presents an opportunity for EE scholars. There

is a risk that EE will eventually wither amidst the capricious world of educational management, if the field fails to elicit, display, and develop its potential. As the concept of EE remains surrounded with ambiguity, it will remain attractive to many, but when times are changing, it maybe as easily be discarded as well. EE scholars have an important role here to further advance theorizing and to critically assess and inform entrepreneurship educators with evidence-based practices. This means that this field has to move beyond the so-called “intention studies” plain. As we clearly stated in the call for this special issue, there is a clear need to go beyond the current narrow intention models of measuring the impact of EE, as EE is more than a “factory” for creating high-potential start-ups. It is suggested that the impact of EE lies in the development of 21st century skills, such as creativity and complex problem solving, noncognitive skills like social competence and resilience, and even broader fostering employability, identity building, and lifelong learning.

This special issue paves the way for promising streams of research that EE scholars should consider as new lines of research. At the heart of the current challenge in investigating the impact of EE is a need for more systematic approaches to EE. This need is confirmed by *U. Kamovich* and *L. Fross* in their contribution to this special issue. Building further on the seminal work of John Biggs, they convincingly show that, over the past 15 years, EE scholars have paid very little attention to constructive alignment. They conclude that reporting about teaching objectives, teaching methods, and teaching content as well as their connection receives scant attention from

researchers. On one hand, this might be due to editors and reviewers who are not requesting such information from the reported interventions. On the other hand, this could also be due to the fact that entrepreneurship education is not familiar with this well-known concept from educational sciences. One way or another, this systematic review clearly points its finger to one of the backbones of EE research, constructive alignment, in particular when one is interesting in its impact.

The issue of impact and misalignment is further picked up by the review article of *S. A. Gedeon* from the perspective of what quality means for different stakeholders. Based on a thorough investigation of literature on the role of quality from the perspective of accreditation agencies, employers, students, faculties, and award agencies, he concludes that stakeholders have surprisingly divergent opinions on what the goals of EE programs should be. Nonetheless, he argues that putting student learning outcomes (e.g., entrepreneurial competencies) at the heart of discussing the quality of EE programs helps to harmonize such diverse interests. All other goals and quality aspects of EE programs (like faculty quality and number of start-ups generated) can be considered as input or output factors. As such, *S. A. Gedeon* questions whether there is indeed lack of rigor or best practices in EE research or that the question for EE scholars lies more in actually tracking “student transformation” in terms of changes in knowledge, skills, and attitudes, that is, competence development.

The issue of competence development is further addressed by *U. Lilleväli* and *M. Täks* who delved into the value of competence models to systemically investigate student transformation in EE throughout all education levels. As the authors state, “competence models provide a platform to meaningfully embed varying interpretations, learning outcomes and roles of EE, and allow educators and other stakeholders to apply EE systematically throughout all education levels.” Thus, competence models can help educational designers, teachers, and learners in the process of systemizing the how, what, and when of teaching certain aspects of EE. Although endless, laundry lists of competencies have already been produced in the last decades; theoretical and empirical works on competence models have largely been ignored. The authors therefore ask themselves the following questions: What do different mapping approaches have in common? Where do they differ? How do they relate specifically to different educational contexts? After investigating five competence models in detail, the authors conclude that these models indeed help in systematizing the EE competence development process and that they also vary significantly amongst the investigated nations and thus cannot blindly be copied. A common feature, however, of all five analysed EE competence models was the focus on developing competencies related to opportunity pursuit, which is not a surprise considering the ample attention to opportunities in the mainstream entrepreneurship literature.

Further advancement of operationalising and measuring competence in educational research is done in an empirical research article by *Y. Baggen et al.* Although there is considerable effort done in measuring learning outcomes

of EE, studies mainly rely on self-assessments: pen-and-pencil type of methods which do not cater for the complex and dynamic tasks as they occur during entrepreneurial activities. More specifically, *Y. Baggen* and colleagues investigate opportunity identification competence in relation to complex problem skill by introducing performance-based assessment methods. The authors further contribute to the relevance of so-called transversal 21st century skills to the domain of EE. The authors conclude that complex problem solving indeed contributes to predicting idea generation of students in higher education. These results emphasize the need to further explore relationships between domain specific constructs from entrepreneurship research and more transversal, generic constructs which have a rich history in mainstream educational psychology literature. Such research will strengthen methodological rigor and will help to collect the necessary empirical evidence on competence development as emphasized in the paper of *S. A. Gedeon* and the paper of *U. Lilleväli* and *M. Täks*.

Finally, *S. Jie* and *R. Harms* add to the debate on the impact of EE arguing that internationalisation of higher education represents an international and cross-cultural experience in EE in a growing number of universities. Cross-cultural competencies should therefore also be considered when talking about desired learning outcomes of EE. Although the results of *S. Jie* and *R. Harms* amongst university students do not show a direct influence of cross-culture competence on the intention to engage in activities aimed at starting an international new venture, further analysis does highlight the importance of thoroughly disentangling the relationships between the different constructs we currently use to measure learning outcomes in EE.

Taken together, the set of articles in this special issue helps in establishing EE as an important subfield of entrepreneurship studies. The editors are confident that this selection of articles contributes to the contemporary scholarly debate within the EE field by addressing the unique challenges EE faces and further advancing our understanding of impacts of EE activities.

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*Päivi Tynjälä*  
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## Research Article

# Complex Problems in Entrepreneurship Education: Examining Complex Problem-Solving in the Application of Opportunity Identification

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In opening up the black box of *what* entrepreneurship education (EE) should be about, this study focuses on the exploration of relationships between two constructs: opportunity identification (OI) and complex problem-solving (CPS). OI, as a domain-specific capability, is at the core of entrepreneurship research, whereas CPS is a more domain-general skill. On a conceptual level, there are reasons to believe that CPS skills can help individuals to identify potential opportunities in dynamic and nontransparent environments. Therefore, we empirically investigated whether CPS relates to OI among 113 masters students. Data is analyzed using multiple regressions. The results show that CPS predicts the number of *concrete* ideas that students generate, suggesting that having CPS skills supports the generation of detailed, potential business ideas of good quality. The results of the current study suggest that training CPS, as a more domain-general skill, could be a valuable part of *what* should be taught in EE.

## 1. Introduction

Acquiring entrepreneurial skills can help in preparing students for a working life characterized by uncertainty and complexity [1]. Accordingly, entrepreneurship education (EE) receives attention as a means to close the gap between the type of young talent required by the market and the talent that is actually being provided by higher education. EE is in this study broadly defined as the “[c]ontent, methods, and activities that support the development of motivation, skill and experience, which make it possible to be entrepreneurial, to manage and participate in value-creating processes” ([2], p. 14). In this definition, EE is not only about new start-up creation; it also includes other value-creation processes which are more and more present in daily (working) life. However, many empirical studies do not apply the broad definition of EE but solely focus on teaching skills that are required in independent entrepreneurship [3]. Rideout and Gray [4] in

their review on EE conclude that research on EE is still in an early stage and that it is unclear *whether* and *how* EE works. The wide debate about EE results in a *black box* of *what* EE should be about.

In this manuscript, we aim to contribute to opening up this black box by explaining an important entrepreneurial capability of which the role in entrepreneurship is widely agreed upon, namely, opportunity identification (OI; [5]). OI is at the conceptual heart of the entrepreneurship literature, as opportunities and their identification are part of the defining start of the entrepreneurial process. Explaining variables behind OI are widely discussed. For instance, Gielnik et al. [6] found that divergent thinking explained the number and originality of generated business ideas. Wang et al. [7] found that self-efficacy, prior knowledge, social networks, and perceptions about opportunities in the industrial environment significantly explained OI of research and development managers. Although these and other studies have significantly

improved our understanding of OI, research on OI is still in an early phase [8, 9].

Hsieh et al. [10] argue that in OI individuals search for or stumble upon problems to solve. Identifying opportunities involves decision-making processes and information-seeking activities to bring facts and relationships between facts to bear in problem-solving [10, 11]. Seeking information and making decisions in systematic ways result in more identified opportunities [12]. A set of skills that supports individuals to systematically seek information and make decisions in the complex world around them is complex problem-solving (CPS; [13]). CPS targets tasks that are characterized as dynamic, nonroutine, and interactive, as they are likely to occur in OI. These tasks require higher-order thinking skills of CPS that cover cognitive (e.g., fluid reasoning; [14, 15]) and noncognitive (e.g., self-management; [13, 16]) processes. Moreover, CPS aligns with the broad definition of EE because CPS can, as a more generic skill, help in managing to act entrepreneurial. Despite the linkages at the conceptual level, the relationship between OI and CPS has not been empirically investigated yet [11].

The importance of CPS for current and future generations of working individuals is best reflected by the decision made by the Organisation for Economic Co-Operation and Development (OECD) to incorporate CPS into the Programme for International Student Assessment (PISA; [17]) and to include the closely related skill of problem-solving in technology-rich environments in the Programme for the International Assessment of Adult Competencies (PIAAC; [18]). In general, these initiatives have assessed the CPS of tens of thousands of students and adults under controlled conditions using computer-based assessment [17, 18]. Using similar methodologies, several empirical studies have identified CPS as a relevant skill that has been found to be related to school and university success (e.g., [19–21]). A small number of studies suggest CPS to be relevant for success in work settings [22–24]. On a theoretical basis, Neubert et al. [25] discussed CPS as a promising skill for improving the prediction of workplace performance in complex and nontransparent tasks.

In short, when entrepreneurs identify opportunities, then they ideally solve complex problems in systematic ways on their journey to create new value. On the basis of this theoretical understanding, we investigate whether skills to solve complex problems are relevant to identify opportunities in the early stages of entrepreneurship. For this purpose, we present an empirical study that relates CPS to OI. We tested 113 masters students who took entrepreneurship or career development courses and mostly intended to start or get involved in a new venture. The objective of this study was to test whether CPS plays an empirical role in OI by using a standardized setting and established tasks from different research areas.

*1.1. Complex Problem-Solving.* In their essence, problems to solve are barriers to overcome between a given situation and an intended goal state. These barriers occur if the functioning of the underlying system is unknown to the individual [26, 27]. For example, an engineer who works on appliances for the rapidly developing Internet of Things faces barriers if the

technical functioning develops too fast for the engineer to stay up to date without constant use and interaction. A lack of knowledge about the functioning of only one component can be considered a barrier that prevents a solution. Accordingly, Buchner (cited in Frensch and Funke [28], p. 14) defined CPS as follows.

Complex problem-solving (CPS) is the successful interaction with task environments that are dynamic (i.e., change as a function of the user's intervention and/or as a function of time) and in which some, if not all, of the environment's regularities can only be revealed by successful exploration and integration of the information gained in that process.

CPS targets tasks that are characterized as dynamic, non-routine, and interactive and thus require more than domain-specific prior knowledge. These characteristics are what makes the barriers complex, or, in other words, that makes a task a complex problem requiring active exploration to find and apply a new solution. To overcome complex barriers requires generic skills for knowledge acquisition and application of this knowledge [16, 29–31]. Knowledge acquisition and knowledge application are domain-general processes of CPS that are distinct from domain-specific prior knowledge (i.e., expert knowledge or expertise; [32–34]).

If, for example, an engineer with vast experience in the Internet of Things faces a previously unknown problem with the dimming of light-emitting diodes (LEDs) in the home automation system that she manages, she is only then likely to solve this problem on the basis of her prior knowledge, once she has gathered new knowledge in order to model the problem in terms that she is familiar with, such as electric circuits. Solving could even mean for her to be entrepreneurial to the extent that she might identify a business opportunity, if her solution is genuinely new and advantageous. In contrast, solving a problem of a system she knows perfectly well, such as the dimming of traditional light bulbs in home automation systems, the electric engineer would very likely have previously known the procedure needed in order to arrive at the solution—she would solve the problem routinely, not entrepreneurially. However, to arrive at a solution for dimming a new technology, such as LEDs, engineers face a complex problem that surpasses their prior knowledge. Her complex problem is to tap into new grounds of successfully manipulating LEDs in ways she has never done before (i.e., dimming) without undesired side effects (e.g., flickering). She must learn how to properly dim LEDs in the first place. That is, arriving at the electric circuit model of her new problem is a complex issue that requires domain-general processes of knowledge acquisition and knowledge application about the functioning of LEDs.

In general, complex problems share the ambiguity of how to approach the task and a lack of transparency in the task environment; the task structure is complex and the environment is dynamic. Variables in the system are interconnected; they change over time and interaction; whether they are relevant or not is unclear at the beginning [13]. Hence, in order to arrive at her circuit model, domain-general processes enable her to explore, recombine, and utilize new knowledge about LEDs in electric circuitries. These processes are especially helpful when prior knowledge is not available or

insufficient, as is usually the case with new technology, such as, for example, LEDs in home automation systems. In short, domain-general processes lead to knowledge structures about how a previously unknown system works (e.g., LEDs in home automation) and how to seize control (e.g., dimming) within such a system [31]. These processes constitute the core of the domain-general construct of CPS [21, 29].

*1.2. Opportunity Identification.* Suddaby et al. [8] recently published a special issue of *the Journal of Business Venturing* on OI, underlining the importance and relevance that OI has in the field of entrepreneurship. Scholars tend not to agree on what opportunities are and how the process underlying opportunities evolves (e.g., [35, 36]). For instance, some authors argue that opportunities emerge in the economic environment and can be *discovered* by alert individuals [37]. Yet, others argue that opportunities are *created* by individuals in interaction with their (social) environment [36]. Recently, authors tend to agree that the different views on opportunities and the process underlying opportunities can coexist [8, 9]: ideas can be “found” in the economic environment or be generated by individuals who are willing to become an entrepreneur.

In this manuscript, we follow Suddaby et al. [8] and Vogel [9] by acknowledging that different views towards opportunities and their underlying process can coexist. Still, the discussion around opportunities in this manuscript mostly hits (but is not limited to) the discovery perspective towards opportunities, having its roots in cognitive psychology [38]. This perspective is considered to have the most connections with CPS. In this article, the capability to identify opportunities is defined as “the ability of individuals to identify ideas for new products, processes, practices or services in response to a particular pain, problem, or new market need” ([11], p. 417).

From a discovery point of view, the market is seen as continuously changing, offering new information all the time, making it possible for individuals to continuously acquire new information that can help in identifying opportunities [36]. The role of information is a first determining factor explaining why some individuals identify an opportunity that others do not identify. It is assumed that information is not evenly distributed over individuals [39]. As a result, it is important (1) to have access to relevant information and (2) to have prior knowledge so that new information can be used adequately. In the example of the engineer who aims to dim LEDs, which is new to her, it helps if she knows experts in light dimming or when she is a digital native, who has the capability to systematically search for relevant information. Regarding the second, prior knowledge can support in interpreting new information. When the engineer already has prior knowledge on the dimming of traditional light bulbs, this helps her to connect new information to what she already knows and, as a result, to give meaning to the information on a deeper and richer level [40]. Consequently, being able to access relevant information and having prior knowledge in a certain domain explain why some individuals identify an opportunity while others do not, without actively searching for it: individuals value information or events differently, because of the prior knowledge they have [41].

Second, uncertainty plays a large role in OI [36]. Individuals have to collect information from relevant stakeholders. Those stakeholders value information in a certain way, may share some information but not all, or could even share wrong information. It is up to the individual to integrate and merge the, often unstable, collection of information into expectations about future events (i.e., the opportunity). It is only *ex ante* possible to determine the eventual value of an opportunity after an idea has been exploited and tested for its potential [40]. The degree of uncertainty has influence on the opportunity beliefs of the individual—individuals can be more or less certain about the opportunity potential of ideas. These beliefs have their impact on whether or not individuals act upon an opportunity [40]. In sum, individuals have to be able to deal with uncertainties about the potential of opportunities and are challenged to collect relevant information from stakeholders.

Third, in their empirical study, Costanzo et al. [39] explain OI based on structural alignment. Structural alignment is “a cognitive tool that people use to compare things—and to draw implications from the comparison” ([39], p. 416). Individuals make sense of new information by comparing it to what they already know and by detecting similarities that can help them to understand and give meaning to the situation at hand. They found that individuals consider alignment with both superficial features and higher-order structural relationships in order to identify opportunities. Superficial features are basics, such as the materials a new technology consists of. Higher-order structural relationships are more complex and abstract, such as cause-effect relationships contributing to understanding how and why consumers behave in a certain way [39, 40].

The study of Costanzo et al. [39] showed that particularly similarities in higher-order structural relationships helped to identify new opportunities.

*1.3. Integrating Complex Problem-Solving and Opportunity Identification.* The elaboration on CPS and OI reveals several potential connections between the field of cognitive psychology and entrepreneurship, namely, regarding (1) the usage and distribution of (prior) knowledge and information, (2) dealing with uncertainty, and (3) the role of CPS in structural alignment.

First, scholars tend to agree that domain-specific prior knowledge is necessary but not sufficient for identifying opportunities. In more complex situations, individuals need skills to apply and expand on their prior knowledge. An increase of knowledge makes it likelier that a person solves a complex problem that then can lead to OI [42]. For instance, the engineer from the example taps into a complex problem when she has the idea of dimming LEDs and realizes that this is not as simple as dimming traditional light bulbs. In this situation, being able to identify opportunities and having high level CPS are both valuable: dimming LEDs has the characteristics of a complex problem (i.e., being dynamic, nonroutine, and interactive; [16]) and, at the same time, has opportunity potential by exploring solutions for dimming in home automation. More specifically, LEDs start flickering

when dimmed like conventional light bulbs, but their application in home automation is new, and appropriate dimming of LEDs might not have been taken care of in advance. Here, having prior knowledge on the dimming of traditional light bulbs is not enough to explore the potential of the opportunity; the engineer also needs the skills to deal with the complex problem situation that requires the domain-general processes of acquiring and applying new knowledge in order to seize control of the dimming of LEDs. Being able both to successfully acquire knowledge and to apply this knowledge to the problem situation at hand is needed to solve the complex problem and explore the opportunity potential of dimming LEDs. As stated, it is only *ex ante* possible to determine the value of an opportunity, when the engineer has used her CPS to develop dimming LEDs and succeeds (or not) in developing means so that LEDs do not flicker [40].

Eventually, differences in the resulting knowledge distinguish those who see opportunities in complex environments and those who do not [43–45]. Similar to entrepreneurs, successful complex problem solvers actively acquire knowledge by assuming that the information around them is incomplete or false [32]. In other words, entrepreneurs and successful complex problem solvers both reveal a great deal of willingness to challenge information. This willingness or tendency might be what facilitates the ability to access information, an ability that can lead to differences in knowledge between those who see opportunities in complex environments and those who do not.

Second, regarding uncertainty, in applying CPS [28], individuals generally overcome complex barriers between a given state and a desired goal state. In entrepreneurship, uncertainty of opportunity beliefs [40], for instance, about how technology, user needs, and whole markets develop, represents such a complex barrier [46]. In this sense, individuals who attempt to create new value need to overcome complex barriers between, on the one hand, a given state of yet-to-be-connected information about technology and user needs and, on the other hand, a desired future state that involves a product or service that does not yet exist. Processes of knowledge acquisition and knowledge application can lead to collecting relevant, correct information that can help (1) to overcome complex barriers, (2) to reduce the amount of uncertainty about the opportunity potential, and, as a result, (3) to increase the opportunity beliefs of the individual [40]. That is, as soon as the engineer of the previous example overcomes the complex barrier of how to dim LEDs in home automation systems in a way that prevents flickering, she succeeded in reducing uncertainty and, as a result, in identifying and exploring opportunities of dimming LEDs in new, efficient ways. To be able to overcome such barriers, the engineer needs to be able to deal with uncertainty and to deal with dynamic, nonroutine, and interactive tasks.

A process that can be applied to support such activities is to simplify the diverse amount of information in the environment so that it becomes manageable (cf. [5, 13]). One way to simplify is to first observe how a problem evolves without interference and next to explore the problem step-by-step by

varying only one variable at a time. To vary only one variable at a time is a strategy to overcome complex barriers, gain control, and eventually solve a complex problem (VOTAT strategy; [47]). However, VOTAT is not sufficient to solve a complex problem that requires a whole set of strategies and their adaptive use (see [48]). The VOTAT strategy is therefore a specific one among many different exploration strategies that might help to simplify knowledge acquisition in the real world as well as in current CPS tests that have been applied in the present study [49, 50].

Third, the supportive role of CPS skills in identifying opportunities can also be argued for when considering the role of cognitive alignment in OI, as investigated by Costanzo et al. [39]. When individuals face a complex task in a dynamic situation, the process of structural alignment can be very demanding, especially when detecting similarities in higher-order relationships with the problem situation at hand. Costanzo et al. [39] argue that individuals need to detect and process relevant signals on a deeper level. Just as in dealing with (new) information and uncertainty, structural alignment could be traced back to the integral processes of CPS: knowledge acquisition and knowledge application [32]. These closely intertwined and equally important processes for solving complex problems [13] lead to knowledge structures about how a previously unknown system works on a deeper level and how to seize control within such a system [31]. Knowledge acquisition begins as a problem solver retrieves information in an environment, where it is yet unclear what is important and what not; it continues as the solver reduces the information in order to keep a set of relevant pieces, thus leading to an actionable problem representation (see above; [34]). Supporting the identification of an opportunity in a real market, an actionable representation ideally contains a sufficient number of pieces of the puzzle by which to identify customers' needs and the ways in which such needs can be met. This actionable representation is the foundation for applying the acquired knowledge to a set goal and, thus, to gradually gain control over the variables of the problem in order to successfully solve the problem, or, in other words, to identify an opportunity.

## 2. The Present Study

The goal of the present study was to empirically evaluate whether CPS plays a significant role in OI. Investigating the linkages between CPS and OI has the potential of contributing to opening up the *black box* of what EE should be about. As stated in the Introduction, in this study, EE is broadly defined, having new-value creation as common core [3]. By comparing a more domain-specific capability, namely, OI, with a more generic skill, namely, CPS, we aim to contribute to a better understanding of what students should learn in EE that is directed towards preparing students on a career full of complexity and uncertainty [1]. From a conceptual point of view, the importance of CPS in OI seems reasonable. As discussed above, CPS (1) helps to adequately acquire and apply new relevant information in the OI process, (2) helps to deal with uncertainty, and (3) supports demanding structural alignment processes. Subsequently, the main

research question of this manuscript is, *To what degree does CPS relate to OI?*

### 3. Method

**3.1. Sample and Procedure.** The sample consisted of 113 Dutch students who were doing their masters studies in the field of life sciences and were enrolled for two semesters in the weekly courses *Entrepreneurial Skills* and *Career Development and Planning* (this sample was also used for a different study with a different purpose, namely, to develop the measurement of OI; see [51]). *Entrepreneurial Skills* addressed important personal characteristics of entrepreneurial individuals, and the students created mind maps of their own entrepreneurial characteristics, goals, and intentions. As part of the course, the students pitched their own venture ideas. In *Career Development and Planning*, students reflected upon and described their career goals and created an action plan towards the realization of these goals. The students were between 21 and 31 years of age ( $M = 23.55$  years,  $SD = 2.00$ ), and 68.1% were female. When asked “What is the likelihood that you will be involved in an entrepreneurial venture sometime in your lifetime?,” almost all of the students (96.2%) stated that they had the intention, at least to some degree, of getting involved in an entrepreneurial venture (“maybe” [30.8%], “probably will” [38.5%], and “definitely will” [26.9%]); 70.2% of the students even stated the intention to get involved within the next 5 years (“maybe” [37.5%], “probably will” [26.0%], and “definitely will” [6.7%]); 7.7% of the sample were currently involved in an entrepreneurial venture, and 12.5% had undertaken an entrepreneurial venture in the past (questions adapted from DeTienne and Chandler [52]).

Split into four almost even groups, the participants rotated between a session in which OI and the control variables were assessed (Session A; see next paragraph), a session in which CPS was assessed in a computer-based format (Session B; see next paragraph), and a course with content that was unrelated to the assessments. Sessions A and B each lasted 45 minutes, whereas the course lasted 1.5 hours, so the first two groups switched between Sessions A and B for the first 1.5 hours while Groups 3 and 4 took the course. Then, Groups 3 and 4 switched between Sessions A and B while Groups 1 and 2 took the course. Switching the groups between separate seminar rooms for each different session resulted in two 10–15-minute breaks for each group.

### 3.2. Measures

**3.2.1. Opportunity Identification.** An earlier developed performance assessment on OI by Baggen et al. [51] was used. In the assessment, the participants were asked to generate business ideas related to sustainable development, as a case closely related to the background of the participants (who were students from a university in the life sciences domain). In the case, examples of problems in the area of sustainable development were given, such as education and climate change. The participants were asked, “Imagine that you are asked to give input for business ideas for new start-ups in the area of sustainable development. These business ideas can

concern people, planet, and/or profit, and may lead to social, environmental and/or economic gains. What ideas for new start-ups come up in your mind?” Furthermore, it was stated that “You do not have to worry about whether the ideas have a high or low potential for success. Do not limit yourself; the more ideas you can list, the better.”

The generated ideas were scored on (1) comprehensibility, (2) concreteness, and (3) flexibility. The scoring criteria were derived and adopted from earlier work of Guilford [53], who developed criteria to score the results of creativity tasks. Comprehensibility refers to responses that actually correspond to the question (1 = comprehensible; 0 = incomprehensible). Concreteness encompasses the extent to which it was possible to visualize or apply the idea (1 = concrete; 0 = not concrete). Per participant, the percentage of comprehensible ideas that were also concrete was calculated. Flexibility refers to the amount of categories in which the participants could generate business ideas. Each idea was scored into one category, corresponding to the examples given in the case on sustainable development. In total, six categories were defined: food, decent housing, energy, climate change, education, and personal health and safety. The flexibility score was calculated by dividing the number of scored categories by the total number of categories (i.e., six).

In order to develop the codebook, two raters (from the team of authors) scored 10% of the ideas in three scoring rounds, which is an acceptable percentage when scoring such large dataset [54]. After each scoring round, they compared and discussed their results and refined the codebook until acceptable levels of interrater reliability were reached for the scoring procedure, Cohen’s Kappa .78 (flexibility), and for the dichotomous variables agreement of 82.9% (concreteness) and 94.7% (comprehensibility). Please refer to Baggen et al. [51] for a more specific elaboration on the analysis of the business ideas.

**3.2.2. Complex Problem-Solving.** We employed one introduction task and a set of six complex task simulations from the fully computer-based CPS assessment test MicroFIN [49, 50]. MicroFIN features multiple, dynamic tasks that are based on a formal framework called “Finite State Automata” [55]. Based on this framework, MicroFIN aims to counter limitations in the breadth of problems included in previous CPS instruments (e.g., MicroDYN; [56]) and facilitate a greater heterogeneity in tasks [49, 50, 57]. MicroFIN was recently found to have convergent validity with an established CPS instrument and discriminant validity with different measures of general mental ability (GMA; [49, 58]). MicroFIN tasks share a general layout of input variables that influence output variables and are in accordance with the theoretical background as outlined in the Introduction (i.e., test items contain (a) values that change with the user’s interaction and (b) various nontransparent interactions between variables, such as threshold or equilibrium states in the input variables; [13]).

For instance, our participants faced the challenge of planning a city while considering the needs of very different interest groups (“Plan-o-Maton” task; see Figure 1). The goal in this nontransparent task was to balance the interests of various parties (e.g., families and industries) by improving their

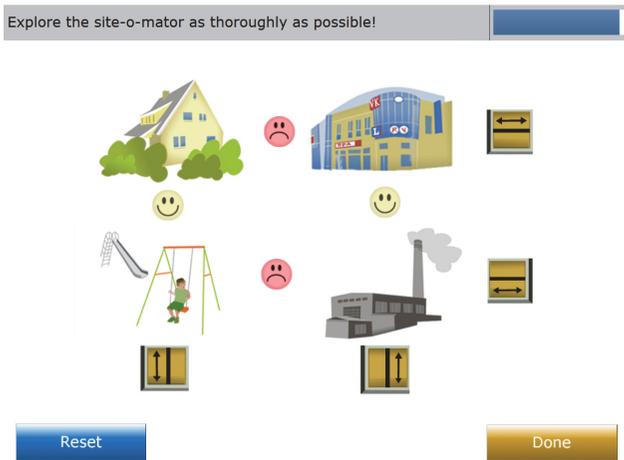


FIGURE 1: Screenshot of the MicroFIN item “Plan-o-Maton” [49, 50]. Problem solvers have to balance the interests of various parties in a city by making alterations in the urban landscape. Along the bottom and the right side: the keys for altering the location of the interest groups. In principle, two stakeholders change places when triggered. On the right side: a city mall and a factory. On the left side: a family home and a playground. Between these parties, smiley faces indicate the atmosphere. The problem solver has to improve the atmosphere by finding one of several optimal setups.

locations in the urban landscape. The parties’ interactions led to discrete states of well-being, also called equilibrium, which could be achieved through various ways of interacting. Similar but different tasks consisted of, for example, (a) the challenge of successfully managing a concert hall that varied according to the type of music (e.g., classical versus Rock’n’Roll), price level, and atmosphere (indoor versus outdoor) or (b) the challenge of successfully harvesting a new kind of pumpkin that varied according to the season and the amount of fertilizer.

Participants were to explore a previously unknown problem in order to derive knowledge about the causal structure of the task and the possibilities of interventions. Next, four items per task were used to assess the participant’s knowledge about the problem (i.e., knowledge acquisition). Subsequently, one more item per task asked participants to apply their knowledge to manipulate each task towards achieving a previously set goal to thereby gain control over the system or, in other words, to solve the complex problem (i.e., knowledge application). Overall, each MicroFIN task took approximately 5 minutes to complete (for a more detailed description of the different MicroFIN tasks and items, see [49, 50]).

In detail, to determine participants’ scores on knowledge acquisition, they received credit for a correct summary of the previously unknown relations within a task (e.g., the Plan-o-Maton) and no credit if they failed to do so. The score was an average of the four items for knowledge acquisition per task. To determine participants’ scores on the knowledge application item, they received credit for reaching the target state on each task (e.g., different states of well-being for families and industries in the Plan-o-Maton), and no credit was

given when participants failed to do so. The scores for knowledge acquisition and knowledge application were further aggregated across all tasks and finally collapsed into one *general* CPS score according to a procedure used by Kretzschmar et al. [58]. Due to a software issue, the data for one MicroFIN task was not saved and, thus, our analyses were based on five tasks. Cronbach’s alpha was calculated as an indicator for the reliability and was based on the approach proposed by Rodriguez and Maeda [59]. Cronbach’s alpha of MicroFIN was .57.

In sum, MicroFIN provided a measure of skills to solve complex problems that stemmed from theoretical considerations of CPS and has been empirically validated [49, 50, 58, 60].

**3.2.3. Control Variables.** In order to measure the unique relation between CPS and OI, we additionally assessed and controlled for two variables that might relate to either CPS or OI: problem-solving self-concept and prior knowledge. Problem-solving self-concept is one’s self-perceived ability to solve problems [61] in addition to the actual problem-solving performance covered by CPS. Self-concept measures should be associated with performance scales of a corresponding ability [61]. As CPS and problem-solving self-concept correspond, controlling for this area of self-concept allows us to show whether it is either the belief in one’s ability or one’s ability itself or both that potentially leverage OI. Prior knowledge about a market or topic has an impact on the development of new venture ideas (i.e., OI) in a specific domain (e.g., [62]). As argued in the section on OI, knowledge is not evenly distributed among people. Those who have prior knowledge in a specific domain are more likely to identify an opportunity [41].

**Problem-Solving Self-Concept.** We used six problem-solving items from the Self-Description Questionnaire III (SDQ III; [61]) to assess problem-solving self-concept. The SDQ III was designed to measure 13 self-concept factors, of which problem-solving is one factor. An example item is “I am good at problem solving,” which participants answered using a similar 5-point Likert scale. Cronbach’s alpha of the scale was .75.

**Prior Knowledge.** The participants had to come up with as many business ideas as possible on the basis of a case that was related to sustainability. Therefore, we aimed to control for the sustainability-related prior knowledge of the participants. We asked the participants how much they knew about several sustainability-related topics such as climate change using a 5-point Likert scale (8 questions) before they took the main survey. Cronbach’s alpha was .76.

**3.3. Data Analysis.** All statistics were calculated using the R software [63]. We applied multiple imputations using the mice package [64] in combination with the miceadds package [65]. In detail, we used 10 imputed datasets (100 iterations; method: predictive mean matching) to account for up to 28% of missing data for two MicroFIN tasks, which were the result of technical issues that occurred in the computer-based

TABLE 1: Descriptive statistics for the assessment of OI, CPS, prior knowledge, and problem-solving self-concept.

Variable	Minimum	Maximum	M	SD
Opportunity identification				
Number of comprehensible ideas	0	23	6.27	3.55
Number of concrete ideas	0	16	5.77	3.20
Flexibility	0.17	1	0.53	0.18
CPS	0.75	5	3.3	0.87
Prior knowledge	1.50	4.88	2.91	0.67
Problem-solving self-concept	1.50	4.83	3.66	0.62

Note. Statistics are based on raw data (i.e., nonimputed). CPS: complex problem-solving; PS self-concept: problem-solving self-concept. The control variable ratings ranged from 1 (*strongly disagree*) to 5 (*strongly agree*).

TABLE 2: Pearson’s correlations between variables.

Measure	1	2	3	4	5
(1) Number of comprehensible ideas					
(2) Proportion concrete	-.01				
(3) Flexibility	.71***	.03			
(4) CPS	.18	.29**	.20*		
(5) Prior knowledge	.05	-.14	-.12	-.10	
(6) PS self-concept	.21*	.12	.15	.20*	.09

Note.  $N = 113$  (imputed data). Manifest correlations are reported. Proportion concrete: proportion of concrete ideas; CPS: complex problem-solving; PS self-concept: problem-solving self-concept. Two-tailed  $p$  values: \* $p \leq .05$ , \*\* $p < .01$ , and \*\*\* $p < .001$ .

assessment at the end of the testing of the second group of participants. Although the technical issues were solved in a short amount of time, not all participants were able to work on all tasks due to external time restrictions. For all other tasks, the amount of missing data was less than 9%. Checking for patterns in missing data, Little’s test indicated that data were missing completely at random (MCAR;  $\chi^2 [579] = 633.5625, p = .057$ ). In the following, we report the results computed on the imputed data ( $n = 113$ ).

In preliminary analyses, we calculated descriptive statistics for our variables as well as bivariate Pearson correlations to provide information about the basic data structure. To test whether CPS explained variance in (1) the number of comprehensible ideas, (2) the proportion of concrete ideas, and (3) flexibility beyond prior knowledge and problem-solving self-concept, we computed multiple regression analyses and compared different models. In Model 1a, we regressed the number of comprehensible ideas on our control variables, and in Model 1b, we included CPS as a statistical predictor in addition to our control variables. Simultaneously, in Models 2a and 3a, we, respectively, regressed the proportion of concrete ideas and flexibility on the control variables, and in Models 2b and 3b, we additionally included CPS.

## 4. Results

**4.1. Preliminary Analyses.** The participants revealed an average total number of 6.27 comprehensible ideas and 5.77 concrete ideas in the OI task. On average, the flexibility score of the participants was .53, indicating that they generated ideas in about three of the six categories (see Table 1).

CPS was not significantly correlated with the number of comprehensible ideas ( $r = .18, p = .071$ ) and was weakly

but significantly correlated to the proportion of concrete ideas ( $r = .29, p = .005$ ) and the flexibility score ( $r = .20, p = .047$ ). The control variables showed correlations with OI that were very weak and nonsignificant (see Table 2). Problem-solving self-concept significantly correlated with the number of comprehensible ideas ( $r = .21, p = .031$ ) and CPS ( $r = .20, p = .050$ ). A correlation of .71 ( $p < .001$ ) between the number of comprehensible ideas and flexibility indicated that they were substantially associated.

**4.2. Tests of Hypotheses.** In the basic Model 1a in which the control variables were used to predict the number of comprehensible ideas, only problem-solving self-concept ( $\beta = .20, p = .037$ ) was a significant predictor. Prior knowledge ( $\beta = .01, p = .908$ ) remained nonsignificant. Model 1b with CPS as an additional predictor (see Table 3) revealed that CPS ( $\beta = .12, p = .174$ ) and the control variables problem-solving self-concept ( $\beta = .18, p = .073$ ) and prior knowledge ( $\beta = .03, p = .775$ ) remained nonsignificant in predicting the number of comprehensible ideas. In comparison with Model 1, CPS explained an additional 1.7% (adjusted: 0.8%) of the variance in the number of comprehensible ideas.

The basic Model 2a, which included problem-solving self-concept ( $\beta = .13, p = .184$ ) and prior knowledge ( $\beta = -.17, p = .143$ ), did not predict the proportion of concrete ideas. However, Model 2b (see Table 3) revealed that CPS ( $\beta = .24, p = .016$ ) significantly predicted the proportion of concrete ideas. Problem-solving self-concept ( $\beta = .08, p = .402$ ) and prior knowledge ( $\beta = -.14, p = .235$ ) remained nonsignificant. CPS incrementally explained 5.9% (adjusted: 5.4%) of the variance in the proportion of concrete ideas in comparison with the basic Model 2a (see Table 3), which included only the control variables.

TABLE 3: Regression analyses with (1) the number of comprehensible ideas, (2) the proportion of concrete ideas of comprehensible ideas, and (3) flexibility as dependent variables.

Predictor	Number of comprehensible ideas		Proportion concrete		Flexibility	
	Model 1a	Model 1b	Model 2a	Model 2b	Model 3a	Model 3b
Intercept						
PS self-concept	.20*	.17	.13	.08	.16	.12
Prior knowledge	.01	.03	-.17	-.14	-.16	-.14
CPS		.12		.24*		.16
R <sup>2</sup>	0.042	0.059	0.041	0.101	0.044	0.072
ΔR <sup>2</sup>	—	0.017	—	0.059	—	0.027

Note.  $N = 113$  (imputed data). Standardized regression coefficients and  $R^2$  values are reported. PS: problem-solving; CPS: complex problem-solving.  $\Delta R^2$  represents the comparison between models (a) and (b) for each dependent variable. Two-tailed  $p$  values: \*  $p \leq .05$  and \*\*  $p < .01$ .

Finally, in the basic Model 3a, problem-solving self-concept ( $\beta = .16$ ,  $p = .106$ ) and prior knowledge ( $\beta = -.16$ ,  $p = .100$ ) did not predict the flexibility score. In Model 3b, CPS was not a significant predictor of flexibility ( $\beta = .16$ ,  $p = .096$ ); the control variables problem-solving self-concept ( $\beta = .12$ ,  $p = .209$ ) and prior knowledge ( $\beta = -.14$ ,  $p = .154$ ) remained nonsignificant. Compared to Model 3a, the model including CPS (Model 3b) explained an additional 2.7% (adjusted: 1.9%) of the variance in the flexibility score. In summary, CPS only significantly predicted the proportion of concrete ideas in Model 2.

## 5. Discussion

With this study, we set out to examine the role of CPS in OI by administering standardized performance tasks of CPS and OI to a sample of 113 students, most of whom had an interest in independent entrepreneurship. We found that CPS incrementally predicted the proportion of concrete ideas beyond the control variables problem-solving self-concept and prior knowledge. These results can be interpreted as the first empirical evidence for a significant role of CPS in entrepreneurial activities and suggest that training CPS skills could be a valuable addition to defining “*what*” should be taught in EE. Below, we first elaborate on the findings, before we reflect on the (practical) meaning of our results for EE.

*5.1. The Role of Complex Problem-Solving in Opportunity Identification.* CPS solely contributed to statistically predicting the proportion of concrete ideas, whereas here all control variables remained irrelevant for this prediction. The correlations between CPS and the three indicators for OI ranged between .18 and .29, which can be considered small [66] to medium effects [67]. This means that CPS processes matter at least to some extent in the application of OI in a standardized entrepreneurial task context. By contrast, our results suggest that prior knowledge does not play any role in the application of such tasks, whereas one’s problem-solving self-concept matters in the number of comprehensible ideas. One may assume that, in a real market, individuals with high levels of CPS are more likely to perform the necessary steps of exploring, simplifying, and controlling complex tasks in order to eventually identify concrete and readily applicable opportunities better than others.

Regarding the sizes of the effects, (a) the overall small effect sizes for CPS actually confirm the pattern of results reported in previous studies with cognitive and noncognitive predictors of entrepreneurial outcomes (e.g., [68, 69]). For example, GMA and the Big Five (i.e., broad personality traits) are two well-researched predictors that both matter but nonetheless do not specifically match the context of entrepreneurship. Gielnik et al. [68] found no significant relation between GMA and OI and only a moderate relation between OI and divergent thinking. In their meta-analysis, Rauch and Frese [69] reported correlations that were close to 0 between domain-general predictors and entrepreneurial outcomes, particularly in studies using the Big Five. Conversely, other studies of their meta-analysis that matched traits with entrepreneurial outcomes reported relatively small to moderate and heterogeneous relations. Rather than resembling specifically entrepreneurial traits, these predictors remained domain-general. As it is not bound to a specific domain either, CPS also does not specifically match the context of entrepreneurship.

Furthermore, (b) as the applied computer-based CPS and paper-and-pencil-based assessments on OI were genuinely different methods, the relations between OI and CPS were invariably due to the particular constructs that were measured and could not be attributed to a common method in accordance with Podsakoff et al. [70]. Hence, in light of (a) previous findings and (b) the use of different measures of CPS and OI in the present study, the direct relations between CPS and OI were not exceptionally small but rather drew a picture of meaningful results that support CPS as a predictor of entrepreneurial activities.

The results suggest that CPS predicts the concreteness of the generated business ideas (i.e., OI). Furthermore, CPS and flexibility were correlated ( $r = .20$ ). Although CPS was not a significant predictor of flexibility, the correlation between flexibility and CPS on the one hand and the relationship between CPS and concreteness on the other hand offer reasons to believe that CPS is of value for generating ideas of *good quality*. This result might be explained based on the process of knowledge acquisition and knowledge application. As stated, differences in (prior) knowledge distinguish those who identify certain opportunities and those who do not [43–45]. More specifically, those who have higher levels of CPS might be able to identify concrete opportunities, which

are visualizable and applicable, in complex environments. Entrepreneurs and successful complex problem solvers both reveal a great deal of willingness to challenge information. This willingness or tendency might be what facilitates the ability to access information, an ability that can lead to differences in knowledge between those who see concrete opportunities in detail and those who do not. In sum, effective problem solvers and entrepreneurs arrive at a higher level of concreteness by (a) reducing uncertainty and recombining resources to solve relevant complex problems, (b) using a range of processes to simplify complex environments, and (c) sharing the tendency to question the relevance and completeness of information. This way, knowledge acquisition processes leverage the applicability of business ideas; when individuals engage more with the task, they give more concrete answers. On the side of knowledge application, someone high in CPS proved to be better than others in applying new knowledge. In OI, this advantage might translate into concrete ideas that are more ready to apply. Taken together, the results of the present study support the idea that CPS advances explanations for how entrepreneurs deal with uncertainty and recombine resources, why they differ from other people, and, eventually, how they identify concrete opportunities that are ready to apply.

Regarding problem-solving self-concept and prior knowledge, our results deviated from our expectations and previous research. Regarding problem-solving self-concept, we expect it to significantly correlate with CPS, such as what Marsh and O'Neill [61] have shown for other areas, where self-concept and ability corresponded. The problem-solving self-concept solely contributed to explaining the comprehensiveness of ideas, neither their concreteness nor flexibility. This pattern might suggest that the belief in one's problem-solving ability supported—at least to a small extent—coming up with ideas at all but did not affect how concrete or flexible the ideas were. As we have shown for CPS, at least for the concreteness of ideas, it is rather one's ability itself than one's self-concept that makes a difference.

Regarding prior knowledge, Shane [41] distinguishes three types of prior knowledge: (1) prior knowledge on markets, (2) prior knowledge on how to serve markets, and (3) prior knowledge of customer problems. The results of his study show that many types of prior knowledge influence the process of identifying opportunities, which can be developed in different functions and roles. As Costanzo et al. [39] argue, the resulting idiosyncratic prior knowledge advantages individuals not only to recognize opportunities at hand, but also to draw parallels between markets by *connecting the dots* between relevant, complicated information from one market to another. The items measuring prior knowledge in this study only related to the content of the case from the OI task. The role of prior knowledge and, accordingly, its measurement might be way more complex and extended, which might explain the lack of relationships between prior knowledge and the three outcomes of OI as used in this study.

**5.2. Strengths and Limitations.** We administered computer-based simulations of complex and dynamic problems to

obtain a performance measure of CPS in order to clarify the relation between OI and CPS. Conversely, previous quantitative research has employed self-assessment questionnaires instead of cognitive performance measures (for a recent review, see [71]) or has obtained performance measures from paper-and-pencil-based assessment tests (e.g., [68]). What these very different approaches have in common is that they cannot account for complex and dynamic tasks as they occur during entrepreneurial activities (e.g., [62, 72, 73]). Neither self-reports nor paper-and-pencil-based performance measures assess the interaction between a person and a dynamically changing task. However, if such complex interactions with dynamic tasks play a role in implementing entrepreneurial activities, as repeatedly proposed in this article, research cannot spare the advantage of computer-based assessments to simulate such problems under controlled conditions. In fact, our results support the application of computer-based assessments to examine and better understand entrepreneurial activities.

Simultaneously, this study revealed several limitations and the need to modify scales and procedures in future research. First of all, except for a measure of problem-solving self-concept and prior knowledge, cognitive covariates and moderators (e.g., GMA and divergent thinking) were not included in our empirical study, although these abilities influence how people process information in general [74] and have previously been examined in the context of entrepreneurship outcomes (cf. [68]), such as OI.

Second, deviating results could be due to the choice of (a) sample or (b) instruments. (a) The sample size was rather small, and, consequently, the power was small. Therefore, the significant results have to be interpreted with care. The age and experience ranges in our student sample were restricted, which may have disguised stronger empirical relations as the sample was composed of young would-be entrepreneurs between 21 and 31 years of age who, due to their lack of practical entrepreneurial experience, could not provide additional information on entrepreneurial success or number of innovations. (b) The independent variable (i.e., CPS) and the dependent variables (i.e., the number of comprehensible ideas, concreteness, and flexibility) were merely indicators for real-life performance in solving complex problems or in identifying opportunities. These constraints came along with detriments to external validity and generalizability and thus reduced the interpretability of the results. However, as the real-world performances of experts in CPS and entrepreneurial tasks are rare and are hardly observable events [39, 75], the observation of fictional task performance in students who are being prepared for entrepreneurial careers was a feasible means for obtaining the first empirical evidence of a relation between CPS and entrepreneurial activities.

**5.3. Future Research.** First of all, in terms of research design, other variables could be included in the research design of which earlier research has shown that they are related to either CPS or OI, such as GMA and divergent thinking [68, 74]. Furthermore, the relationship between CPS and OI

could be investigated among different groups of people, such as independent entrepreneurs and entrepreneurial employees. Such research would provide insight into the relationship between OI and CPS in different settings.

Second, future study designs should use longitudinal data and intervention studies in order to enable the study of temporal dynamics or conclusions about causality and training effects on CPS and entrepreneurial activities (cf. [76, 77]). In their experimental study, DeTienne and Chandler [52] found that creativity training had a stronger effect on the innovativeness of generated ideas by students, compared to the number of generated ideas. Apparently, creativity influenced the quality of the generated ideas, which is in line with the results of the current study that carefully suggest that CPS also impacts the quality of ideas. In future research, the influence of training CPS on the OI capabilities of students could be tested in order to investigate whether CPS has a similar effect as creativity on OI capabilities.

*5.4. Practical Implications.* As stated, it is difficult to disentangle what should be taught in EE when following the broad definition [3]. As a response to critique of that kind, educators increasingly engage students in alternative ways of learning, such as experimentation and real-world start-up practices (for details, see [78]). If solving complex problems is part of what individuals do on their journey towards new-value creation, as the present study suggests, CPS could possibly contribute valuable skills to EE. Per definition, skills are modifiable through practice and training [79]. It follows that CPS skills are precisely what the name implies—a set of skills that can possibly be sharpened with instruction and practice. Previous empirical findings point to the possibility of increasing CPS and related skill with instruction and practice, at least in the research lab [80–85].

More specifically, educating CPS skills could be part of the so-called progression models. In a progression model, learners gradually learn to act entrepreneurially over levels and grades in the educational system [3]. Such progression model could start at primary education, where learners can develop their CPS skills by actively engaging in everyday problems and challenges of society and technology that are in particular dynamic and change over time and with interaction. Later, in secondary and higher education, teaching gets a stronger focus on learning curriculum knowledge. Accordingly, then, more domain-specific entrepreneurial capabilities, such as OI, could be taught.

However, dating back to the beginnings of institutionalized education, initiatives to enhance CPS are still in their infancy without a unified underlying conceptual framework and valid instructional methods [86]. A significant obstacle hindering more practical considerations of CPS in assessment and education has been the absence of valid, reliable measures of the underlying construct. This hindrance has recently been overcome as the application of CPS tests in PISA 2012 [17] and first validation studies on CPS in the educational sector reveal (e.g., [19–21, 58]). Accordingly, assessing CPS skills in EE could be a very first step towards weaving CPS into EE.

## 6. Conclusions

Our empirical research identified weak but significant statistical relations supporting that CPS plays a role in the application of OI in the early stages of entrepreneurship. With the study's limitations in mind, the results pointed towards CPS as a domain-general predictor of entrepreneurial activities. Starting from the preliminary evidence we have, we suggest that whether an individual successfully identifies an entrepreneurial opportunity and thereby solves a complex problem in a dynamic and previously unknown task environment will depend in part on his or her CPS level. However, our findings also need to be replicated and substantiated in the future. For the time being, our contribution to entrepreneurship research is an empirical study in which we evaluated whether CPS plays a role in the application of OI of students who are presumably much affected by the complex and rapidly developing technological advancements of our times. Accordingly, integrating CPS skills in EE would be highly valuable as it is a generic skill that has potential linkages with a crucial entrepreneurial capability, namely, OI, and that fits the broad definition of EE with value creation at its core.

## Conflicts of Interest

Samuel Greiff is one of two authors of the commercially available COMPRO test that is based on the multiple complex systems approach and that employs the same assessment principle as MicroDYN. However, for any research and educational purpose, a free version of MicroDYN is available. Samuel Greiff receives royalty fees for COMPRO.

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## Review Article

# In Search of Alignment: A Review of Impact Studies in Entrepreneurship Education

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This study uses the concept of alignment as a framework to examine empirical research on the impact of entrepreneurship education interventions on students. Alignment assumes that effective instruction requires congruence between three instructional components: intended outcomes, instructional processes, and assessment criteria. Given the extant diversity and complexity of entrepreneurship education impact, scholars have not been able to explain how teaching approaches and methods are being adjusted to the variety of expected outcomes. In order to address this gap, we critically reviewed the published empirical studies on entrepreneurship education impact in 20 journals over a 15-year period (2000–2015). We found 16 empirical studies that met our inclusion criteria. Our findings revealed that teaching objectives, teaching methods, and teaching content receive scant attention from researchers. This study will be of value to scholars researching the impact of heterogeneous entrepreneurship education practices and approaches on individuals. Our analytical framework could contribute to less contradictory findings of entrepreneurship education impact studies. We also identify research limitations and suggest avenues for future research.

## 1. Introduction

The impact of entrepreneurship education has received increasing attention in recent review studies [1–6]. Prior reviews have for the most part used a methodological rigour lens examining extant empirical studies on entrepreneurship education impact [2, 3, 7]. Consequently, entrepreneurship education researchers are aware of the methodological weaknesses pertinent to the extant literature and have recommendations as to how to overcome them. Yet, scholars have not been able to explain whether the teaching approaches and methods are adjusted to the various expected outcomes [8], particularly given the diversity and potential complexity of the entrepreneurial learning outcomes that educators might impact [9]. This study attempts to address this gap by asking how have the objectives, delivery modes, and impact assessment been aligned in empirical entrepreneurship education literature?

It is customary to differentiate between a “narrow” and “wide” view on entrepreneurship in education. The narrow definition assumes that individuals should be encouraged

to start up their own businesses, while the wide definition puts emphasis on making individuals more opportunity oriented, creative, self-reliant, proactive, and innovative [10]. The definition, that one adheres to, affects educational objectives, content design, target audience, teaching methods, and assessment procedures, leading to a vast variety of existing approaches [5]. In the context of this study, we support both views and define entrepreneurship education as a diverse and eclectic phenomenon. It implies that we study entrepreneurship education interventions that employ various curricula and teaching methods as well as outcomes.

Consistent with Rideout and Gray [7], we conducted a literature review of relevant empirically based studies between 2000 and 2015 (we include articles published until January 1st 2016). Following Henry et al. [11], we performed a within-journal search. We targeted major entrepreneurship and small business journals and management journals and added two specific journals that widely publish on the topic of entrepreneurship education. We brought the concept of alignment into focus to examine identified empirical studies. In carrying out this research we applied a fundamental

concept of effective instruction, instructional alignment, to the entrepreneurship education literature on impact assessment. The evaluation of impact is a key dimension of any teaching intervention and therefore requires to be taken into consideration at the intervention design stage [12]. Impact assessment allows for the evaluation of entrepreneurship education outcomes. As there is a stream of research concerned about the impact of entrepreneurship education in higher education [6, 7, 13], there is a need to analyse the current knowledge; thus our focus is on entrepreneurship education at the university level. We undertake a literature review of empirical impact studies according to the new analytical lens over a 15-year period. This paper contributes to extant entrepreneurship education literature by responding to the need for theory-driven frameworks to assess the impact of entrepreneurship education interventions (cf. [10, 12]). Our study should be of value to scholars researching the impact of heterogeneous entrepreneurship education practices and approaches on individuals. Additionally, our suggested framework could contribute to less contradictory findings of entrepreneurship education impact studies, taking into account the fact that it can be replicated to assess a given entrepreneurship education initiative. We believe that our paper adds to the improvement of the quality of research on the impact of entrepreneurship education interventions and corroborates the decisions of education and policymakers to stimulate and further invest in entrepreneurship education initiatives.

This article begins by explaining the origin and essence of the alignment concept. We then introduce an analytical framework that is used for setting up the research context for this study. The methodology section outlines the selection and steps of our search strategy and data analysis approach. Next, we describe the findings from our analysis. Finally, we derive conclusions, briefly state limitations, and outline theoretical and practical considerations.

## 2. The Concept of Alignment

Teaching entrepreneurship represents a system that incorporates many interacting elements: teachers, students, teaching context, learning activities, and outcomes. According to Von Bertalanffy, as cited in Biggs ([14], p. 350), any system with elements that constantly interact with each other strives to reach a stable equilibrium. A similar pursuit for balance as well as congruence can be relevant when addressing the issue of impact assessment in entrepreneurship education. One way to attain a necessary congruence between the key elements of entrepreneurship education intervention is likely by adopting the principle of alignment.

According to Cohen [15], the idea of applying the principles of instructional alignment to teaching is not novel, and instructional alignment is a well-established phenomenon in the domain of instructional design. Cohen's [15] research into instructional alignment concluded a positive effect—about four times greater—of the aligned instructional efforts, even from little instructional effort, compared to nonaligned instructions. Further, using the assumption that students construct their own learning, Biggs [14] successfully merged

the constructivist stream of learning with the concept of alignment to create constructive alignment, making it “one of the most widely read, cited and applied conceptual frameworks in higher education” ([16], p. 929).

Indeed, Biggs [14, 17] succeeded in integrating a working version of constructivism with instructional design at three cross points. First, the curriculum—in the form of objectives—is clearly stated in terms of content specific levels of understanding that imply appropriate teaching/learning activities. In turn, the teaching/learning activities require students to do the things that will likely elicit the objectives. And the assessment tasks address those same objectives, proving or disproving whether the students have learned what the objectives declare. The author suggested that the alignment concept constitutes an entirely criterion-referenced system with the highest level of consistency throughout the system [17].

Despite the popularity of this integrative concept for enhancing the quality of teaching and learning [18], this framework has not been examined in entrepreneurship education in detail [16]. For example, Jones [19] used the process of constructive alignment to evaluate a framework for organizing enterprise curricula. More recently, Macht and Ball [16] relied upon the framework of constructive alignment, together with other established educational frameworks, to propose a novel framework for entrepreneurship education. Another indication in extant entrepreneurship education literature of the value of constructive alignment is a study by Mwasalwiba [5], who mentions the usefulness of the alignment concept in guiding the choice of course objectives, course content, and teaching methods, and how the impact of desired outcomes should be assessed.

Following the tenet of constructive alignment that learning is most effective if curriculum objectives, teaching methods, and assessment are aligned, our paper suggests that research on entrepreneurship education can benefit greatly if researchers perceive the principle of alignment as relevant for assessing the impact of entrepreneurship education. In this study, we seek to obtain balance in studying impact assessment, despite the argument that, for some entrepreneurship theory, and thus entrepreneurship education, does not mirror the heterogeneity and intricacy of entrepreneurial practice [20]. Another argument that seems omnipresent is that entrepreneurship education is a young research discipline with a body of knowledge that is still inexplicit. Other reasons include the idea that entrepreneurship education is heterogeneous, which limits standardization across institutions, faculty, and students, and the influence of nonacademic practitioners who teach what and how they like [21]. By looking at impact assessment as an aligned system, we can not only mitigate the existing concerns, but also study the impact of entrepreneurship education interventions in a reasonably effective and consistent manner.

Using the concept of alignment, Table 2 presents the framework used to guide the analytical process of this study. It is recognized that educators readily pursue high-level aims, like teaching for deep understanding, in the courses they offer; however, they usually struggle to break down their aims into explicit objectives [14]. It is a demanding and

important task to both formulate the curriculum objectives and make them meaningful and understandable for students [14]. Entrepreneurship educators should decide for themselves and make students aware of clear objectives they wish to achieve after the course or program is finished. For this reason, *objective(s)* is the first element of our analytical framework.

The next educators' step is intended to develop the teaching/learning activities that specifically respond to the explicit objectives. Teachers are free to select appropriate teaching/learning activities. As Biggs ([14], p. 354) rightly claimed: "selecting appropriate teaching/learning activities is a matter of experience and judgement." Since the activities are nested in the context, it is also the teacher's responsibility to create the environment that will be beneficial and engaging for students to attain required objectives [17]. This step implies that entrepreneurship educators, in spite of their conceptual differences in understanding how entrepreneurship should be taught and a variety of teaching contexts, ought to include teaching/learning activities that support their defined objectives. In order to merge teaching/learning activities and content to be taught into one category, we use the term *delivery mode*, which is the second element in the framework.

The next decision concerns how stipulated curriculum objectives may be assessed. It is essential to apply an appropriate assessment task that permits the evaluation of individual student performance [14, 17]. The decision of how impact will be assessed is critical for entrepreneurship educators and scholars who study impact assessment. It allows students to demonstrate what they have learned with respect to the expectations set up in the objectives. It simultaneously allows scholars to make assessments, interpretations, and clearly convey the effect of educational intervention on students using appropriate assessment methods and indicators. Thus, methods and indicators form our third element, which is termed *impact assessment mode*.

In the context of this study we define intervention in a wide sense: it is any entrepreneurship program, course, or training. Impact assessment focuses on the outcomes of the interventions and seeks for causality between intervention and marked effect or influence. Thus, it leads to the attribution of specific impact measures to specific interventions [22]. According to Hulme [22], predetermined objectives of the intervention are necessary for impact assessment to take place. Knowing the actual impact, we may be able to say something about the effectiveness of entrepreneurship education intervention.

### 3. Method

**3.1. Literature Review.** In order to search for and analyse entrepreneurship education impact studies through the lens of alignment, we conducted an exhaustive and systematic review (see Table 3) of the entrepreneurship education literature (cf. [7]). We identified relevant peer-reviewed journal articles from the past 15 years—between January 2000 and December 2015 (inclusively). We explicitly targeted only empirical studies with university-based (including business schools) students as the focal point (given the

nature of our research goal—to review the impact of actual entrepreneurship education interventions—we deliberately excluded conceptual papers and literature reviews). Our focus on entrepreneurship education interventions in a university setting is governed by a fast-growing body of empirical research on entrepreneurship education outcomes that need to be studied [6]. We built our search and selection strategy on the established method of systematic literature review [18, 23], which has been recognized within the entrepreneurship field in general (e.g., [24–26]) and within the field of entrepreneurship education in particular (e.g., [4, 5]). Following Henry et al. [11] we started by compiling a list of corresponding journals within which to do our literature search. The convenience of using a focused journal-led search method, compared to a general Boolean search across the broad business databases and/or search engines (e.g., [2, 5]), lies in filtering out the resulting search hits from step one [24].

**3.2. Data.** Fourteen out of twenty journals in our set have been selected on the basis of their inclusion in the Association of Business Schools (ABS) Academic Journal Quality Guide (Journal of Business Venturing, Entrepreneurship Theory and Practice, Strategic Entrepreneurship Journal, Journal of Small Business Management, Small Business Economics, Entrepreneurship and Regional Development, International Small Business Journal, Family Business Review, International Journal of Entrepreneurship and Innovation, Journal of Family Business Strategy, Journal of Small Business and Enterprise Development, Venture Capital: An International Journal of Entrepreneurial Finance, and International Entrepreneurship and Management Journal) and the *Entrepreneurship and Small Business* subject field (Journal of Enterprising Culture is omitted, since Scopus does not cover this journal). Such inclusion indicates the quality of the publishing outlets and thus their application to aid reviews of research outputs [27]. Four journals represented the Academy of Management (Academy of Management Journal, Academy of Management Review, Academy of Management Perspectives, and Academy of Management, Learning and Education); in addition, we included two journals—Education and Training and Journal of European Industrial Training—that widely publish on the topic of entrepreneurship education and are well-represented in previous reviews (see, e.g., [2, 5, 6]). As previous studies of entrepreneurship education have selected the same journals we view this as a shared agreement on the fact that those are being recognized as the most important on both submission and publication levels in the area of entrepreneurship education. This is particularly the case of Education and Training and the Journal of European Industrial Training. We did our searches through Elsevier's Scopus using a generic Boolean keyword search including one string: (entrepr\* OR enterprise) AND (education) in the title, abstract, and key words fields. The entire process of our systematic search is illustrated in Figure 1. The first step generated 615 hits. In the next step, we conducted a manual review of each of the 615 hits. During the first round of screening, one of the coauthors manually examined the titles and abstracts, excluding all nonempirical studies. Next, both authors went

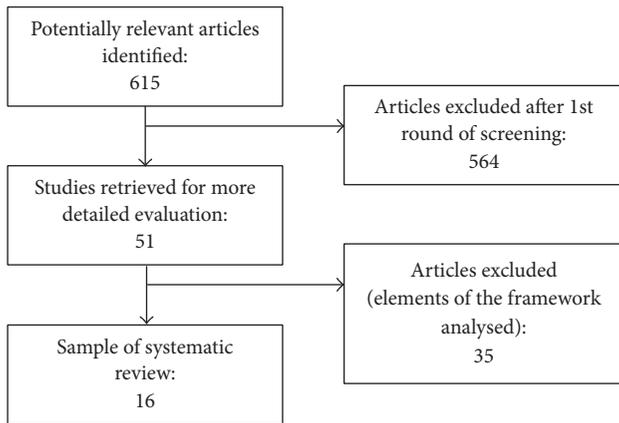


FIGURE 1: Systematic review flow diagram.

into the main body of the remaining articles and filtered them out based on the following relevancy criteria: (a) university-level students (including business schools) being involved in an entrepreneurship education intervention and (b) some type of impact assessment taking place. A total of 51 studies were identified that met our filtering criteria.

In the next step, a perusal of each article was conducted by the authors to decide if the article provided sufficient information for each element of the analytic framework. This step was especially time-consuming and required not only meticulous reading but also substantial reflection as the majority of studies were not explicit about their objectives, delivery mode, and impact outcomes. The third step refined our results to a total of 16 empirical studies which were included in the review process. We developed a detailed reading guide with particular emphasis on the three categories of our analytical framework. A variety of other categories like intervention type (e.g., program, course, and training), key research question, focus or purpose, and methodological approach were also included in the guide (see Table 4).

The authors together constructed a reading guide that allowed us to analyse each study in detail. First, the authors analysed 5 out of the 16 articles and filled in the guide independently and discussed and agreed on definitions and conflicting interpretations. This step allowed ensuring a high-level of reliability. Next, the authors read the residual manuscripts independently and discussed discrepancies if any occurred. The reading guide was employed by the authors to manually fill in the categories presented in the guide, particularly emphasizing objective(s), delivery mode, and impact assessment mode adopted in the articles. Since the three elements of our analytical framework were not always stated explicitly, the authors needed to read the articles while carefully pondering the substance of the three elements. Table 5 presents a finished table with the results for objective(s), delivery mode, and impact assessment mode from our review, while Table 6 introduces snippets of some of the evidence collected from our review. The next section introduces the findings from our review of the 16 published research articles.

## 4. Results

*4.1. Descriptive Analysis.* Table 1 summarises the identified empirical articles that fulfilled our selection conditions, specified by journal. The results show that no article was published before 2006, while 5 articles were identified in the 2006–2011 period and 11 articles were published between 2012 and 2015. Table 1 also shows that studies are not spread across many journals. Only a handful of journals, 6 of the 20 initially selected outlets for our review, are represented in the table. Both Education and Training and Journal of Small Business Management are the top two journals, with 4 and 5 relevant studies, respectively. The lack of studies published in other journals could indicate that the concept of alignment was not embraced due to its novelty and lack of detailed examination in the field of entrepreneurship education.

Our review of 16 studies showed that a variety of definitions have been applied to determine the boundaries of entrepreneurship programs. First, we observed that some studies lack explicit definition of which intervention type has been studied [28] and may change terms throughout a study [13]. Second, our analysis also reveals that the interventions vary greatly in duration and at times do not match what one would consider a program or course. For instance, a bundle of studies did not report on the time period for the intervention [25, 29, 30]. Yet, others define a course that may last between three days or twenty-four hours of class in total [1] to one semester [31]. Similarly, articles with a program specified as an intervention face a similar trend. Two studies report a six-week program [32, 33], while other programs carried on for twelve months [34] and around five months [35], respectively.

A review of the theoretical perspectives adopted in our selected studies indicate that the Theory of Planned Behaviour holds a dominant position. Two studies do not specify any theoretical stance [33, 36]. Other theoretical perspectives, such as the action regulation theory, human capital theory, and structuration theory, are used and tested in isolated instances [28, 32, 37]. With regard to methodological approaches, the absolute majority of the studies are quantitative ( $n = 12$ ). There are only four notable exceptions with one qualitative article [25], and three others which employ a mixed method approach [28, 31, 32]. Among all the studies, questionnaire is the most common instrument for data collection, while researchers also used interviews as a data collection method [25]. Further, we structure the analysis according to the three elements of the analytical framework, drawing upon selected data from the studies to exemplify our points.

*4.2. Objectives of the Interventions.* The analysis shows a diverse set of program/course objectives. The objectives span from being unspecified [35, 38] through the rather generic to the more specific. Objectives like the “programme is targeted to final year students in higher education institutes who are interested in undertaking business opportunities in the future before they graduated” ([30], p. 607), “the programme aims to prepare students for an entrepreneurial career, specifically to prepare them for establishing their own businesses” ([34], p. 192), or cultivate professionals [36]

TABLE 1: Empirical impact studies published in each journal 2000–2015.

Journal title	Publication period			Total
	2000–2005	2006–2011	2012–2015	
Academy of Management Learning and Education	0	0	2	2
Education and Training	0	2	2	4
International Entrepreneurship and Management Journal	0	1	2	3
Journal of Business Venturing	0	1	0	1
Journal of European Industrial Training	0	1	0	1
Journal of Small Business Management	0	0	5	5
Sum of articles	0	5	11	16

TABLE 2: Impact assessment elements.

Objective(s)	Delivery mode	Impact assessment mode
Objective(s) that entrepreneurship educators need to communicate to students and wish students to attain.	Teaching/learning activities and teaching content that support educator's defined objective(s).	Assessment methods and impact measures that clearly convey the impact of an educational intervention.

offer a good illustration of the generic motive throughout some studies. We argue that there is no clear delineation of implicitly formulated objectives in these generic motives. With regard to more accurate objectives, some educators set to raise students' awareness about entrepreneurship and its key related issues [1, 8] or encourage an enterprising student mindset [25] as their objective. Others take a step forward and divide their objectives into two parts: encourage students to consider an entrepreneurial career and provide entrepreneurial skills and knowledge of the business planning process [29]. For example, Fretschner and Weber [31] take a composite approach to stating objectives. The authors aim at changing individuals' belief systems that that will ultimately drive their attitude toward entrepreneurship, make students aware of self-employment as a viable occupation in the future, and have an effect on an individual's personal attitude toward entrepreneurship.

*4.3. Delivery Mode.* The teaching/learning activities aim to reflect methods that engage students and require of them to perform in the way specified in the curriculum objectives. It is teachers' role to encourage students by enabling appropriate and stimulating learning-related activities. The activities are selected because their function and purpose are meant to be coherent with educators' total teaching system [14]. This review demonstrates that teaching/learning activities can be divided into several categories based on the level of detail found in description. The activities range from unspecified [31] to broadly described [35] to well-articulated [28, 29, 34].

With regard to the broadly outlined methods, Souitaris et al. ([35], p. 574) indicate that "a wide range of activities across all four components (formal teaching of courses, business planning, interaction with practice and university support)" were offered in the program. Similarly, another study briefly says that the program is dedicated to entrepreneurship topics and covered various situations such as starting new venture, acquiring existing businesses, and venturing in corporations [8]. These two examples exemplify vagueness in outlining

delivery mode. By contrast, some authors address the description of teaching/learning activities and content to be taught with a better rigour. Across all 16 empirical studies, there are a number of notable examples of such rigour. One is the paper by Rauch and Hulsink [34] who used various methods: (1) communicating theoretical knowledge through structured lectures, biography analysis of entrepreneurs, and case teaching method and (2) providing practice-oriented classes that involved activities like field projects, mentoring sessions with entrepreneurs, and pitches. Another study by Gielnik et al. [28] reviewed an entrepreneurial training that used active learning approach to cover twelve topics from the domain of entrepreneurship, business management, and psychology in twelve modules over a period of twelve weeks. The modules in this class were chosen based on comprehensive literature reviews of pertinent topics and content in entrepreneurship education.

We found that in the studies with the outlined methods, whether broadly, moderately, or well-articulated, conventional teaching methods (i.e., lectures and seminars, case studies, and class discussions) are dominant, followed by mixed methods (i.e., lectures and practice-oriented classes, lectures and independent projects, classroom session, and field work). This illustrates adherence to traditional pedagogical methods, while also showing evidence of educators' willingness to increase their reliance on the action-learning approach of delivering entrepreneurship education.

*4.4. Measurement of Impact Assessment.* When making a decision about the impact assessment indicator, it is necessary to consider the extent to which it embodies the target objectives of an intervention and how suitable it is for assessing the impact. It can be useful to reverse the question and ask what degree of impact a chosen assessment approach is likely to draw out. Inappropriate mode of the impact assessment of entrepreneurship education intervention might be misguided and even detrimental.

TABLE 3: Steps in the review process.

Stage	Description
1	The researchers compiled a list of 20 entrepreneurship journals. <sup>(a)</sup>
2	The search was limited to articles published in the aforementioned journals in the fifteen-year period between 01/01/2000 and 31/12/2015.
3	Within-journal searches were performed through Elsevier’s Scopus by using a generic Boolean keyword search string (entrepr* OR enterprise) AND (education) in the <i>title, abstract, and key words</i> fields.
4	The above combined searches found a total of 615 peer-reviewed articles.
5	The authors manually examined the titles, abstract, and key words of the resultant articles. The following inclusion criteria were applied: empirical articles, studies of university students involved in entrepreneurship program or course; some type of assessment or evaluation takes place. More in-depth reading of the whole paper was undertaken if the decision to keep or omit the paper was not obvious. As a result, a final sample of 51 articles was selected.
6	Papers were then reviewed using a common reading guide designed by the authors. A special emphasis was placed on the three categories of the analytical framework. A final total of 16 empirical studies were kept for the detailed review process.

<sup>(a)</sup>The first fourteen journals, except for Journal of Enterprising Culture, are in the Academic Journal Guide 2015; four journals are published by the Academy of Management; in addition, two journals extensively publish on the area of entrepreneurship education—Education and Training and Journal of European Industrial Training.

TABLE 4: Reading guide.

(1) Article title
(2) Author(s)
(3) Publication year
(4) Journal
(5) Intervention type (e.g., course, program, training)
(5a) Time period
(5b) Country
(6) Key research question/focus/purpose
(7) Methodological approach
(7a) Quantitative, qualitative, or mixed
(7b) Unit of analysis
(7c) Data collection method
(7d) Sample size
(8) Objectives of the intervention
(9) Delivery mode
(10) Impact measures
(10a) Measure type (soft/hard)
(11) Key findings/results

As may be anticipated, psychological constructs, and student’s entrepreneurial intention in particular, are dominant impact measures (e.g., [8, 35, 38, 39]). Some studies utilize numerical impact measures. Jones et al. [29], for example, aim at evaluating the impact of the program by measuring the difference of entrepreneurial career aspirations before and after the course using the Likert-type scale and percentages. Mohamed et al. [30] measure participants’ perceptions toward the program using scores from a Likert scale of 1 to 7, indicating that the program develops interest in entrepreneurship (97% of the respondents), provides its participants with the requisite skills to carry out proper business practices (89% of the respondents), and changes students’ perceptions from taking jobs offered by the government and private sector and becoming entrepreneurs instead (86% of the respondents). Interest in starting a business is another

example of a simplistic impact measure used by Van Auken [33] to assess which aspects of the program affected students’ interest in business ownership after graduation.

To assess impact, a number of studies rely on existing scales and methods from extant literature, while some scholars design novel means and suggest new measures. An apparent illustration of the existing assessment means would be the Theory of Planned Behaviour (TPB) by Ajzen [40]. Fayolle et al. [8] employ TPB to measure the impact of the entrepreneurship education program and make use of the questionnaires designed and validated by Kolvereid [41]. Similarly, Souitaris et al. [35] adopted a 3-item measure of career intention proposed by Kolvereid [42]. Entrepreneurial mindset, which relates to the intention to become an entrepreneur, was measured by Solesvik et al. [37] through a Likert-type scale with five statements indicating various aspects of intention suggested by Liñán and Chen [43].

New assessment means and measures are also present in the studies. Rauch and Hulsink [34] designed a list of 19 behaviours, which consists of a representative set of activities associated with the formation of new ventures. It allowed them to not only deduce that the entrepreneurship education program has a positive effect on the intention to become an entrepreneur, but also recognize an impact on entrepreneurial behaviour 18 months after the first course in the program was completed. Gielnik et al. [28] provide another example of a new assessment means and measure. They use entrepreneurial action and business creation to measure the impact of an action-based entrepreneurial training. The study shows that the training has a significant impact on business creation and an effect on entrepreneurial action through action-regulatory mechanisms like action planning, entrepreneurial goal intentions, action knowledge, and entrepreneurial self-efficacy.

Despite the prevalence of quantitative impact assessment measures and methods, our analysis found a study by Jones et al. [25] which used semistructured interviews with 122 students to qualitatively assess a perceived impact of the course on entrepreneurial attitudes, motivations toward an entrepreneurial career, and attitudes toward the learning experience.

TABLE 5: Summary of empirical impact studies.

Author(s)	Year	Objective(s)	Delivery mode	Impact measure(s)	Data collection instrument(s)
Gielnik et al.	2015	Start and operate a microbusiness such that it makes profit within the training period of 12 weeks under real business conditions.	<p>The training can be described as action-based entrepreneurship training.</p> <p>Twelve topics from the domains of entrepreneurship, psychology, and business administration were included to provide students with comprehensive skills in entrepreneurship. Examples of such topics are identifying business opportunities, marketing, financial management, networking, acquiring starting capital.</p> <p>The training content was taught in form of action principles and active learning (learning-by-doing).</p>	Entrepreneurial action; business creation.	Questionnaires and interviews
Rauch and Hulsink	2015	Prepare students for an entrepreneurial career, specifically to prepare them for establishing their own businesses.	<p>Overall, the program provided theoretical knowledge about entrepreneurship and subsequently uses more and more practice-oriented classes involving active and participative learning philosophies.</p> <p>A variety of teaching methods were used in the program (e.g., lectures, case studies, field projects, mentoring, experiential learning).</p>	Entrepreneurial intention; entrepreneurial behaviour.	Questionnaire
Jones et al.	2008	Encourage students to consider an entrepreneurial career.	<p>The course focused around two key elements: (1) the role and key attributes of the entrepreneur; (2) the development of a viable business idea. The content of the course aimed at informing the nascent entrepreneur in fundamental entrepreneurial knowledge, which included awareness of the entrepreneurial personality and skills required for successful business management and the evaluation of a valid business idea. The course supported multiple pedagogies, including face-to-face and e-learning delivery to provide maximum flexibility in its delivery.</p>	Entrepreneurial career aspirations.	Questionnaire
Jones et al.	2011	Encourage an enterprising student mindset.	<p>The course focused around two key elements: (1) the role and key attributes of the entrepreneur; (2) the development of a viable business idea. The content of the course aimed at informing the nascent entrepreneur in fundamental entrepreneurial knowledge, which included awareness of the entrepreneurial personality and skills required for successful business management and the evaluation of a valid business idea. The course supported multiple pedagogies, including face-to-face and e-learning delivery to provide delivery flexibility.</p>	Entrepreneurial attitudes; career motivations toward and entrepreneurial career; attitudes toward the learning experience.	Interviews

TABLE 5: Continued.

Author(s)	Year	Objective(s)	Delivery mode	Impact measure(s)	Data collection instrument(s)
Mohamed et al.	2012	Not stated.	Participants were exposed to several modules such as business opportunities, marketing, entrepreneurial simulations, and looking at the characteristics of successful entrepreneurs all of which are possessed to help motivate graduates to join the business field. The program was conducted in a classroom environment and there were no field visits.	Perceptions of participants toward the programme (1) to enhance and develop interest in entrepreneurship, (2) to provide skills to perform proper business practices, (3) to change the perception from depending on jobs offered by the government and private sector and instead becoming an entrepreneur.	Structured questionnaire
Solesvik et al.	2013	Encourage students to acquire assets to promote entrepreneurial mindsets.	Two entrepreneurship-specific education modules relate to theoretical and practical issues focusing upon entrepreneurial and business start-up processes. Entrepreneurship was taught through lectures and seminars. A portfolio of complementary activities grouped under 4 components: (1) a "taught" component with 4 modules (accounting, finance, marketing, management); (2) a "taught" component on competencies (self-efficacy, risk-taking, proactiveness) as personality traits and attitudes; (3) a "business-planning" component (business plan competitions and advice on developing a specific business idea); (4) an "interaction with practice" component (talks from practitioners and networking events). Exposition, lecture-discussion, some experiential exercises were typical techniques used in the program.	Intensity of entrepreneurial mindset.	Structured questionnaire
Sánchez	2011	Not stated.	Introduce students to a variety of entrepreneurship, language, and cultural experiences that would help them become more confident in their abilities and interested in starting a new business.	Entrepreneurial competencies (self-efficacy, proactiveness, risk-taking). Intention of self-employment.	Questionnaire
Van Auken	2013	Introduce students to a variety of entrepreneurship, language, and cultural experiences that would help them become more confident in their abilities and interested in starting a new business.	Entrepreneurship component (e.g., lectures on core entrepreneurship topics, small firm visits, independent projects around small businesses) was combined with study abroad learning context (e.g., understanding Spanish culture and language). The course consisted of lectures given by the instructor. A business mentor was invited for coteaching. Successful and failure cases were used to help students to know more about business practices. Lecture contents included entrepreneurial skills, ready skills (i.e., professional innovation ability), and business functional skills (e.g., marketing, risk management, human resources, financial and operational management). Students practiced business plan writing and were asked to present their business plan for starting-up their new business.	Interest in starting a business.	Questionnaire
Chen et al.	2015	Cultivate professionals.	Cultivate professionals.	Entrepreneurial intentions; learning satisfaction; learning efficacy.	Questionnaire

TABLE 5: Continued.

Author(s)	Year	Objective(s)	Delivery mode	Impact measure(s)	Data collection instrument(s)
Souitaris et al.	2007	Not stated.	Activities grouped under 4 components: (1) formal teaching of courses; (2) business planning; (3) interaction with practice; (4) university support.	Entrepreneurial attitudes (attitudes toward self-employment, subjective norm, perceived behavioural control). Intention to become self-employed. Nascency (indication of entrepreneurial behaviour).	Questionnaire
Fayolle et al.	2006	Introduce entrepreneurship as a possible and alternative choice of career for the students.	In terms of content and teaching approaches, the program was entirely dedicated to entrepreneurship topics, covering different situations such as corporate venturing, acquiring existing businesses, and starting new companies.	Perceived behavioural control; entrepreneurial intention.	Questionnaire
Fayolle and Gailly	2015	(1) Increase students' awareness. (2) Encourage students to see in entrepreneurship a potential career option.	The program included the teaching of key concepts of entrepreneurship (1/3 of all classes) as well as team workshops. It focused more particularly on the context and conditions of evaluation of venture creation projects. The main pedagogical approach relied on assessing new venture creation projects on the basis of their business plan.	Entrepreneurial attitudes and intention.	Questionnaire
Fretschner and Weber	2013	(1) Change belief systems that ultimately drive the attitude toward entrepreneurship. (2) Have an effect on an individual's personal attitude toward entrepreneurship. (3) Make students aware of self-employment as a viable occupational option.	The curricular goals of the course were largely in line with a typical awareness program, which implied that students learn about the nature of entrepreneurship; acquire knowledge in fundamentals like entrepreneurs' role in the economy and society, stages of the entrepreneurial process, crucial abilities and key competences used by entrepreneurs, tasks and challenges in the start-up phase.	Motivational antecedents of entrepreneurial intention; students' behavioural beliefs (positive and negative) that underlie students' personal attitude.	Mixed survey questionnaire
Karimi et al.	2016	(1) Increase students' knowledge about entrepreneurship. (2) Influence students' entrepreneurial attitudes and intentions. (3) Encourage students to be job creators rather than job seekers.	The course is classified in the category of "entrepreneurial awareness education." Educators from different universities might use various teaching materials and methods for this course, although the course description is almost the same at every university. Readings, lectures, class discussion, guest speakers, case studies, and business plans are the methods most often employed in the course. The program was centered both on the classroom and intense experiential learning. Students worked in teams of four, with each team assigned to two entrepreneurs. Classroom sessions emphasized the content of how to assist the clients, with modules addressing consulting approaches in the different functional areas of the venture. Fieldwork consisted of time spent in the ventures, interaction with clients, competitors, suppliers, and resource providers. Each team had to assess the venture, establish priorities, and produce a minimum of eight deliverables, four for each of their assigned clients. A deliverable (e.g., enhancing operational processes and flows, implementing bookkeeping systems) was defined as a problem within the venture that was solved by the teams.	Entrepreneurial intention; opportunity identification perception.	Questionnaire/survey
Morris et al.	2013	Provide hands-on consulting support to entrepreneurs that have been in business for one to two years and are struggling to survive but are committed to the venture.		Entrepreneurial competencies.	Survey/questionnaire

TABLE 5: Continued.

Author(s)	Year	Objective(s)	Delivery mode	Impact measure(s)	Data collection instrument(s)
Piperopoulos and Dimov	2015	<p>Two types of courses were distinguished in the study:</p> <p>(1) Theoretically oriented. It aimed at providing students with the ability to analyse enterprise from an international perspective within the context of a wide range of organization studies, management, and social science debates.</p> <p>(2) Practically oriented. It emphasized the development of business skills, self-employment and the small business sector, and occupational awareness of new venture start-up.</p>	<p>(1) Theoretically oriented course. The course was taught by a single lecturer in a stand-and-deliver approach. Students were passive recipients of knowledge. The content of the courses covered topics such as personality characteristics, entrepreneurial traits, opportunity recognition, idea implementation, the risks associated with entrepreneurship and exit. Case studies were used to enrich the normal lecture delivery.</p> <p>(2) Practically oriented course. The course was taught by a team of academics and practitioners. Students worked in teams in self-directed and learning-by-doing environment. The course content covered everything from team building, idea generation, innovation, creativity, business planning, networking, and pitching to investors as well as adapting to change and the unpredictability of the real world and creating “plan-b and exit scenarios.”</p>	Entrepreneurial intention.	Survey

TABLE 6: Snippet samples of evidence.

	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
Authors	Gielnik et al.	Rauch and Hulsink	Fretschner and Weber	Morris et al.	Fayolle et al.
Year	2015	2015	2013	2013	2005
Journal	AMLE	AMLE	JSBM	JSBM	JEIT
Intervention type	Training	Program	Course	Program	Program
Time period	12 weeks	12 months	Semester	6 weeks	One day (9 hours)
Country	Uganda	The Netherlands	Germany	South Africa	France
Methodological Approach	Mixed methods	Quantitative	Mixed methods	Mixed methods	Quantitative
Data collection method	Interviews and questionnaires	Questionnaire	Mixed survey	Survey/questionnaire	Questionnaire
Unit of analysis	Nonbusiness students	Entrepreneurship students	Business students	Students	Engineering students
Sample size	304	74	48	40	20
Measure type (soft/hard)	Soft/hard	Soft	Soft	Soft	Soft
Key findings/results	Training had a significant impact on business creation and business opportunity identification; training had significant effects on entrepreneurial goal intentions, action planning, action knowledge, and entrepreneurial self-efficacy.	Entrepreneurship education had a positive effect on attitudes toward entrepreneurship, perceived behavioural control, and the intention to become an entrepreneur; the intention to become an entrepreneur affects entrepreneurial behaviour.	Personal attitude heavily affects students' decision for self-employment after the entrepreneurship awareness course, while perceived behavioural control is not a relevant predictor of start-up intentions; extrinsic motivation (financial success) displaces intrinsic motives (self-actualization) in an awareness education.	Authors identified idiosyncratic competencies; they also developed measures to determine competency development; competencies can be enhanced based on exposure to an entrepreneurship program.	In the short term, the program had a strong, measurable impact on the entrepreneurial intention of students; it also had a positive, but not very significant, impact on their perceived behavioural control.

This study is a follow-up and builds upon the quantitative evidence within Jones et al. [29], whose study is also included in our final sample. Jones et al. [25] aimed to provide a rich body of evidence to confirm that entrepreneurship education can have a positive impact on both entrepreneurial attitudes and entrepreneurial career choices.

A study by Fretschner and Weber [31] and another by Morris et al. [32] are noteworthy for their mixed method research designs. Fretschner and Weber [31] relied on the mixed method to measure and understand the impact of an entrepreneurial awareness course on students. The qualitative strand was used to gain insight into the formation of students' personal attitudes toward the entrepreneurial behaviour by understanding their behavioural beliefs. The beliefs represent drivers with positive (e.g., independence, financial success, and self-reliance) or negative (e.g., risk, workload, and responsibility) attitudinal change toward entrepreneurship. The authors designed and used open-ended questions to elicit students' basic behavioural beliefs about self-employment, which were critical to trigger in students by the course. Morris et al. [32] employed a multi-round Delphi technique to form a list of core entrepreneurial competencies by asking 20 distinguished entrepreneurs and 20 leading entrepreneurship educators. After a final set of 13 competencies was produced, the authors developed a set of self-reporting measures to assess progress in mastering each competency after being involved in a program.

## 5. Discussion

The aim of this study was to review the entrepreneurship education literature on impact assessment by employing the concept of alignment. In doing so, we sought to develop a more complete understanding of the relationship between entrepreneurship education and its impact on individuals. Our review revealed several key findings that we discuss below.

The first key finding in our study relates to empirical impact studies where scholars are concerned with describing entrepreneurship education interventions. Sixteen studies met our inclusion criteria and provided descriptions, with a varying level of detail, of the interventions, including objective(s) and delivery mode. This finding partly supports the claim by Fayolle et al. [44] that there are scant empirical data reporting teaching beliefs, real practices, and outcomes for learners beyond entrepreneurial intention. Despite the fact that the teaching beliefs are not part of our review, we have observed that entrepreneurship education practices are rarely well-documented in the empirical studies in our final sample. Scholars are not preoccupied with giving a detailed account of the intervention, particularly the objective(s) and delivery mode of the entrepreneurship education intervention. This finding is also consistent with Rideout and Gray [7] who state that some researchers, as other reviews discovered, do not provide sufficient information about their entrepreneurship education programs.

Our second noteworthy finding relates to the concern by Fayolle et al. [44] with regard to the outcomes. Indeed,

regardless of which intervention the students were part of, the authors' choice of the impact measures converged toward entrepreneurial intentions, making intentions a prevalent outcome for individuals. While the formation of entrepreneurial intentions after an intervention is a legitimate outcome, authors avoid or omit detailing the linkage between the objective(s), delivery mode, and the formation of intentions. We argue that researchers, when using entrepreneurial intentions and their motivational antecedents to assess the impact of an entrepreneurship education intervention, should provide a sound explanation of what type of intervention is being assessed. For example, awareness program or course aims at changing students' belief systems that ultimately drive the personal attitude toward the entrepreneurship and hence entrepreneurial intention [31]. Further, we do encourage researchers to go beyond using entrepreneurial intentions as an outcome of the impact. Our review revealed other outcomes like entrepreneurial action and business creation [28], entrepreneurial career aspirations [29], and entrepreneurial competencies [38]. Overall, quantitative measures dominated in the studies. Consistent with [6], we believe that the dominance of quantitative measure has been predisposed by the direction of a fast-growing body of empirical research on entrepreneurship education outcomes. Researchers have tended to focus on subjective and short-term impact measures such as entrepreneurial attitudes and intentions. Finally, we identified a variety of impact measures that are used by scholars. Nevertheless, we can conclude that a positive effect of entrepreneurship education interventions prevails, whatever impact measure entails.

The third key finding is that objectives are, with only few exceptions, outlined poorly and in vague terms. Interestingly, the failure to define specific objectives is found not only in less impactful journals in the field of entrepreneurship, but also among top-ranking publication outlets. A review of the teaching objectives outlined in the selected studies indicates poor efforts to define clear and specific objectives. This observation leads us to hypothesizing that such poor efforts are made by either educators in those interventions or scholars who did not commit to investigating the objectives of program and courses. Hence, although the educators might have high-level aims, they are prone to make a common mistake of not descending "from the rhetoric of their aims to the specified objectives" ([14], p. 351). Moreover, the issue of contradictory objectives in a single intervention—educating about, for, and in entrepreneurship—prompts a haphazard selection of teaching methods and content [5]. Thus, less consistent outcomes are to be expected if the diversity of objectives remains. A fundamental assumption that a marked impact is generated when objectives are stated in a clear manner should be of important concern to educators and entrepreneurship scholars who research into the impact of entrepreneurship education interventions. Moreover, when one sets up referencing criteria in terms of objectives, she/he facilitates the process of setting up both teaching and assessment agendas [14].

Similarly, we noted that a description of the delivery mode of the interventions receives lack of attention from scholars. When researchers describe interventions, they tend

to be generic and omit or perhaps intentionally avoid details that might be important to other scholars who study impact assessment or educators running a similar course or program. It could be argued that such behaviour is counterintuitive, given the notion that teaching methods are not an end per se and are instead selected to achieve particular course or program objectives [12]. What to teach (content) is equally as important as how to teach (teaching methods), and both follow objectives. Our review suggests that traditional approaches to teaching, which are ascribed to teaching “about” entrepreneurship and aim at providing a general understanding of entrepreneurship [10], prevail in the studies. Yet, we have also observed the evidence that educators are moving toward and adopting teaching “for” and “through” entrepreneurship, despite the challenges (e.g., resource and time constraints, cost implications, and assessment challenges) that these approaches were facing [45].

A fourth and probably not surprising finding is lack of alignment between objectives, delivery mode, and impact assessment. One possible explanation is that a requirement to document entrepreneurship education intervention has not been seen as an important priority by scholars and reviewers. Even if authors make an effort to report learning objectives and delivery mode, they seldom link them to impact. A choice of impact assessment measures and methods seems to have been a dominant focus for scholars while conducting research on the impact of entrepreneurship education. In other words, the research has been driven by the notion of impact without paying much attention to the coherence between the three elements—teaching/learning objectives, delivery mode, and impact assessment mode. Another explanation is that scholars may not feel comfortable or motivated to approach educators whose diverse entrepreneurship programs or courses they research on. Thus, they report shallow information about intervention’s objectives or delivery mode without delving into details. We argue that applying the principle of alignment may allow researchers to increase the comparability between the studies, despite different curricular and instructional designs of the entrepreneurship education interventions. Such differences have been seen as part of the reason why some entrepreneurship education impact studies arrive at contradictory results [31].

## 6. Conclusions

In this article, we asked: How have the objectives, delivery modes, and impact assessment been aligned in empirical entrepreneurship education literature? According to our knowledge, the current study is the first review that has used the concept of alignment to examine entrepreneurship education impact studies. Our review focused on studies of university-based entrepreneurship education interventions from 2000 through 2015 that attempted deliberately or unwittingly to depict at least two out of three elements of the analytical framework we employed.

The study revealed sixteen empirical studies that met our inclusion criteria. Thus, we argue that the principle of alignment remained distant from being taken into consideration. First, we suggest that this is the case because the concept of

alignment is new to the field of entrepreneurship education; therefore, it has not been sufficiently examined yet. Second, it could also be the case that entrepreneurship journals do not require from scholars to provide elaborate descriptions of entrepreneurship education interventions in impact studies. Our findings did demonstrate that scholars are not used to giving significant attention to both course or program objective(s) and delivery mode, making focus on impact a driving force in the studies. Presumably, the better the practitioners demonstrate the first two elements—teaching objective(s) and delivery mode—the better the scholars are able to take them into account when using existing or designing new impact assessment methods and measures.

As Rideout and Gray ([7], p. 346) suggested, entrepreneurship education seems to be a phenomenon “where action and intervention have raced far ahead of the theory, pedagogy, and research needed to justify and explain it.” Likewise, research on impact assessment of entrepreneurship education interventions has raced ahead of the theory needed to confirm and explain it. The framework we suggested can facilitate the process of balancing out the race between research and theory.

Even though the framework offers an applied and theoretically grounded approach to study the impact of entrepreneurship education, the paper does not propose that this is the only suitable approach. It presents value for policymakers, educators, and researchers who have differing interests and theoretical orientations with regard to entrepreneurship education [5] and do not endorse one-approach-fits-all model of entrepreneurship education [46]. On that premise, we believe that the framework is useful due to its embedded flexibility in embracing the heterogeneity of educational practices and approaches adopted in entrepreneurship education, which should be appreciated, according to Jones and Matlay [47]. To assess the impact of an entrepreneurship education intervention on an individual effectively, the framework can be enacted to align the endless variations of objective(s), teaching methods and contents, and impact assessment methods and measures. Furthermore, the framework could also be empirically replicated to assess a given entrepreneurship education initiative. Based on our review, we may conclude that the elements of the framework have been poorly aligned in the empirical studies we examined.

*6.1. Limitations and Avenues for Future Research.* While our work contributes to the knowledge on impact assessment of entrepreneurship education, we acknowledge that it has its limitations, which imposes restrictions on how one should interpret our findings and conclusions. First, similar to Henry and Foss [24], we accept that a specific number of particular journals and investigation time periods may have led to the omission, although unintentional, of some relevant articles. Indeed, although we have reviewed a small sample size, it was purposeful and the articles included in our study underwent a peer review process in corresponding journals, which can serve as a proxy for a minimum quality control [23]. Second, extra insights could be gained by looking for studies listed in citation databases like Business Source Premier and/or Web of Science and increasing search time frame.

There are a number of avenues for future research that arise in light of our findings. A way forward for future research could be to generate richer methodological research. One avenue could be to utilize a longitudinal research and a mixed method approach more often in order to both attribute specific impacts to specific entrepreneurship education interventions and also provide an interpretation of the processes that take place in the intervention and of their plausible impacts.

Another avenue, which is in line with Rideout and Gray [7], could be well-designed case studies to identify important mediators, including objectives, teaching methods, and taught content, in entrepreneurship education interventions, and understand how they function and exert influence upon individuals using rich and insightful data. Entrepreneurship education interventions do not operate in isolation. The context that surrounds them has an influence on them. This includes educators' beliefs about the teaching objectives they would like to attain, the delivery mode to be utilized, and the impact to be made. Scholars could take advantage of a case approach to better elucidate the complex nature of the impact of entrepreneurship education, which is a context-embedded phenomenon.

Finally, in future research we encourage scholars to increase the relevance and practical usefulness of research on entrepreneurship education impact to practitioners. This could be achieved not only if researchers and practitioners apply their joint efforts to interpret the results of the research [48], but also if scholars talk to practitioners beforehand and ask for specificities around each entrepreneurship education intervention they plan to conduct research on. We believe that by bridging both communities (research and practice) to study the impact of entrepreneurship education, we help to make explicit taken-for-granted assumptions about teaching objective(s), delivery mode, and impact assessment methods and measures, as well as their congruence with each other.

## Disclosure

An abstract and an early version of this article were submitted, but not presented, to NORSI Research School Conference 2016.

## Conflicts of Interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

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## Review Article

# Competence Models as a Tool for Conceptualizing the Systematic Process of Entrepreneurship Competence Development

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Entrepreneurship Education (EE) is believed to be an important key to supporting learners to become entrepreneurial, which means it needs to be approached systematically. Competence models provide a platform to meaningfully embed varying interpretations, learning outcomes, and roles of EE and allow educators and other stakeholders to apply EE systematically throughout all education levels. The aim of this study was to understand how systematic entrepreneurship competence development throughout the education levels is conceptualized in different EE competence models. In other words, what are the critical aspects to consider while constructing systematic competence models for EE purposes? The results of the analysis of the competence models help educators, school boards, policymakers, local municipalities, researchers, and other relevant stakeholders to obtain a clearer understanding of how EE learning outcomes can be systematically achieved at all education levels. However, lacking empirical proof regarding the impact of the models' application, these models represent the "optimal set" of expected competencies for specific education levels and types. In its original form, a competence model established for a specific education system is unlikely to fit the needs and aims of other education systems. Thus, it is recommended that any model be adapted to a specific need and with a focus on learning outcomes.

## 1. Introduction

Entrepreneurship, defined by many as the creation and management of new ventures, allows innovation in products, services, and markets, generates jobs and supports competitiveness, and is thus considered as one of the key drivers of the economy [1, 2]. Society in its broader meaning, however, is improved not only by entrepreneurs but also by individuals with entrepreneurship competence (set of knowledge, attitudes and skills for opportunity recognition and exploitation, value creation, and action orientation). Such individuals are more prone to identify problems and take actions, enhancing social as well as economic well-being [3, 4]. Entrepreneurship Education (EE) is seen as a major driving force to enhance the development of entrepreneurship competence [3–6]. Thus, it is important to have a systematic approach to EE on all education levels to prepare learners to become entrepreneurial.

Learners need an understanding of how different cultural contexts enable innovation from early on and how youth and adults can stand ready to succeed in an entrepreneurial economy [7]. Hence, it is crucial to identify and compare how entrepreneurship competence can be developed systematically throughout the different education systems and levels.

In the European context, national EE strategies (which are the basis for systematic competence development) vary to a large extent. Firstly, there are specific strategies focusing solely on EE, which establish a common vision for various policy fields like education, innovation, and economic development (e.g., Estonia, Sweden, Norway, Finland, Belgium, Germany, and Wales). Secondly, many countries have broader education-related strategies that consist of aims for EE-like education and training, youth development, and/or lifelong learning strategies (e.g., Greece, Bulgaria, Latvia, Austria, Turkey, and Serbia). Third, there are broader

economy-related strategies that feature EE as a part of business, employment, and/or SME development strategies (e.g., Lithuania, Romania, Spain, and Scotland) [5, 8, 9]. The systematic development of entrepreneurship competence in different countries is thus examined in the context of national EE strategies.

On an individual level, less than one-fourth of the students in EU member states have been said to have participated in an entrepreneurship-related course or activity at school, and a great number of 15-year-olds lack basic problem solving skills [5]. The reasons for this vary: more than half of the countries have very few or no guidelines for specific teaching methods, very few countries include practical entrepreneurial experiences as a mandatory, regular part of their curriculum, EE learning outcomes are fragmented in most EU countries, and there is insufficient assessment of the EE learning outcomes [5, 10]. Although most of the EU member countries have shown an increase in developing EE, many countries have inconsistencies in their systematic development of competencies from primary through secondary and tertiary education. For example, in Estonia, France, and Italy, the cross-disciplinary (or other compulsory) EE-related activities in primary education are replaced or even duplicated by elective entrepreneurship courses at the successive education stages, making the competence development random [5, 11]. Thus, competencies laid down from the grassroots in primary school are not developed sustainably at the successive education levels. Also, in many countries like Estonia, Lithuania, Germany, and Spain, numerous initiatives in public and private sectors are run independently and with no plans for a coordinated systematic of competence development [5, 8, 11]. To increase the impact of EE and help teachers to understand the ways entrepreneurial competencies can be developed, a more coordinated approach to the gradual development of EE is needed [5].

Following this line of thought, the aim of the present study was to understand how various EE competence models conceptualize the systematic progress of developing entrepreneurship competence throughout the education levels.

## 2. The Need for a Systematic Approach to Competence Development in Entrepreneurship Education (EE)

*2.1. Theory: Competence Development and Competence Modeling.* Competence models and competence-based education have become widely spread throughout different fields of education as a central, strategic tool for educational development and integrating education with training and lifelong learning (e.g., The European Lifelong Learning Strategy, the OECD initiated *Definition and Selection of Competencies: Theoretical and Conceptual Foundations*, and others) [12–14]. McClelland [15] and Wesselink and Wals [16] complement the previous, stating that using competencies helps to describe human behavior associated with high job performance and thus they can be applied in strategic workforce planning, training, motivating, and performance management.

There are many definitions and classifications related to the terms competence/competences and competency/competencies. Le Deist and Winterton consider these terms useful in bridging the gap between education and job requirements [17]. Weinert adds that there are many different theoretical approaches for conceptualizing competence [18]. For example, various researchers define competence as sets of combined behaviors (knowledge, skills, and attitudes) that are important in the distribution of desired results (carrying out the task) in specific contexts [16, 19, 20]. Jensen and Schnack [21] highlight the aspect of action in their competence description, elaborating it as the ability to act now and in the future, taking responsibility for one's actions. Mulder et al. [22, p. 757] claim that “competence is seen as a series of integrated capabilities consisting of clusters of knowledge, skills, and attitudes necessarily conditional for task performance and problem solving and for being able to function effectively in a certain profession, organization, job, role, and situation.” Rychen and Salganik [23, p. 43], in considering the DeSeCo study [13] and Weinert's [18] work, have defined competence as “the ability to successfully meet complex demands in a particular context through the mobilization of psychological prerequisites (including both cognitive and noncognitive aspects).” Following previous lines of thought and considering the context of this article, we can say that entrepreneurship competence is a series of integrated capabilities consisting of knowledge, skills, and attitudes for taking entrepreneurial actions (opportunity identification, evaluation, and pursuit) and creating value (for others and society). In the present study, we speak of the concept of *entrepreneurship competence* to refer to the definition of entrepreneurship competence described above. When we use the term *entrepreneurial competencies*, we refer to the competencies, capabilities, and characteristics that belong to entrepreneurship competence.

The next step after establishing a clear definition of competence is to gain an understanding of how competence models were established and conceptualized. There are various approaches and classifications in the literature that are used for conceptualizing competence, like *action competence* [4, 21, 22], *key competencies* [12–14], *meta competencies* [24, 25], the *demand-oriented functional approach* [23], and others [18]. Recent authors of research have suggested using the multidimensional holistic approach to design educational competence models (as this approach is better aligned with education, learning, and workplace requirements) [16, 17, 26].

It should be noted that the term *competence model*, in this context, refers to the sets of competencies and characteristics forming the competence model. Moreover, it is “a standardized description of specific activities and competencies within a context (considering both the people and work performance perspective) that are necessary to function as a professional in a particular field” [16, 27–29]. Bartram [20] warns that too distinct models are hardly generalizable and overly broad model constructs may fail to apprehend relevant dimensions of performance, that is, dimensions of an observable goal-relevant action/behavior [30, 31]. Mulder [26] claims that competence models generated for education and training should be inclusive and in balance, cover the

whole spectrum of the whole profession, and be functional. Also, competencies should make sense and define a certain field of professional activity, like teaching, entrepreneurship, innovation, or others. Moreover, in education, competence profiles help to update and improve the overall quality of education and training by helping to also consider the needs of the sector or organizations, but only when the competencies are operationalized as unambiguously as possible [16, 32]. Barnett [33] argues that, in the United States, competence-based education failed because of the tendency to decontextualize competence by going into too much detail. Therefore, a distinction between personality- and performance-based criteria is needed with a balance between the two in order to ensure the clarity and understanding of the competence model. However, what the specific criteria for finding the right balance are remains somewhat unclear in the literature.

In sum, we can conclude that a number of criteria should be considered in constructing and conceptualizing competence models for educational purposes and could also be used as a basis for analyzing existing EE competence models. The aim, the definitions, and the approach of the competence model should be explicit and aligned with the purpose. Competencies listed in the models should relate to a specific educational context and have a reasonable balance (distinct versus inclusive) between personality, social context, and performance. Conceptual and operational as well as individual and social aspects of competencies and how these aspects of competencies advance in different education systems should be taken into account. For educational purposes, the whole spectrum of a competence model should be considered.

*2.2. Theory: EE Competence Models and the Aims of EE.* Until recently, only few EE competence models have been reported in the literature of which only two were supported by scientific proof [29, 34]. Another recent trend seems to be the advancement of holistic competence models favoring a gradual development of competence throughout education levels and in relation to qualification standards, hereafter simply referred to as “competence models” (e.g., the Danish model, EntreComp model, and EU model).

In the EE framework, the competence model is seen as a step-by-step advancement in various contexts and with learning outcomes and roles of EE throughout the education system [4, 35]. For teachers, competence models might serve as a practical tool to prepare and monitor learners’ competence development based on their previous experiences during different types and forms of education settings. More specifically, competence models help teachers to establish suitable learning aims, outcomes, learning activities, and assessment methods for their target group [34]. Using EE competence models in planning teaching and assessment allows teachers to set their focus on activities that support the development of entrepreneurship competence in various courses [4], such as engineering, humanities, and mathematics. Also, competence models support teachers in developing learners’ entrepreneurship competence by proceeding with progressively demanding assignments [36]. Thus, competence models help teachers and educators to efficiently enhance learners’

entrepreneurship competence development throughout their schooling [12, 36]. For learners, a competence model is beneficial for progressively accomplishing more complex educational activities in order to develop the competencies needed to discover and create entrepreneurial opportunities [37]. Learners have also been found to learn more if teaching is based on tangible learning outcomes and feedback [38]. For education program managers and curriculum developers, a systematic EE framework allows considering applying the gradual development of entrepreneurship competence and embedding entrepreneurial competencies for intended learning outcomes in the early phase of curricular development [36]. For policymakers, the competence model helps to embed EE learning outcomes in the wider education system. Moreover, a competence model can be considered as the “glue” between the different elements of entrepreneurship competence, including the aims and stages of EE, each successive stage having slightly different but more advanced outcomes regarding the same concepts and elements. Thus, establishing a competence model appears to have a significant importance in systemizing the process of *how*, *what*, and *when* a certain aspect of EE should be taught.

However, competence models are uncommon in the existing literature, and there are an insufficient number of sources critically analyzing current competence models [4]. There is also limited empirical evidence regarding the capability of learners at different education levels, in the EE context [6, 39]. A significant limitation is the lack of efficient assessment methods to measure the impact of EE on entrepreneurial competencies, and thus systematic applications of EE would contribute to mitigating this issue [39, 40]. Also, there is still significant doubt as to what EE learning outcomes and subsequent application methods are most effective and relevant. Hence, to solve the problems arising from the differing elements of EE, a competence model is suggested to serve as a valid solution that would make EE more tangible, measurable, and effective [4, 34–36, 39, 41, 42].

One of the main barriers to establishing a shared understanding of EE has been the differing approach to the term *entrepreneurship*. Does it represent the process of starting and managing a business with scarce resources and changing market conditions [1, 4, 42]? Or does it represent solving social issues and improving life as a whole through various value creation processes by an enterprising person [6, 37, 39]? The former regards a person who seeks to establish his/her own business, and the latter someone who explores and exploits opportunities and possesses entrepreneurial competencies that can be used to create value for others in all fields of life [37, 39, 43]. Based on the previous line of thought, the starting and managing of a business represent the “narrow approach” to entrepreneurship, while exploring and exploiting opportunities with a set of entrepreneurial competencies and supporting value creation in all fields of life represent the “broad approach” to entrepreneurship [39, 42, 44, 45]. The two approaches, narrow and broad, allow setting two different aims for EE: (1) supporting the management of a new business and (2) developing innovative, creative, and enterprising individuals [46]. In this article, we define entrepreneurship as a process where value (economic, social,

and cultural) is created through entrepreneurial actions (opportunity identification, evaluation, and pursuit). Based on this definition, EE can be considered as a learning process that supports the development of entrepreneurship competence, that is, identifying, evaluating, and pursuing opportunities to create economic, social, and cultural value for others. The narrow approach to EE, in this case, focuses on developing entrepreneurial competencies related to value creation concerning creating, managing, and scaling a venture.

Based on the literature, entrepreneurial competencies relevant to the narrow approach include understanding business processes, analyzing the market, developing products, identifying and allocating suitable resources, choosing an appropriate sales strategy, financing the business effectively, and many other aspects [39, 47]. Entrepreneurial competencies suited to the broad approach include sense of initiative, creativity, risk-taking, negotiation skills, the ability to work individually and in teams, leadership skills, ambition, and other aspects [36, 39, 47–49]. Entrepreneurial competencies relevant to the broad approach are targeted at developing and supporting an entrepreneurial mindset in order for people to create different forms of value in different fields of life [36, 37, 48]. These competencies also help learners to succeed in business programs and other complex entrepreneurial assignments that require using entrepreneurial competencies related to the narrow approach [36]. Competencies applicable to the narrow approach can thus best be developed in the presence of an already established set of entrepreneurial competencies of the broad approach [39, 47]. Therefore, in light of the possible gradual development in entrepreneurship competence, learning outcomes should be set appropriately and considered potential target groups. This means considering many variables of the competence development process, which makes assessing and measuring competence development an extremely complex undertaking.

Also, it has been stated that, to maximize the effectiveness of the EE competence models, it is best to start with EE as early as possible, starting with establishing the foundation for entrepreneurial competencies, which is crucial for learners to later on have the prerequisites necessary to choose whether to pursue becoming an entrepreneur in the future [4, 46]. At the higher levels of education, where learners are closer to graduating and finding a job or creating a business, it is considered more relevant for the focus to be on value creation in the narrow approach [4, 39, 46].

In sum, after the literature review and considering the overarching question of how systematic competence development models are constructed and conceptualized in EE, we arrived at the following research questions as a basis for the analysis:

- (1) What are the aim, definitions, and approach taken for constructing the EE competence models?
- (2) How do the EE competence models relate to specific educational contexts?
- (3) How and when are competence levels expected to advance in different education systems?
- (4) What are the entrepreneurial competencies listed in the EE competence models?

Finding answers to the established research questions helps to increase the understanding of the critical aspects of entrepreneurship competence that support achieving well-balanced and systematic competence descriptions in EE competence models.

### 3. Methodology

The process of our analysis started with finding and examining the existing competence models in the literature. The criteria for selecting the competence models for analysis were the following: (1) the competence models have to present a form of entrepreneurship competence development for different levels; (2) some form of gradual development of the competence has to be exhibited; (3) the competence model has to be designed on a national or regional scale; and (4) the competence model has to contribute significantly to the existing understanding of systematic EE.

We found numerous attempts to conceptualize entrepreneurship competence, but most of the models were designed in a specific context that could not be generalized to the broader educational context, did not present the aspect of gradual development, or were not focused on the learner's development per se. A few good examples of well-established models in their particular contexts are the action-based and unified progression models proposed by Lackéus [4, 42] and the conceptual framework (triadic model) for entrepreneurial learning by Rae [50].

Based on the established selection criteria, we arrived at five EE competence models for analysis. These models were (1) the model offered by Gibb [39] (referred to as the “UK model”), (2) the model known as *National Content Standard for Entrepreneurship Education* (referred to as the “USA model”) [34], (3) the Danish model [40], (4) the Norden model (referred to as the “Nordic model”) [41], and (5) the EntreComp model (referred to as the “EU model”) [37], which were, respectively, created in and for the contexts of the United Kingdom, the United States of America, Denmark, Scandinavian and Nordic countries (Denmark, Sweden, Norway, Finland, Iceland, Faroe Islands, and Åland Islands), and Europe.

To answer the first research question, we conducted a comparative analysis by comparing the aims, the definitions, and the approaches to constructing the five competence models and examining how these relate to our definition of EE as described earlier.

The second research question was answered by examining the background of the competence models in order to understand the educational contexts for which they were constructed. This mainly included observing various aspects of the educational context, such as whether models were established on existing parts of the education system, for whom the models were tailored, and how various aspects might affect their applicability in specific contexts.

For the third research question, we compared how the gradual development of competencies is established by finding answers to how and with what timeline the progression is described in the models.

We answered the fourth research question in two phases. Firstly, we examined and matched the competencies of all five models to see which entrepreneurial competencies all of the analyzed models have in common and what the different models focus on. Secondly, as it is not explicitly described how the competencies were chosen for the five models, we aimed to understand what components comprise the entrepreneurship competence described in the models. For this analysis, we organized the competencies in light of the Le Deist and Winterton [17] classification of four dimensions: (1) conceptual competencies related to an occupation, (2) conceptual competencies related to an individual, (3) operational competencies related to an occupation, and (4) operational competencies related to an individual. This categorization and comparison largely confirmed the results of the analysis for the first three research questions, since the comparison of entrepreneurial competencies made the alignment between the aims and definitions more explicit.

#### 4. Results and Discussion of the Analysis

The overall aim of all chosen EE competence models is to gain a common understanding of EE and set learning outcomes for different education levels and to establish a bridge between educational policies, real-life practices, curricular developments, businesses, and other EE stakeholders. Still, the common understanding of EE and its aims and learning outcomes differ depending on the educational context, learners' capabilities at different education stages, national strategies in other related policy areas (e.g., employment and innovation), and many other aspects.

All analyzed models provided descriptions of the competencies within the frame of formal, informal, and non-formal education settings, leaving out preschool. However, as referred to earlier in this study, to make full use of the competence models, it is most effective to start developing entrepreneurship competence as early as possible, preferably even before the general education begins [4, 46].

The varying ways in which the core competence areas are defined in different competence models refer to the different interpretations of EE and its main aims, as well as defining which are best suited to the context in which they were created. Some of the differences between models might be due to, for instance, whether EE is taught as a stand-alone subject or its learning outcomes are embedded with other subjects, or due to the background of the education systems and prevailing skills of learners. To exemplify this further, the United States might have a stronger business approach mainly because of its model's specific focus and aim, but also because of their long history of developing EE [34]. Also, according to Le Deist and Winterton [17], the approaches of the competence models in the USA have been mostly behavioral rather than holistic. In Europe, the first implication of the significance of EE on policy (*European Green Paper on Entrepreneurship in Europe*) was published in 2003 [5]. Hence, in Europe, the systematic development of EE is a more recent phenomenon and the competence models developed are suited to educational purposes for wider audiences, aligning with the multidimensional holistic

approach. Also, transferable competencies are more in focus than pure business orientation [5]. This coincides with the ideas of Gibb [37, 39], who found that more functional and behavioral business-related competencies could be developed in the presence of an already established set of broader, holistic entrepreneurial competencies. The latter indicates that educational context and background as well as the existing foundation of learners' entrepreneurial competencies should be considered when deciding on the core competence areas and the broader aims of EE. In addition, this means considering many variables in the competence development process, which makes assessing and measuring competence development an extremely complex undertaking.

*4.1. What Are the Aim, Definitions, and Approach Taken for Constructing the EE Competence Models?* An overview of the aims and definitions pertaining to the EE competence models is highlighted in Table 1.

The aim and definition of the UK model are made explicit. The model seems to blend a functional approach with holistic elements (mainly focusing on the ability to perform in a specific profession) of the entrepreneurial competencies outlined in the classification of conceptualized competencies by Le Deist and Winterton [17]. The learning orientation of EE is toward the *broad* approach of EE in primary education and is changing gradually toward the *narrow* approach in secondary education and more explicitly in vocational and higher education, highlighting the focus of the aims and outcomes that should be considered at the different education levels. Similarly to the EE definition chosen for this study earlier, EE is considered as a process that supports developing entrepreneurship competence, although the emphasis is not explicitly on opportunity identification and pursuit but also on innovation and effectiveness. However, how the competencies of EE should be gradually developed throughout the education levels remains implicit in this competence model (see Table 4). Also, learning outcomes across the education levels in the UK are considered to be more narrow and outcome-oriented [22], thus confirming the main focus on EE in the UK, as shown in Table 1.

In the USA model, the aim and definition refer to the behavioral and functional approach in conceptualizing competence as it strives to develop the abilities to perform and improve the effective interaction of individuals with their environment (see more in Table 4). Direct reference is made to developing criteria for entrepreneurship programs. The descriptions of entrepreneurial competencies refer to the narrow approach of EE, but few skills under the core competence area of "entrepreneurial traits and behaviors" indicate the broad approach of elements such as demonstrating honesty and integrity, valuing diversity, or setting personal goals, to name a few [34]. While focusing on preparing learners to succeed in business, which is the process of EE, the pursuit of opportunities and the creation of value are not explicitly described in the EE definition.

The aim and definition of the Danish model are aligned with the broad approach to EE, and the model is constructed as a holistic competence model. The model addresses four dimensions that, depending on the context, refer to (1) the

TABLE 1: Description of the aims and definitions of the chosen EE competence models.

Model	Aim	EE definition
UK	Provide a competence model for potential EE learning outcomes for each level of the education system, and provide recommendations for when EE should be introduced to the curriculum and how it might be integrated.	EE is the process that supports the development of “behaviors, skills, and attributes that can be applied individually and/or collectively to help individuals and organizations of all kinds to create, cope with, and enjoy change and innovation involving higher levels of uncertainty and complexity as a means of achieving personal fulfillment and organizations’ effectiveness.” [39, p. 106]
USA	Design a tool kit of standards and performance indicators for developing a curriculum for entrepreneurship programs supporting a lifelong learning process.	EE is a lifelong learning process that “prepares youth and adults to succeed in an entrepreneurial economy.” [34, p. 1-2]
Danish	Provide a framework for EE that aligns the overall purpose of EE with learning outcomes, teaching content, and progression throughout the educational system. Also help to deliver feedback, evaluation, and assessment to support learning.	EE is the set of “content, methods, and activities that support the development of motivation, competence, and experience that make it possible to implement, manage, and participate in value-added processes.” [40, p. 7]
Nordic	Clarify competencies and EE learning outcomes, and provide a tool for teachers and practitioners to plan learning outcomes and pedagogy for EE. Function as a reference point for decision makers who draw up legislation and frameworks related to EE, and support school leaders in providing relevant structures, environments, and EE development.	EE refers to “teaching that supports the development of entrepreneurial resources, competencies, and experiences.” [41, p. 7]
EU	Identify key components of entrepreneurship in terms of competencies, establish a shared conceptual model that any initiative aiming to foster entrepreneurial learning can refer to, and plan learning outcomes suggesting what European citizens should know, understand, and be capable of to demonstrate a certain level of proficiency in entrepreneurship.	EE, specifically, is a process that supports the development of entrepreneurship competence, which implies “acting on opportunities and ideas and transforming them into financial, cultural, and/or social value for others.” [37, p. 7]

Source. UK model [39], USA model [34], Danish model [40], Nordic model [41], and EU model [37].

learner’s competence preparedness, (2) the framework for learning goals, (3) the teaching content, and/or (4) the overall educational planning (see Table 4) [40]. The authors of the Danish model have defined EE not as a process like in the previous models, but as a set of methods, content, and activities that support the development of competencies relevant to value creation. Still, the competencies described in the Danish model imply that EE is interpreted as a process therein. Hence, we analyzed the model accordingly. The categorization of the competencies is consistent for all education levels and the gradual development of the competencies is explicitly systematic [40].

In the Nordic model, the aim and definition are clearly focusing on giving teachers and practitioners a tool by providing them with information on learning outcomes and pedagogical suggestions. The authors of the model have defined EE as teaching that supports entrepreneurship competence development, pointing to the process of creating value and pursuing opportunities rather implicitly. The model highlights the broad approach to EE, and the categorization of the core competencies is similar to that in the Danish model in regard to their content but differs in the names given the core competencies. The model is holistic and the gradual development of entrepreneurship competence is exhibited

clearly throughout the education levels that are considered in the model. This model, while created in the context of Scandinavian and Nordic countries, is seen as the extension of education reforms that have already occurred, and it aims to give a more tangible form to EE elements that already exist in various subjects within the education system [41].

The aim and definition of the EU model are aligned with the criteria that we found in the literature. In other words, the aim and definition of the competence model are made explicit and are aligned with the holistic approach. The EU model, hence, provides a better understanding of systematic EE by combining learning outcomes, progression, and elements that could be adapted to various target groups and contexts. In this model, EE is defined as a process that supports the development of entrepreneurship competence, proposing pursuing opportunities to create various sorts of value. Thus, among the five models, it is the most explicit one with reference to the opportunity pursuit process and value creation in various fields. Moreover, the model in question provides the closest match with the core criteria proposed by competence development literature in general [17, 20, 22].

Only the UK and USA models include organization and/or economy in their definition, also referring to the *narrow* approach. Value creation has been emphasized in Danish

TABLE 2: Description of when and/or how expected competence levels advance in the EE competence models.

Model	Educational context and focus of the models for gradual development	Notes
UK	<ol style="list-style-type: none"> <li>(1) Primary education: <i>child-centered</i></li> <li>(2) Secondary education: <i>subject-centered</i></li> <li>(3) Vocational education: <i>skill-centered</i></li> <li>(4) Higher education: <i>discipline-centered</i></li> </ol>	<ol style="list-style-type: none"> <li>(1) Learners are approached on an individual basis. <i>Foundation of entrepreneurial competencies</i> is laid.</li> <li>(2) Subjects connected with tasks requiring entrepreneurial competencies.</li> <li>(3) Specific skills of learners related to business creation skills. <i>Supporting learners to become self-employed.</i></li> <li>(4) Additionally, learners obtain in-depth <i>understanding of diverse aspects of entrepreneurship within their discipline.</i></li> </ol>
USA	<ol style="list-style-type: none"> <li>(1) Basics</li> <li>(2) Competence awareness</li> <li>(3) Creative applications</li> <li>(4) Start-up</li> <li>(5) Growth</li> </ol>	The first three are categorized as <i>job training</i> and the last two as <i>job experience</i> . The first two stages are for gaining an introductory understanding of entrepreneurship and enhancing <i>basic entrepreneurial competencies</i> , the 3rd stage is about gaining initial <i>practical experiences related to entrepreneurship</i> , and the last two stages are focused on evolving skills in <i>managing and expanding a business</i> .
Danish	<ol style="list-style-type: none"> <li>(1) Compulsory schooling</li> <li>(2) Vocational education</li> <li>(3) Upper secondary education</li> <li>(4) Profession-based tertiary education</li> <li>(5) Degree course</li> </ol>	All core competencies are embedded in the core subject and curriculum, dividing the four competencies by skills and knowledge. The focus is on ensuring that the level of competence in core subjects gradually increases throughout the education system regarding innovation and entrepreneurial processes.
Nordic	<ol style="list-style-type: none"> <li>(1) Year 3: early years</li> <li>(2) Year 6: intermediate years</li> <li>(3) Year 9: leaving school</li> </ol>	At all three stages, entrepreneurial competencies represent the ultimate goal and intended learning outcomes. All competencies other than personal resources are divided by skills and knowledge at all levels.
EU	<p>4 standard qualification levels further split into 8 sublevels</p> <ol style="list-style-type: none"> <li>(1) Foundation: discover &amp; explore</li> <li>(2) Intermediate: experiment &amp; dare</li> <li>(3) Advanced: improve &amp; reinforce</li> <li>(4) Expert: expand &amp; transform</li> </ol>	The gradual development of entrepreneurship competence is based on 8 nonlinear proficiency levels. Value creation at all levels: (1) foundation: external support, (2) intermediate: increasing autonomy, (3) advanced: responsibility to transform ideas into action, (4) expert: driving information, innovation, and growth (reference domain). Note that when the first 3 levels can be applied to all citizens, the expert level is more context-dependent.

Source. UK model [39], USA model [34], Danish model [40], Nordic model [41], and EU model [37].

and EU models, although the former includes the methods, content, and activities necessary in EE while the latter focuses on the broader aim of EE, thus leaving more room for interpretation of the EE concept. The Nordic model focuses on improving entrepreneurial resources, competencies, and experiences. This focus could be due to the model's emphasis on early education levels, teaching methods, and a specific target group, that is, teachers and practitioners (see Table 2).

The definitions for EE used in all of the examined models emphasize the importance of the process of opportunity pursuit and value creation: Danish and Nordic models more implicitly and the UK, USA and EU models more explicitly. Therefore, the process component is a crucial aspect of EE and should thus be made explicit and aligned with the aim, definitions, and approach of an EE competence model.

In general, the holistic approach seems to be the most dominant in conceptualizations of the most recent competence models, especially in those focusing on developing an

entrepreneurial mindset in the broad sense (e.g., Danish, Nordic and EU models). Also, the holistic view is likely to be used more in the early education stages. Behavioral and functional competencies seem to be included more so in the UK and USA models, where competencies are more individually focused (and thus easier to understand and develop).

The common aim of all examined competence models is to establish a set of learning outcomes for the different education levels and thus to provide EE stakeholders with a clear understanding of EE. Specifically, the five examined competence models aim to create a bridge between education policies (including policymakers), real-life practices (including teachers), curricular development (including school leaders and educational institutions), businesses, and other relevant stakeholders.

*4.2. How Do the EE Competence Models Relate to Specific Educational Contexts?* As we found earlier, the specific context

common to all the models is EE. Still, even within EE, the greater context of competence models can vary depending on what the aim of the competence model is and how the EE is defined.

As seen in Table 1, every competence model is established with a specific education context in mind. The UK model was initially established based on the learning outcomes of UK graduates, and thus it indicates that the earlier successive competence development stages (in this case, education levels and types) are targeted to support achieving the main aim at the graduate level [39].

The USA model demonstrates a different approach, since it is meant to standardize entrepreneurship programs and be used as a reference point in the development of the entrepreneurship program curriculum [34]. When compared to the other four EE competence models, the USA model has a more business-focused approach and it provides a more detailed and technical description of the learning outcomes, making it difficult to be matched with other models [5, 34].

The Danish and Nordic models are designed for an overarching context: the Nordic countries. Nonetheless, the Nordic model was created to be adapted to the already existing, liberated, and reformed education system and focuses on developing learners' abilities in how to make the best use of that freedom and liberty [41]. Also, the Nordic model suggests not to teach entrepreneurship as an academic subject per se but rather guides EE stakeholders to embed EE in the existing subjects. It does this by providing a more tangible form of the EE elements that already exist in various subjects within the education system and that are aligned with the broad holistic approach [41].

The EU model was created for the context of the EU and its member states, and as such it is a competence model that could be used and applied in both broader and more specific learning contexts ranging from formal education and training to workplace and informal and nonformal learning. The competencies that are listed in this model are clearly context-bound and necessitate taking action and responsibility, as well as being focused on achieving goals (see Table 4). It seems that, in the construction of the EU model, a reasonable balance between personal and social factors affecting performance was aimed at. The main aspects of the whole spectrum of the profession of an entrepreneur seem to have been considered. The strength of this model is the action aspect that is integrated in its description as a value creation process.

In sum, a competence model should be suited to the education system's context it is designed for and feature a detailed description and sufficient suggestions for its everyday practical application. When the competence model is presented in combination with insufficient instructions and guidance, its proper application may be easy to overlook. Also, context-related aspects of the examined competence models are presented rather generally and this makes adapting the models to a particular context a complex undertaking. We therefore suggest making decisions related to applying the models in specific contexts more explicit.

*4.3. How and When Are Competence Levels Expected to Advance in Different Education Systems?* It is important to have an overview of when and how the expected competence levels are expected to advance in different education systems (see more in Table 2).

As a result of our analysis, we identified three different ways in which the analyzed competence models have described their systematic development of entrepreneurial competencies: (1) specific education levels and types (Nordic, Danish, and UK models); (2) job- and business-related competence levels (USA model); and (3) nonlinear proficiency levels (EU model).

For specific education levels and types, the degree of the sophistication of competence development in EE is built along a similar timeframe in these three types of models, but they differ in regard to the education levels and types that the EE is to cover. For example, while the Nordic model focuses on the first nine years of general education in three stages, the Danish model covers the entire education spectrum across four levels and one type of education (vocational education). The UK model highlights three stages (primary, secondary, and higher education) plus vocational education, and it ties each education level and type to a specific learning orientation (i.e., child-, subject-, skills-, and discipline-centered). The USA model associates education stages with learner-centered themes (job- and business-related competence levels) that gradually become more complex but does not directly link these themes to different education levels since this is not the primary aim of this competence model [34]. Yet, the authors of the USA model suggest that the "basic" stage should be introduced in primary, middle, or high school and that the timing of the subsequent stages should be established depending on when the "basic" stage is introduced. The EU model is based on eight proficiency levels that establish a reference point for the development of competencies and provide a structure for users of the model to understand learning outcomes. Understanding and enhancing the proficiency levels can make applying the model more effective so as to achieve a greater impact through value-creating activities [37]. However, the model should be used with caution since the eight proficiency levels that are used to describe the competence development are not necessarily directly related to specific education levels but rather apply to all kinds of learning contexts. Connecting the outcomes shown in Table 2 with those in Tables 1 and 4, it is fair to say that the observed competence models are related to the EE contexts for which they were created.

Based on the analysis for the three preceding research questions, we suggest that when the main aim and definition of EE as well as the competence development stages are defined and developed in light of their education context, the application of the model within the education system is more likely to be accepted. This includes appropriately establishing the progression of the entrepreneurial competencies by considering the current and prospective competence levels of the learners.

*4.4. What Are the Entrepreneurial Competencies Listed in the EE Competence Models?* As highlighted in Table 5, we found

19 common entrepreneurial competencies described in all five models, such as responsibility and creativity, opportunity recognition and exploitation, teamwork, and management skills in a business context. This analysis is valuable, since it helps to map the most important competencies related to entrepreneurship competence.

However, a number of common competencies were featured in only two, three, or four of the five models (see Table 5). It is noteworthy that while the Danish, Nordic, EU and UK models share similar, comparable learning outcomes, most of the competencies in the USA model—due to its main aim—are too detailed and technical to be matched with other competence models (e.g., the abilities to “implement workplace regulations,” “plan follow-up strategies in selling,” and “explain the nature of the Consumer Price Index” could not be matched with competencies of other models). We therefore compared and confirmed the competencies that matched at least two of the five models (see Table 5). The abilities to “reflect” and to “believe in one’s efficacy” were featured in the three most recent competence models, that is, the Danish, Nordic, and EU models. This indicates the growing importance of attitudinal (mindset-related), metacognitive, and transferable competencies and lifelong learning for EE development. The list of entrepreneurial competencies that are most important regarding entrepreneurship competence is likely to be phrased slightly differently when using different classification methods proposed by different researchers. Still, based on our findings, even when using other terms and classifications, such a list should remain similar to the 19 mapped competencies that are described in all five models (plus prospectively those that are described in four models, as shown in Table 5).

Again, note that how such competencies were chosen was not explicitly described in the models. Consequently, our comparison of competencies can make only a marginal contribution to the understanding of how to systematize the established list of entrepreneurial competencies. In pursuit of understanding how the systematic development of entrepreneurship competence has been conceptualized, it is hence crucial to understand which components belong to entrepreneurship competence. For this reason, we organized the competencies using Le Deist and Winterton’s [17] classification of conceptualizing a competence framework in order to create an overview instrument for combining different components of competence (e.g., to set a focus on planning learning outcomes). The results of this analysis phase are highlighted in Table 3. Categorizing competencies according to conceptual versus operational skills and occupational versus personal contexts helps in trying to understand the balance between the competencies and other characteristics of the entrepreneurship competence. Note that this list of entrepreneurial competencies is a result of an analysis and is not a systematically constructed entrepreneurship competence model. However, it helps one to understand what the balance ideally could be and what competencies are essential for designing an effective entrepreneurship competence model. Dividing conceptual versus operational skills also helps one to understand what theoretical entrepreneurship

concepts should be addressed in developing entrepreneurship competence. Knowing what or for whom conceptual competencies should be operationalized and put into action helps in choosing appropriate processes and instructions for educational interventions. Also, attitude and other aspects that should be supported in competence development can be much more systematically supported through this analysis, rather than solely basing such aspects on a specific competence model. Depending on the context within which competence models are to be created and applied, having this map of competencies can assist educators and policymakers in deciding where to direct emphasis in entrepreneurship competence development.

When looking at and comparing the lists of conceptual versus operational competencies, some inconsistencies or questions may arise; for example, “what conceptual knowledge would be relevant for controlling costs?” or “what conceptual knowledge is needed to handle big data or to validate ideas?” and so on. Considering that this list of competencies is a summary of competencies from different competence models, we point this out to challenge the thought process of constructing competence rather than evaluating the balance between various competencies.

Every studied competence model has its own aim and focus, which implies that all competence models describe an individual set of entrepreneurial competencies. On the one hand, this could imply that specific competencies are more likely to be developed in some education systems due to the surrounding educational, individual, and policy-level background and situation. On the other hand, the varying competence elements in different competence models might again confirm the uncertainty regarding which competencies are more prone to be effective at which educational stage. Also, it can be said that the goals of the entrepreneurial competencies developed in the frameworks of all the examined competence models reflect the desired outcomes of national and/or regional EE strategies. The latter suggests intentionally aligning entrepreneurial competencies with the goals of the EE strategy.

Nevertheless, we found little information and no clear evidence on how the described learning outcomes and competence levels in the examined competence models were formed. The (entrepreneurial) capability of learners at various education stages should thus be observed more closely in order to obtain more empirical proof of the suitability of chosen learning goals [39].

## 5. Main Concluding Points

The aim of the present study was to understand how different EE competence models describe and conceptualize the systematic progress of developing entrepreneurship competence up the education ladder. In sum, we can conclude that the structure and focus of existing EE competence models vary significantly. However, the feature common to all five analyzed EE competence models was the focus on developing competencies related to opportunity pursuit and value

TABLE 3: Division of competencies based on Le Deist and Winterton [17] classification of entrepreneurial competencies stated in the EE competence models and in the literature.

	Competencies related to the occupation (entrepreneurship)	Competencies related to the individual (entrepreneurial person/entrepreneur)
<p>Conceptual <i>Occupational:</i> cognitive knowledge and understanding <i>Individual:</i> effectiveness, metacompetence, including learning-to-learn</p>	<p>(i) Project management and business planning (ii) Defining an opportunity (iii) Demonstrating creativity, problem solving, and systematic thinking (iv) Different forms of idea generation (v) Awareness of globalization and the consequences (vi) Economic and financial concepts (vii) Demonstrating cross-functional awareness (viii) Understanding taxation</p>	<p>(i) Demonstrating commitment (ii) Seeing and acting strategically according to the bigger picture (vision) (iii) Identifying personal strengths and weaknesses and designing personal development plans to overcome weaknesses and develop strengths (pursuing self-development) (iv) Learning from the experience: able to monitor and evaluate processes and use them in the learning process (v) Learning-to-learn: able to identify opportunities for self-improvement within an organization and beyond (vi) Ability to learn from failure and reflect on your own failures (vii) Showing emotional self-control</p>
<p>Operational <i>Occupational:</i> functional, psychomotor, and applied skills <i>Individual:</i> social competence, including behaviors and attitudes</p>	<p>(i) Taking action (ii) Negotiating and persuading (iii) Planning, developing and executing, and sticking to a project management plan and a sustainable business plan/strategy (iv) Controlling costs (v) Challenging basic assumptions with data (vi) Identifying, testing, evaluating, and exploiting (business) opportunities (vii) Gathering, analyzing, and evaluating information (viii) Organizing constructive discussions (ix) Managing a conflict (x) Applying effective time management for oneself and in teams (xi) Organizing constructive discussions (xii) Designing value-creating processes (xiii) Explaining concepts and opinions (xiv) Presenting and public speaking (xv) Writing and reporting skills (xvi) Structuring idea generation processes (xvii) Applying technical (subject-related) expertise (xviii) Ability to get support (know-how) from external sources (xix) Using economic and financial concepts to assess the financial health of an initiative (xx) Managing risks by using strategies to reduce risks (xix) Expanding a network effectively and meaningfully (xxii) Identifying needed resources and allocating them efficiently to achieve goals (resource management) (xxiii) Protecting ideas (intellectual property rights) (xxiv) Monitoring the progress (xxv) Using sensory concepts and creativity in relation to academic knowledge (xxvi) Delivering results and meeting customer expectations (e.g., monitor and maintain quality and productivity) (xxvii) Identifying and recruiting talent (xxviii) Using creativity in all phases of the project (xxix) Visualizing knowledge</p>	<p>(i) Adapting to changes in the environment and context (ii) Dealing with ambiguity (iii) Coping with pressure (iv) Maintaining a positive outlook and working enthusiastically (v) Helping others to identify their strengths and weaknesses (vi) Encouraging others to take action (vii) Seeking and introducing change (viii) Leading and supervising (providing direction and supervising, coaching, delegating, empowering, motivating, and developing others) (ix) Acting with confidence (x) Accepting and supporting diversity in a team and utilizing it (xi) Listening (xii) Appealing to emotions (xiii) Working together with others (xiv) Encouraging and supporting organizational learning (xv) Managing interdependency (xvi) Taking responsibility (xvii) Making an impact (xviii) Making stakeholders take responsibility (xix) Communicating (xx) Upholding ethics and values (xxi) Acting with integrity (xxii) Showing social and environmental responsibility</p>

Sources. UK model [39], USA model [34], Danish model [40], Nordic model [41], EU model [37], and Le Deist and Winterton [17].

TABLE 4: Core competence areas and stated subcompetencies of analyzed EE competence models.

	Core competencies together with listed subcompetencies and traits	Notes
UK model	<p><i>Areas that represent the broad approach</i>  <i>Develop entrepreneurial competencies:</i> opportunity seeking, initiative taking, autonomy, negotiating, risk-taking, intuitive decision making, strategic orientation  <i>Experience entrepreneurial life:</i> problem solving, decision making under pressure, learning by doing, coping with uncertainty  <i>Understand entrepreneurial values:</i> independence, ownership, trust, self-belief, action orientation  <i>Feel motivated to begin an entrepreneurial career:</i> knowing the benefits of being an entrepreneur and understanding the role in society  <i>Areas that represent the narrow approach</i>  <i>Key business development how-tos:</i> planning, researching, developing, marketing, management, finances, regulatory  <i>Networking capacity:</i> knowledge of developing, holding, maximizing the value of partnerships meaningfully  <i>Mindset and perseverance to carry out new venture creation</i></p>	Competence areas of the UK model are described rather broadly and are not elaborated as in the other models presented in this article
USA model	<p><i>Area that represents the broad approach</i>  <i>Entrepreneurial skills:</i> processes and traits associated with entrepreneurial success (entrepreneurial processes and traits)  <i>Areas that represent the narrow approach:</i>  <i>Ready skills:</i> basic business knowledge and skills that are prerequisites for becoming a successful entrepreneur (business foundations, communication &amp; digital skills, economics, financial literacy, professional development)  <i>Business functions:</i> business activities performed by entrepreneurs in managing a business (financial, human resources, information, marketing, operations, risk and strategic management)</p>	Under 3 sections, 15 major entrepreneurial competencies are presented as learning outcomes
Danish model	<p><i>Action:</i> ability and motivation to implement value-creating initiatives and realize them through cooperation, networking, partnerships  <i>Creativity:</i> ability to recognize and create ideas and opportunities  <i>Outward orientation:</i> understand surrounding opportunities/needs and their dynamic interaction with one's own capacity and ability to adapt to a specific setting in order to create social, cultural, and/or financial value  <i>Attitude:</i> personal mindset to meet challenges and have faith in one's own ability to act in the world and realize dreams and plans</p>	The 4 listed aspects are originally described as dimensions that are interconnected, complementary, and suggested to be embedded in the core curriculum
Nordic model	<p><i>Action:</i> pupils' ability to take tangible action (plan, structure, execute, collaborate, communicate, manage finances and resources)  <i>Creativity:</i> ability to see, sense, create opportunities, solve problems, think in different ways, experiment with different forms of knowledge  <i>External competencies:</i> knowledge about, understanding of, interaction with culture, the surrounding world, external parties  <i>Personal resources:</i> subjective belief and trust in how one can act in the world, resources to facilitate this, how dreams/visions can be realized</p>	Personal resources (e.g., perseverance) are highlighted in a different category as they are complex to teach, test, and assess. However, they are crucial to support mindset development

TABLE 4: Continued.

	Core competencies together with listed subcompetencies and traits	Notes
EU model	<p><i>Ideas and opportunities:</i> spotting opportunities, creativity, vision, valuing ideas, ethical and sustainable thinking</p> <p><i>Resources:</i> self-awareness and self-efficacy, motivation, perseverance, mobilizing resources, financial and economic literacy, mobilizing others</p> <p><i>Action:</i> taking initiative, planning and management, coping with uncertainty, ambiguity and risk, working with others, learning through experience</p>	<p>The model's 3 competence areas incorporate 15 subcompetencies that consist of 442 learning outcomes. All competencies can be achieved at different levels, not just the highest level is expected. All learning outcomes are tailored for both individuals and groups</p>

Source. UK model [39], USA model [34], Danish model [40], Nordic model [41], and EU model [37].

creation processes, which are critical and central aspects of entrepreneurial activities.

In the studied literature, the competence models were found to function as a backbone for the different approaches, aims, and stages of EE, and thus the models are considered to be important in systematizing the EE competence development process. We agree that the systematic application of competence development might help to create efficient methods of assessing the impact of EE on entrepreneurial competencies, an issue that should be observed more closely in future research on entrepreneurial competencies [39, 40].

Our present analysis confirms that one EE competence model is unlikely to fit the needs and aims of another education system when simply copied and pasted. It can therefore be said that competence models should be carefully focused on those learning outcomes that are most relevant to a learner's environment, background, existing knowledge, and trends in their social and financial environment, as well as other aspects of their educational and local context.

The EE competence model is suggested to be a valid solution for the gradual development of competencies and differing elements of EE (e.g., learning outcomes and pedagogical approaches) pertaining to different types and stages of education and thus makes EE more tangible, measurable, and effective [4, 34–36, 39, 41, 42]. We do agree that generic competence models contribute to this knowledge and that different competence models contribute to difference aspects of knowledge regarding competence development in EE. Also, there is a tendency for EE competence models to focus on certain core competence areas, learning outcomes, and target groups depending on the educational context and external environment.

To be a valid basis for EE measurement instruments, the competence models' construction and conceptualization principles should be more consistent across the European Union member states. Furthermore, evidence of how the described competence models (e.g., competence levels and learning outcomes) are established helps to understand the context of the established competence models.

The analysis of this study maps the core components of entrepreneurship competence and makes the design of the analyzed competence models more explicit. Understanding

these core components provides a grasp of what competencies are essential for designing an effective EE competence model and supports achieving well-balanced and systematic competence descriptions in EE competence models. Also, knowing which competencies should be operationalized for whom helps in choosing suitable processes and instructions for educational interventions. Hopefully this understanding can be translated into a more systematic and transparent conceptualization and gradual development of entrepreneurship competence. Our study provides a reference point for designing systematic EE learning outcomes that could help learners to enhance their entrepreneurship competence at all education levels. Also, this study helps to gain a clearer understanding of how EE learning outcomes can be achieved systematically, and it therefore contributes to the work of and can be useful for educators, school boards, policymakers, local municipalities, researchers in the field of EE, and other relevant stakeholders.

We found no clear evidence for how the described learning outcomes and competence levels in observed competence models are established: a limitation that can be overcome by making this process explicit when designing EE competence models in future. Additionally, to the best of our knowledge, no thorough empirical research has been conducted on the effectiveness of the competence models other than for the USA model, as described earlier [51]. Also, as the Nordic and Danish models are presently still being tested and developed on an ongoing basis, it is still too early to engage in more extensive generalizations and conclusions on what works best in developing entrepreneurial competencies as such. The EU model has thus far also been applied to and tested in real settings to only a limited extent, and thus more refinement is needed based on the feedback from practitioners and end users [37]. Hence, it is difficult to say which variation of the core competence areas and which description of their gradual development are most efficient for most effectively enhancing particular entrepreneurial competencies.

There is no simple way to observe the progress and development processes of competencies. What is common is that the presented models highlight an "optimal set" of expected competencies for a specific educational stage. The comparison of EE learning models and related aspects

TABLE 5: Categorization of common and differing competencies between all five observed EE competence models.

Competencies	Models
Identify, define, test (validate), and exploit opportunities (e.g., through trends or cultural, social, and economic conditions, personal resources)	EU, Nordic, Danish, UK, USA
Gain understanding of economic and financial concepts and apply it to assess the financial health of initiatives	EU, Nordic, Danish, UK, USA
Ability to communicate effectively: constructive discussions; making stakeholders take responsibility, etc.; ability to use plan as a relationship management instrument	EU, Nordic, Danish, UK, USA
Take action and encourage others to do the same	EU, Nordic, Danish, UK, USA
Plan and organize: develop, execute, and stick to a project management plan	EU, Nordic, Danish, UK, USA
Work together with others (by independently contributing to a vision); managing interdependency	EU, Nordic, Danish, UK, USA
Expand your network effectively and meaningfully; can see all activities in terms of networks of know-how	EU, Nordic, Danish, UK, USA
Be flexible and adapt to changes: use results of monitoring to adjust the vision, aims, priorities, and activities; communicate effectively regarding reasons for changes and adjustments; willingness to change in relation to existing perceptions and habits	EU, Nordic, Danish, UK, USA
Manage risk: use strategies to reduce risks	EU, Nordic, Danish, UK, USA
Accept and support diversity in a team or organization; assess significance of own and others' cultural background and values	EU, Nordic, Danish, UK, USA
Develop sustainable business plans; describe business models, markets, and market conditions simply; can develop and defend a business plan and scale	EU, Nordic, Danish, UK, USA
Identify personal strengths and weaknesses (personal resources), help others to identify theirs; design personal and team development plans to overcome weaknesses and develop strengths	EU, Nordic, Danish, UK, USA
Develop effective time management for yourself (and the team)	EU, Nordic, Danish, UK, USA
Design value-creating processes	EU, Nordic, Danish, UK, USA
Learn from experience: ability to learn from monitoring and evaluating processes and to apply this to the organization's learning processes	EU, Nordic, Danish, UK, USA
Using creativity in all phases of the project (ideation, planning, and executing); structure idea generation processes and use different forms of idea generation; illustrate subject knowledge and creativity through sketches, models, and prototypes	EU, Nordic, Danish, UK, USA
Ability to see and act strategically according to the bigger picture (vision)	EU, Nordic, Danish, UK, USA
Awareness of societal structures, components, problems, and opportunities; understand cultural, social, and economic conditions in an international and global context; understand sources of complexity and uncertainty in a global context	EU, Nordic, Danish, UK, USA
Present results and projects to a specific target group; knowledge of presentation forms and tools; ability to defend a business plan and scale	EU, Nordic, Danish, UK, USA
Ability to manage resources (material and nonmaterial): identify needed resources and allocate them efficiently to achieve goals	EU, Nordic, Danish, UK
Analyze the context of opportunities	EU, Nordic, Danish, USA
Ability to create a budget for value-creating activities	EU, Nordic, Danish, USA
Take responsibility in value-creating activities and seizing opportunities	EU, Nordic, Danish, USA
Cope with uncertainty and ambiguity	EU, Nordic, Danish, UK
Assess and evaluate risk	EU, Nordic, Danish, USA
Work independently, helping others to do the same; praise the initiative of others; autonomy	EU, Nordic, Danish, UK
Define goals and design a strategy to achieve the goals	EU, Nordic, Danish, USA
Team up: ability to encourage people to work together and build an organization	EU, Nordic, Danish, USA
Use media effectively: define a communication strategy and improve support for the vision	EU, Nordic, Danish, USA
Define priorities	EU, Nordic, Danish, USA

TABLE 5: Continued.

Competencies	Models
Monitor your progress: develop performance indicators and create a data collection plan; analyze/evaluate own and others' activities using relevant criteria	EU, Nordic, Danish, USA
Awareness of globalization and consequences	EU, Nordic, Danish, USA
Maintain focus on interrupted tasks and projects over a long period; work persistently	EU, Nordic, Danish, UK
Believe in your ability to make things happen (efficacy) and learn from failures	EU, Nordic, Danish, UK
Awareness of working life and career opportunities; can relate to entrepreneurial world regarding a wide range of different social and employment contexts; understand relevance of entrepreneurial behaviors to a wide range of self-employment, employment, and social contexts; having role models relevant to field of study and context; can compare and contrast with expectations of employment career	EU, Nordic, UK, USA
Stay driven	EU, Nordic, UK, USA
Be determined and motivated (using all outcomes as temporary solutions) to achieve goals	EU, Nordic, UK, USA
Be accountable (responsible to all stakeholders)	EU, Nordic, UK, USA
Ability to find and manage funding; can identify financing needs and know where to go for resources	EU, Danish, UK, USA
Understand taxation and make smart decisions accordingly	EU, Danish, UK, USA
Develop emotional intelligence and emotional awareness; can apply all key aspects of emotional intelligence	EU, Danish, UK, USA
Respecting and promoting ethical and sustainable behavior; analyze and evaluate ethical issues in relation to personal, scientific, and global phenomena	EU, Danish, USA
Be resilient and assured that an individual/organization can make difficult decisions and deal with failure	EU, Nordic, UK
Ability to get support from outside the organization (information, know-how); understand sources of assistance and professional advice fully, including how to use them	EU, UK, USA
Listen actively to and understand end users from a wide range of resources	EU, UK, USA
Work using (academic) problem solving	EU, Nordic, USA
Ability to reflect on your own and help others to reflect on their achievements and temporary failures in order to develop	EU, Nordic, Danish
Use sensory concepts and creativity in relation to academic knowledge	EU, Nordic, Danish
Awareness of imagination and creativity in society; theories and concepts in innovation and entrepreneurship	EU, Nordic, Danish
Experiment with knowledge and academic subjects; experiment and improvise with subject knowledge and personal experiences	EU, Nordic, Danish
Knowledge of different types of projects, management, and leadership; having capacity for entrepreneurial leadership	EU, Danish, UK
Analyze and evaluate relationships between research-based knowledge and possible business models; understand the opportunities for using knowledge gained in higher education in a new venture context	EU, Danish, UK
Knowledge of methods to develop personal and professional academic resources; build know-how	EU, Danish, UK
Selling (knowing that income comes from selling)	EU, UK, USA
Owning development	EU, UK, USA
Can see product/service as a set of benefits to the customer	EU, UK, USA
Can apply entrepreneurial competencies to the stages of business growth	EU, UK, USA
Can relate entrepreneurial competencies to the design of entrepreneurial organizations of different scales and contexts (public and private)	EU, UK, USA
Can develop a product/service concept	EU, UK, USA
Can find, approach, and sustain good customers	EU, UK, USA
Can appraise and learn from competition	EU, UK, USA
Can cost and apply price	EU, UK, USA
Can anticipate major business development and survival problems	EU, UK, USA
Can deal with all of the statutory and regulatory aspects of self-employment	EU, UK, USA
Can effectively use IT and the Internet in general in pursuit of building a business; having strong international web-based management capacity	EU, UK, USA

TABLE 5: Continued.

Competencies	Models
Can describe and compare cultures	Nordic, USA
Translate needs, wants, and interests into goals, and help others to reflect on theirs (following aspirations)	EU, UK
Protecting ideas, including intellectual property rights, describe strategies for how to do it	EU, USA
Ability to use proper strategies to keep up individual and team's motivation	EU, USA
Assessing impact (choose right indicators, monitor, analyze, and reiterate)	EU, USA

Note. Competence models in brackets (e.g., "(USA)") indicate that the competency was described either vaguely or indirectly in the model. Source. UK model [39], USA model [34], Danish model [40], Nordic model [41], and EU model [37].

supports grasping what may be more important and efficient in various contexts, but more information about the application of competence models is needed.

### Conflicts of Interest

The authors declare that they have no conflicts of interest regarding the publication of this paper.

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## Research Article

# Cross-Cultural Competences and International Entrepreneurial Intention: A Study on Entrepreneurship Education

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To identify and foster potential international entrepreneurs are important goals for entrepreneurship education. Based on the theory of planned behavior (TPB), we argue that International entrepreneurial intention (IEI) is a predictor of international entrepreneurship (IE). In addition, cross-cultural competences are hypothesized as antecedents to IEI and moderators of the relationship between TPB elements and IEI. We integrate two elements of cross-cultural competences (global mindset and cultural intelligence) in a TPB-framework to identify the drivers of students' IEI. We analyze a sample of 84 students with OLS regression and moderation analysis. OLS regression results reveal no significant direct effects from cultural intelligence and global mindset on IEI. Moderation analyses suggest a negative, significant moderating effect of cultural intelligence on the relationship between personal attitude and IEI and on subjective norms and IEI. Therefore, simply enhancing global mindset and cultural intelligence does not contribute to students' IEI. More is required from entrepreneurship education, such as improving the perception of international entrepreneurship as a valuable career choice.

## 1. Introduction

Entrepreneurship education has been acknowledged as an effective way to develop students' entrepreneurial intention [1]. With increasing recognition of the importance of international entrepreneurship, entrepreneurship educators may also want to strengthen students' international entrepreneurial intention (IEI). International entrepreneurship (IE) is defined as "the discovery, enactment, evaluation, and exploitation of opportunities - across national borders - to create future goods and service" [2, p. 7]. IE is playing an important role in countries' economic development. For example, Eurofund revealed that around 20% of the young enterprises in Europe are born global [3]. These new startups contributed significantly to job creation and welfare in Europe [4]. According to McKinsey, 86% of tech-based startups are "born global" in the USA [5], and 360 million people are now engaging in cross border e-commerce worldwide [5]. Therefore, to identify and to support students who intend to expand their entrepreneurial activities internationally are a key goal for entrepreneurship education.

The theory of planned behavior (TPB) [6, 7] argues that entrepreneurial intention is an effective predictor for entrepreneurial behavior [8]. The central tenet of TPB [9] is that planned behaviors (such as international entrepreneurship) are intentional and can be predicted by intention towards that behavior [10]. Prior studies have confirmed the validity of TPB in predicting entrepreneurial intention (EI) [11]. For example, Van Gelderen et al. [11] reported that TPB can explain 38% of the variance of EI. With regard to IEI, Sommer [12] showed that there is a positive relationship (path coefficient of .32) between IE self-efficacy and IEI.

Previous research has shown that international entrepreneurs need to deal with numerous cross-cultural issues [13]. Hence, cross-cultural competence is a critical driver of international performance [14]. Two main cross-cultural competences [15] are cultural intelligence (CQ) and global mindset (GM). Both are regarded as prerequisites for intentions and success in the international business context [16, 17]. For example, compared to entrepreneurs that have a low degree of cross-cultural competences, highly cross-culturally

competent entrepreneurs perform better at identifying international business opportunities [18].

CQ is person's "capability for successful adaptation to new cultural settings, that is, for unfamiliar settings attributable to cultural contexts" [19, p. 5]. CQ enables individuals to conduct appropriate behavior in foreign cultural contexts [20]. Such behaviors lower the risk of business activities in new cultures. A lower risk could trigger individuals' intention to engage in international entrepreneurship. GM is a mindset that "combines an openness to and awareness of diversity across cultures and markets with a propensity and ability to synthesize across this diversity" [21, p. 117]. GM strengthens individuals' willingness to take risks [22]. With such willingness, individuals would be more likely to engage in IE activities. Also, GM raises global entrepreneurs' alertness to diversity and fosters creative thinking [23].

We believe that TPB-based models on IEI can profit from an integration of the cultural competence literature [12, 24]. TPB addresses the link between intention and attitude, subjective norms, and perceived behavioral control. The strength of these links may be enhanced by CQ and GM [25]. Second, a combination of both CQ and GM in one model is warranted, as both constructs overlap yet also differ in key aspects [17]. For example, CQ focuses on the behavioral ability to interact interpersonally, and GM stresses awareness and integration of diversity across cultures [26]. Third, CQ and GM may be related directly to IEI. Hence, to derive a more complete explanation and counter issues of missing variable bias, an integration of cultural competences into the TPB model is warranted.

This study integrates CQ, GM, and the standard TPB model to identify the drivers of students' IEI. The study's objectives are (1) identify whether GM and CQ could lead to IEI directly; (2) evaluate the possible moderating influence of GM and CQ on TPB elements to IEI; and (3) assess the effect of the same factors on EI (instead of IEI) to show whether the effects of CQ and GM are unique for IEI rather than both IEI and EI. Doing so contributes to the international entrepreneurship literature by exploring drivers of IEI. In addition, this study provides indications for universities' entrepreneurship education programs on how to strengthen students' IEI.

## 2. Theory and Hypotheses

**2.1. TPB and (International) Entrepreneurial Intention.** TPB postulates three conceptually independent determinants of entrepreneurial intention, the "self-acknowledged conviction by a person that they intend to set up a new business venture and consciously plan to do so at some point in the future" [27, p. 676]. The first determinant is the attitude towards the behavior, which refers to the extent of an individual's positive evaluation of IE. It reflects the desirability of engaging in IEI activities. A positive personal attitude towards IE indicates that the respondent is more in favor of engaging in IEI activities than in other career paths [28]. The second predictor is "subjective norms." It refers to the perceived opinions from social reference groups (such as

family members and friends) regarding whether the individual should perform IE. Given highly supportive subjective norms from surrounding important people, individual would feel encouraged to engage in IE. The third antecedent is the level of perceived behavioral control (PBC), which refers to the perceived ease of performing a particular behavior [29]. PBC reflects the perceived ability to become an international entrepreneur [28]. People who perceive to be more able to perform international entrepreneurship activities are more likely to engage in them than in other career paths.

We expect that individuals with a positive personal attitude, subjective norms, and perceived behavioral control would be more likely to have intentions to engage in international entrepreneurship. Formally,

(H1) *the higher the degree of personal attitudes, the higher the international entrepreneurial intention;*

(H2) *the higher the degree of subjective norms, the higher the international entrepreneurial intention;*

(H3) *the higher the degree of perceived behavioral control, the higher the international entrepreneurial intention.*

**2.2. Cultural Intelligence and IEI.** CQ is defined as "a person's capability for successful adaptation to new cultural settings, that is, for unfamiliar settings attributable to cultural contexts" [19, p.5]. It consists of four facets: a cognitive facet, a motivational facet, a behavioral facet, and a process facet [26].

The cognitive facet of CQ is embodied in one's own personality, social identity, and social roles. It refers to an individual's capability to adapt effectively to new cultural contexts. The cognitive facet contains three critical elements. First is the cognitive flexibility, which means a constant reshaping and adaptation of the self when operating within a new cultural setting. Second is the reorganization capability to reformulate one's self-concept in new situations. Third are strong reasoning skills, which help to understand reasons behind phenomena in new cultures. In the global market, high CQ individuals find it easier to understand the foreign environment, acquire market knowledge, reshape their own cognitions, and recognize opportunities. All these allow an entrepreneur to choose an effective product-market fit [30].

The motivational facet of CQ focuses on a person's self-efficacy and personal motives. Perceived self-efficacy is a positive judgement of one's capability [31]. Persons who believe in their capabilities to understand people from other cultures are more likely to engage in international activities. In addition, high efficacy means "when the going gets tough, the tough get going." Individuals who encounter barriers will reengage with greater vigor rather than quit. Hence, individuals with high CQ would highly judge their personal capability and have a greater vigor to engage in IEI activities.

The behavioral facet of CQ suggests that international activities need actual implementation. A high CQ not only is composed of knowledge but requires action in specific situations. People with high CQ are better able to behave appropriately in different cross-cultural situations. For example, this could mean the selection of an appropriate strategy. In addition, individuals with high CQ are talented mimics [26].

Mimicry means to imitate key practices from others and serves as a vital capability for entrepreneurs in foreign markets [32]. With such a capability, individuals could discover market opportunities easier than others in other cultural contexts. Therefore, entrepreneurs with a high level of CQ would have a stronger intention to conduct international entrepreneurship.

From the process perspective of CQ, a person with high level of CQ has a greater capacity to store and categorize new experiences. This may decrease the uncertainty of conducting international entrepreneurial activities and thus increase the intention to engage. For example, international experience has a significant positive influence on IEI [12].

From our discussion of the four facets of CQ, we hypothesize that individuals with a higher level of CQ would have greater knowledge, more motivation, better executive efficiency, and more experience with regard to international entrepreneurial activities. Formally,

*(H4) the higher the degree of cultural intelligence, the higher the international entrepreneurial intention.*

CQ moderates the TPB-IEI relationship as well. CQ enables individuals with a better understanding of foreign cultures. As a consequence, uncertainty with regard to the international environment will be lower, and the international environment will be regarded as more friendly. For example, Nyaupane et al. [33] found that students' abroad experience changed their original attitude towards local people. For instance, students' positive attitudes towards Dutch people increased at the end of an exchange. Hence, the familiarity with the new culture would strengthen the link between an individuals' attitude and IEI. Therefore, we assume that

*(H4a) cultural intelligence moderates the impact of personal attitude on IEI: the higher the CQ, the stronger the PA-IEI relationship.*

Similarly, based on the cognitive facet of CQ we argue that individuals with high CQ have more knowledge of foreign cultures. With more knowledge, they are more confident in their judgement and therefore develop a distance to others' opinions [34]. Hence, high CQ enables individuals to free themselves from their surrounding peoples' opinions. Formally

*(H4b) cultural intelligence moderates the impact of subjective norms on IEI: the higher the CQ, the weaker the SN-IEI relationship.*

In addition, the behavioral aspect of CQ suggests that adaptation is not only thinking about what to do but also taking actions in specific situations. This indicates that an entrepreneur with a high level of CQ is able to determine when and how to perform activities related to international entrepreneurship. Such a behavioral control ability reduces the risk and thus increases the willingness to conduct IE. Therefore, a higher degree of CQ could enhance the effect of PBC on IEI. We assume that

*(H4c) cultural intelligence moderates the impact of perceived behavioral control on IEI: the higher the CQ, the stronger the PBC-IEI relationship.*

**2.3. Global Mindset and IEI.** GM is defined as a mindset "that combines an openness to and awareness of diversity across cultures and markets with a propensity and ability to synthesize across this diversity" [21, p. 117]. A global mindset captures a frame of reference based on interacting diversity [26]. A global mindset involves scanning the world from a broad perspective, looking for unexpected trends and opportunities to achieve personal, professional, or organizational objectives, and searching for the broad picture and context surrounding situations [35]. It also entails embracing the complexity and contradictions inherent in global interactions. This implies that entrepreneurs both accept and embrace the complexity involved in adapting to foreign markets in a global economy. GM involves four facets: personal attributes, cognitive knowledge and skills, motivation, and resources for adapting behavior [15].

The personal attributes of GM refer to a state of mind that is characterized by an orientation towards the outside and openness and willingness to learn from alternative systems of meaning held by others [36]. Having a global mindset requires six personal characteristics: knowledge, conceptualization, flexibility, sensitivity, judgement, and reflection [37]. With these personal attributes, people tend to be open to themselves and others by rethinking boundaries and changing their behavior. Therefore, individuals with a strong GM would be more open to and eager to learn more about international entrepreneurial activities, which may lead to a stronger intention to engage in them.

The cognitive perspective of GM refers to a combination of openness and awareness of diversity across cultures and markets and a propensity and ability to synthesize across this diversity [21]. GM is the filter through which people look at the world [21]. Knowledge, understanding the world, and skills that enable to effectively work in a global context are necessary to sustain and develop a global mindset [38]. A better understanding of the world will lead to lower uncertainty. A higher degree of skills enables entrepreneurs to execute strategies effectively in the global context. Such knowledge and skills enable people to respond to and to create market opportunities. Both elements enable entrepreneurs to conduct international entrepreneurship. An entrepreneur with a grasp of the needs of different markets can build bridges between the needs of different markets and the venture's global experience and capabilities.

The motivational facet of GM addresses the willingness to engage in global activities. The motivational facet of GM indicates that individuals with a strong GM are more willing to learn from others and adjust themselves to dynamic global environments. With a strong GM, entrepreneurs are more motivated to seek rather than reject globally oriented behavior, such as international entrepreneurship activities.

The behavioral facet of GM makes entrepreneurs not only think globally but also act locally. Kefalas [39] argues that a global mindset allows individuals to see the world as a whole and to use this perspective to design value-maximization

strategies for everyone involved. Thus, a strong GM makes it possible for entrepreneurs to strengthen value-maximizing strategies and compete in a global market. Equipped with these competitive abilities, entrepreneurs may be more likely to engage in international entrepreneurial activities.

In summary, we expect that people with a strong GM would have personal attributes that are more positive towards international activities, more cognitive knowledge and skills, more motivation, and better behavioral capabilities, which leads to international entrepreneurial intention. Formally

(H5) *the higher the degree of global mindset, the higher the international entrepreneurial intention.*

We propose no interactions between GM and TPB-antecedents because the GM constructs tap less into behavioral components than CQ. For example, Andresen and Bergdolt [15] find that only 40% of the items of the GM construct indicate a behavioral component, whereas 86% of the items of CQ have a behavioral perspective. Thus, we argue that GM may matter, but matter less for interactions that involve behavioral intentions. As a consequence, we do not hypothesize moderation effects of GM and TPB for GM's lower degree of behavioral components.

**2.4. CQ, GM, and IEI.** Only few studies focus on the relationship between CQ and GM. Drawing on Earley and Mosakowski [40], Levy et al. [36] argue that it is difficult to develop the requisite set of interpersonal skills (CQ) without a fairly high level of global mindset (GM). Thus they argued that GM is the prerequisite of those skills and abilities that make up CQ. In another vein, Lovvorn and Chen [16] found that CQ acts as a moderator in the relationship between international experience and global mindset: individuals need cultural intelligence to transform their experiences into a global mindset. Ramsey et al. [41] identified the application scope of CQ and GM. They imply that the concept of CQ ought to be used when the context is focused on interpersonal outcomes, while GM ought to be used when it focuses more on strategic outcomes.

Based on the arguments above, we suppose an interaction between CQ and GM. CQ reflects the ability for effective interpersonal behavior in the global context. GM reflects the ability to recognize and synthesize information from foreign cultures. Persons who are able to reflect and synthesize this information (GM) and use this perspective in their personal interactions (CQ) would be more effective than those that would lack one of these elements. We propose that a combination of GM and CQ would make an entrepreneur more aware and able to be inclined towards international entrepreneurship. Formally

(H6) *global mindset moderates the impact of cultural intelligence on IEI: the higher the GM, the stronger the CQ-IEI relationship.*

Figure 1 shows the conceptual model of this study.

### 3. Methods

**3.1. Sample and Data Collection.** This study is based on undergraduate university business students enrolled in an

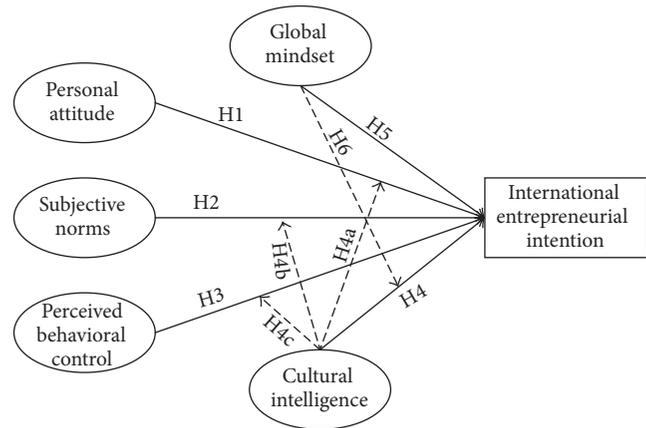


FIGURE 1: The conceptual model of this study.

entrepreneurship course ( $N = 120$ ) at a Dutch university. We study the drivers of IEI among business students for three reasons [11]. First, the majority of business students (except accounting students) are not educated with an institutionalized professional identity in mind, which gives space and options for students' career development. Second, business students are exposed to business and management knowledge, and students equipped with this knowledge could be pulled rather than pushed into entrepreneurship. Third, entrepreneurship education has been an important part of business administration education. In addition, studying at an international university, business students get access to a unique international and cross-cultural environment, which provides a fertile ground for nurturing international entrepreneurs.

Data was collected through a self-report survey. A randomly selected group received a questionnaire that focusses on IEI (*Questionnaire A* available in Supplementary Material available online at <https://doi.org/10.1155/2017/9042132>), while the other participants received the questionnaire on EI. During one class session, most students finished the printed survey. We also provided an online survey for those who did not attend this particular class or were unwilling or unable to finalize the survey in class. After dropping cases with missing data, our sample consists of 84 respondents (41 from the *international* group, 43 from the *national* group), with a response rate of 70%.

Chi-square tests show that there are no significant differences between these two groups on students' age (*Pearson Chi-square* = 9.122,  $p = .521$ ), gender (*Pearson Chi-square* = 0.001,  $p = .979$ ), abroad experience (*Pearson Chi-square* = 18.421,  $p = .142$ ), language skills (*Pearson Chi-square* = 3.430,  $p = .489$ ), nationality (*Pearson Chi-square* = 8.854,  $p = .546$ ), entrepreneurial experience (*Pearson Chi-square* = .009,  $p = .923$ ), and parents' entrepreneurial experience (*Pearson Chi-square* = .607,  $p = .436$ ). 52.4% of the students are Dutch, and 35.7% are German. Most of them (about 70%) are between 19 and 21 years old and 56% are male. About 70% of the students have international study or work experience. More details are shown in Table 1.

TABLE 1: Descriptive statistics of the sample characteristics.

Item	Category	International			National			Group difference	
		Count	Percent (%)	Cum. percent (%)	Count	Percent (%)	Cum. percent (%)	Pearson Chi-square	Asymptotic significance (2-sided)
Age	19	11	26.8	26.8	12	24.9	24.9	9.122	.521
	20	13	31.7	58.5	10	23.2	51.2		
	21	6	14.6	73.2	8	18.6	69.8		
	Others	11	26.8	100	13	30.2	100		
Gender	Male	23	56.1	56.1	24	55.8	55.8	.001	.979
	Female	18	43.9	100	19	44.2	100		
Years of abroad experience	0	11	26.8	26.8	14	32.6	32.6	18.421	.142
	1-5	13	31.7	58.5	4	9.3	41.9		
	2-10	6	14.6	73.2	10	23.3	65.1		
	Others	11	26.8	100	13	30.2	100		
Number of foreign languages	1	11	26.8	26.8	7	16.3	16.3	3.430	.489
	2	17	41.5	68.3	17	39.5	55.8		
	3	9	22.0	90.2	14	32.6	88.4		
	Others	4	9.8	100	5	11.6	100		
Country of birth	Netherlands	20	48.8	48.8	24	55.8	55.8	8.854	.546
	Germany	17	41.5	90.2	13	30.2	86.0		
	Others	4	9.7	100	6	13.9	100		
Self-entrepreneurial experience	Yes	12	29.3	29.3	13	30.2	30.2	.009	.923
	No	29	70.7	100	30	69.8	100		
Parents' entrepreneurial experience	Yes	15	36.6	36.6	12	27.9	27.9	.607	.436
	No	26	63.4	100	30	72.1	100		

TABLE 2: Reliability statistics of the scales.

	International			National		
	Cronbach's $\alpha$	Cronbach's $\alpha$	Dropped item	Cronbach's $\alpha$	Cronbach's $\alpha$	Dropped item
Total	0.895	—	—	0.869	—	—
IEI/EI	0.971	—	—	0.957	—	—
PA	0.896	—	—	0.916	—	—
SN	0.804	—	—	0.649	0.665	— (no improvement)
PBC	0.716	—	—	0.788	—	—
CQ	0.776	—	—	0.734	—	—
GM	0.559	0.648	Item 1	0.715	—	—

TABLE 3: Sampling adequacy.

	International	National
KMO and Bartlett's test		
Kaiser-Meyer-Olkin measure of sampling adequacy	.485	.597
Bartlett's test of sphericity		
<i>Approx. Chi-square</i>	1183.980	1107.208
<i>Df</i>	528	561
<i>Sig.</i>	.000	.000

3.2. *Operationalization.* All items were measured using 7-point rating scales. In the final analysis, the value for each scale is represented by the unweighted mean of its items. The items for the dependent variables, IEI and EI, were taken from Kautonen et al. [10]. They reflect the intention to engage in activities aimed at starting an international new venture (or a domestic new venture). To differentiate between IEI and EI, the key word “international” was added to all items in the case of the international group (similarly hereinafter).

*Personal attitude* (PA) was measured with students' perceptions on taking steps to start an international new startup in the future by rating six adjective pairs. *Subjective norms* (SN) was measured with two sets of scales: one capturing the opinion from students' surrounding important people (family members, best friends, and other general important people) on the topic of the students' potential engagement in starting an international new venture and the other measuring the degree to which students consider the opinions of others [10]. These scores were multiplied to derive the SN score. *Perceived behavioral control* (PBC) was measured with four items, with two addressing the ease of performing international entrepreneurial activities and the other two capturing students' felt control over such behavior. Items for all the above constructs are taken from Kautonen et al. [10].

*Cultural intelligence* (CQ) was measured by nine items of the mini-CQS developed by Ang and Van Dyne [42]. While the original CQ scale contains 20 items [43, 44], we opted for the mini-CQS to shorten the survey with an eye on the response rate.

*Global mindset* (GM) was measured with six items which addressed students' attitudes towards and feelings about acting in diverse cultural contexts. Items were adopted from Gupta and Govindarajan [21]. This scale assesses individuals' rather than organizational GM. We transferred the statements from Gupta and Govindarajan into rating scales.

We add students' gender as the control variable. Prior literature has identified gender as an important factor for entrepreneurial intention [45].

The scales are reliable (Cronbach's  $\alpha > 0.7$ , see Table 2). When we divide the sample into the international and national group, the reliabilities differ slightly. In the international group, scales for PA, SN, PBC, IEI, and CQ passed the reliability threshold, but GM did not. This is acceptable, however, taking into account the small sample size. In the national group, all scales are reliable except SN. As the deletion of the lowest scoring item did not improve Cronbach's  $\alpha$  for SN, we kept all items. Sampling adequacy is acceptable [46] for the national group survey (KMO = .597 > .5,  $p = .000$ , see Table 3). For the international group we have slightly lower values (KMO = .485 < .5,  $p = .000$ ). This is also acceptable, however, taking into account the small sample size.

3.3. *Method of Analysis.* Due to the low sample size, we were restricted in the use of methods of analysis and used OLS regression to test the relationship between personal attitude, subjective norms, perceived behavioral control, cultural intelligence, and global mindset on (international) entrepreneurial intention. To test the moderation effects, we use moderated multiple regression [47]. We report the standardized coefficients.

## 4. Results

Table 4 displays the correlation table. For the first part of the analyses, two OLS regressions were calculated. Results in Table 5 suggest that personal attitude has a positive, significant relationship with both international entrepreneurial intention ( $b = .611$ ,  $p = .000$ ) and national entrepreneurial intention ( $b = .892$ ,  $p = .000$ ). The results provide support for hypothesis 1.

TABLE 4: Correlation table.

	International							National						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7
IEI/EI	1							1						
Gender	-.046	1						-.264	1					
PA	.726**	.105	1					.907**	-.246	1				
SN	.546**	.180	.563**	1				.356*	-.038	.270	1			
PBC	.499**	.130	.456**	.437**	1			.302*	-.007	.320*	.362*	1		
GM	.167	.272	.379*	.228	.267	1		.082	.154	.145	.186	.290	1	
CQ	.065	.061	.088	.029	.291	.660**	1	.015	-.150	-.038	.209	.206	.477**	1

\*\*  $p < .05$  and \*  $p < .1$ , two-tailed.

TABLE 5: Direct effects on (international) entrepreneurial intention.

Variables	International	National
(Constant)		
Gender (female = 1)	-.125 (.279)	-.014 (.848)
Personal attitude	.611 (.000)***	.892 (.000)***
Subjective norms	.181 (.188)	.123 (.099)*
Perceived behavioral control	.182 (.173)	-.014 (.848)
Cultural intelligence	.069 (.658)	.072 (.381)
Global mindset	-.166 (.324)	-.098 (.234)
	$R^2 = .616^{***}$	$R^2 = .845^{***}$
	$Df = 40$	$Df = 42$
	$F = 9.087$	$F = 32.767$

\*\*\*  $p < .01$  and \*  $p < .1$ .

In addition, the results indicate no significant findings on other direct relationships for either the international or national entrepreneurial intention.

To test the moderation hypotheses, a series of moderated regression analyses was run. In models 1a–e, moderations of CQ on the relationship between TBP-antecedents (PA, SN, and PBC) and IEI were analyzed. The results in Table 5 indicate a negative, significant interaction between CQ and PA in the model with IEI (model 1c,  $b = -.296$ ,  $p < .05$ ). Explained variance increases by 7.4%. Results also suggest a negative interaction between CQ and SN in the model with IEI (model 1d,  $b = -.244$ ,  $p < .05$ ), which increases the explained variance by 5%. These findings run counter to hypothesis 4a, while they support hypothesis 4b. The result shows no significant moderating effects of CQ on PBC, which fails to support hypothesis 4c.

In models 2a–e, moderations of CQ on the relationships between PA, SN, and PBC and EI were tested. The results in Table 6 indicate no interaction between CQ and PA, SN, and PBC in the model with EI as a dependent variable. Models 1f and 2f show the moderation of GM on CQ for IEI and EI. Results show no significant interactions between GM and CQ for either IEI or EI.

To illustrate the significant interactions regarding hypotheses 4a and 4b, we plot the moderation effects of CQ from models 1c and 1d. As shown in Figure 2, those that score high on CQ have a weaker relationship between PA and IEI (less steep slope). This runs counter to hypothesis 4a. Figure 3 shows the interaction effect of CQ

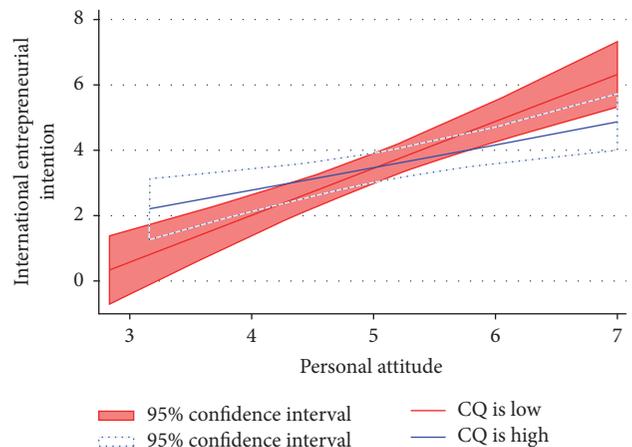


FIGURE 2: The interaction effect of CQ and PA on IEI.

on the relationship between SN and IEI. Those that score high on CQ have a weaker relationship between SN and IEI, which lends support to hypothesis 4b.

### 5. Discussion

The goal of this study was to identify the drivers of students' IEI, by analyzing the effects of two cross-cultural competences, cultural intelligence and global mindset, in the context of the TPB framework. Our analyses reveal surprising findings (Table 7).



TABLE 7: Summary results of hypothesis tests.

Hypothesis	Expected	Result
(H1) PA → IEI	pos.	pos.
(H2) SN → IEI	pos.	n.s.
(H3) PBC → IEI	pos.	n.s.
(H4) CQ → IEI	pos.	n.s.
(H4a) CQ * PA → IEI	pos.	neg.
(H4b) CQ * SN → IEI	neg.	neg.
(H4c) CQ * PBC → IEI	pos.	n.s.
(H5) GM → IEI	pos.	n.s.
(H6) GM * CQ → IEI	pos.	n.s.

pos.: positive; neg.: negative; n.s.: not significant.

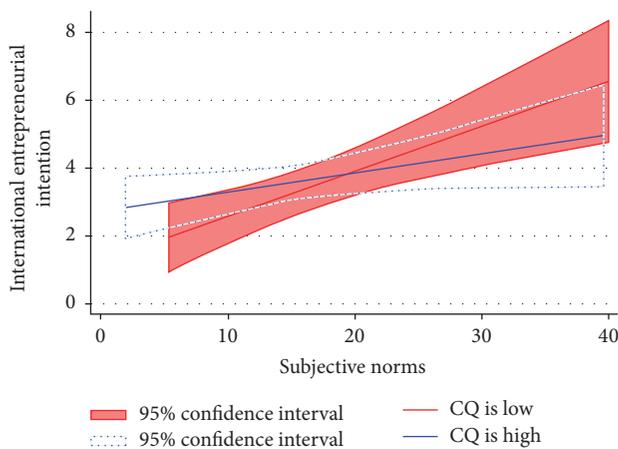


FIGURE 3: The interaction effect of CQ and SN on IEI.

Literature shows that personal attitude, subjective norms, and perceived behavioral control have a significant positive relationship with entrepreneurial intention [10]. However, our empirical results show only a positive relationship of PA on IEI. This indicates that the attitude towards IEI may be an important antecedent to intention. Subjective norms show no significant relationship with IEI. Even though the SN constructs are an importance-weighted indicator of others' norms, there is a gap between the perceived social norms and intention. A potential reason may be that, among many other factors [48], in particular parents influence on entrepreneurial career decisions may be limited [49]. Neither does PBC have a significant influence on IEI. While contrary to the mainstream, our finding is consistent with the study of Van Gelderen et al. [11], who show that components of PBC (perseverance and self-efficacy) lack support in explaining EI. We suggest that PBC alone may not motivate intentions that lead to action. It facilitates action for those who are motivated to engage in it. It can also imply that students realize that while they may experience as much control as possible, entrepreneurial activities need a lot of external resources, such as financial support and business networks. As students may have a lower level of these resources, their own degree of PBC may matter less for their IEI.

Direct effects analyses show that neither global mindset nor cultural intelligence has a significant influence on IEI. These results are surprising, as we have provided strong arguments for such potential links. We suggest that GM may not be directly related to IEI because GM refers to a mindset rather than to intentions that lead to actions. With regard to the missing link between CQ and IEI, we can speculate that CQ as such is context-free and may be enacted in any other career choice, with an international entrepreneurial intention being only one possible career choice.

Moderation effects analyses show that only the interactions of CQ and PA as well as CQ and SN towards IEI are significant. From the discussion of the dimensions of CQ follows that a high degree of CQ implies a high degree of knowledge of and high adaptive capability of new cultural contexts. When individuals have enough knowledge of new cultural contexts and can adapt effectively to new cultures, they may not view conducting an international new business as challenging as without a high level of CQ. Also, students with a high level of CQ are more likely to see the difficulties in IE activities and hence are less likely to intend to act, even those that may initially value international entrepreneurship.

A similar moderation effect was found regarding the negative impact of CQ on SN-IEI relationship (Figure 3). The positive relation between SN and IEI is lower for high CQ students than for low CQ students. This suggests that those who have a low degree of CQ are impacted more in terms of IEI by what their environment says. It might be because sufficient knowledge of a new cultural context reduces the extent of importance of other important people's opinion. This result is in line with the independence of judgement that is facilitated by a high level of CQ and supports hypothesis 4b.

## 6. Conclusions

**6.1. Theoretical Implications.** Our study contributes to the literature by drawing upon the concepts of global mindset and cultural intelligence, to develop a framework that explains the antecedents of international entrepreneurial intention based on an addition to the TPB framework.

The significant moderation effects of CQ on the relationships between PA and IEI and SN and IEI show that it is useful to combine the literatures of cross-cultural competence

and international entrepreneurship to move closer to a complete model. Future studies could follow this direction and explore the relationship between cross-cultural competence and other constructs from the international entrepreneurship domain, for example, the international performance of international new ventures. In addition, exploring the mechanisms behind the relations would contribute to a deeper understanding of IE(I). We suggest integrating other constructs such as firm-level capabilities as a theoretical foundation for an application to our findings to international new ventures rather than student entrepreneurs. Further, our results show no significant direct linear relationships between GM and CQ to IEI. In addition, there may be nonlinear relationships between these constructs. Future studies may identify those nonlinear relationships. Studies following this direction take a step further to explain the role of cross-cultural competences in the field of international entrepreneurship and international entrepreneurship education.

**6.2. Practical Implications.** Prior studies confirmed the role of entrepreneurship education in enhancing students' EI [50–53]. For educators, policy makers, and university management, results of our study provide some important implications. First, if a limited link between TPB and IEI would be a result of a lack of in-depth education on IEI, educators could emphasize the international element more. Second, if a missing link between PBC and IEI would be a result of a lack of practical engagement with international entrepreneurship, entrepreneurship education could emphasize the international domain more, for example, by integrating international entrepreneurship in an applied Lean-Startup class [54] or by paying particular attention to the specifics of STEM students [55]. Third, since a high CQ could make students more independent of their environment's opinion, educators may think about how to introduce CQ into the curriculum.

**6.3. Limitations and Future Research.** This study has taken a step in the direction of analyzing the relationship between GM, CQ, PA, SN, PBC, and IEI/EI on a student sample. However, it is possible that analyses of target groups with different working or entrepreneurial experience may result in different findings. Also, the small sample size limits the choice of methods of analysis as well as the power of our results. Future studies could extend the sample size to fulfill the criteria for using Structural Equation Modelling, to reap its advantages compared to OLS [56]. In addition, other constructs could be added to our model in future studies. For instance, need for achievement, internal locus of control, self-efficacy [57], and social media network [58] are relevant constructs that could explain IEI.

## Conflicts of Interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

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## Review Article

# Measuring Student Transformation in Entrepreneurship Education Programs

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This article describes how to measure student transformation primarily within a university entrepreneurship degree program. Student transformation is defined as changes in knowledge (“Head”), skills (“Hand”), and attitudinal (“Heart”) learning outcomes. Following the institutional impact model, student transformation is the primary goal of education and all other program goals and aspects of quality desired by stakeholders are either input factors (professors, courses, facilities, support, etc.) or output performance (number of startups, average starting salary, % employment, etc.). This goal-setting framework allows competing stakeholder quality expectations to be incorporated into a continuous process improvement (CPI) model when establishing program goals. How to measure these goals to implement TQM methods is shown. Measuring student transformation as the central focus of a program promotes harmony among competing stakeholders and also provides a metric on which other program decisions (e.g., class size, assignments, and pedagogical technique) may be based. Different stakeholders hold surprisingly different views on defining program quality. The proposed framework provides a useful way to bring these competing views into a CPI cycle to implement TQM requirements of accreditation. The specific entrepreneurial learning outcome goals described in the tables in this article may also be used directly by educators in nonaccredited programs and single courses/workshops or for other audiences.

## 1. Introduction

Entrepreneurship has become well recognized as a driver of economic prosperity and many governments strongly fund the creation of new entrepreneurship degree programs worldwide [1]. However, others have criticized entrepreneurship education as lacking rigor [2], a common framework [3], and best practices [4, 5]. One of the most comprehensive assessments of entrepreneurship education programs, including seven surveys since 1979, concluded that “there is little consensus on just what exactly entrepreneurship students should be taught” ([6], p. 169). In fact, the question “can entrepreneurship be taught?” continues to be raised (e.g., [7, 8]).

Many authors have pointed out that there is a lack of research on how to measure the success of entrepreneurship programs [6, 9–12]. In fact, there have been calls for total reenvisioning of the way entrepreneurship education is designed, implemented, and assessed [13, 14].

Entrepreneurship education is a broad subject that may be applied to single classes, workshops, modules, courses, curricula, and degree programs. It can be delivered to children, youth, undergraduates, graduates, executives, professors, corporations, immigrants, refugees, and those in need. In the context of this article, I will focus primarily on university entrepreneurship degree programs. Readers interested primarily in single courses or different audiences may benefit most from Table 2, where they will find entrepreneurial learning outcomes they may wish to incorporate directly into their classes/courses/modules.

*1.1. Best Practices and Total Quality Management (TQM).* The total quality management (TQM) revolution started with the influential books by TQM gurus such as Juran [15], Crosby [16], Deming [17], and Garvin [18]. Central to all these systems are the concept that “quality” must be defined and measured in order to manage it and the concept that customer satisfaction is the ultimate goal [19]. TQM specialists must

translate qualitative external customer quality expectations into quantitative internal goals. Central to the continuous improvement cycle is the ability to collect meaningful data that is compared against well-defined quality goals [20].

The TQM wave was adopted by higher education and by 1996 over 160 US universities were involved in adopting TQM [21] and many researchers had investigated the implementation of TQM principles within university business school programs (e.g., [22–25]). This resulted in significant improvements to the primary worldwide university accreditation agency standards [26] that continue to be updated following TQM measurement and continuous process improvement principles [27, 28]. Although much progress has been achieved in applying TQM to administrative processes, the core processes of teaching and research are still lagging [29].

Regardless of whether any entrepreneurship educator is interested in accreditation, they will still be interested in having high quality and setting goals. The fundamental issue is defining precisely what “quality” means to different stakeholder groups and how conflicting opinions are resolved to set specific measurable goals [30].

## 2. Centrality of Student Transformation

Kanji et al. [60] defined the customers in higher education as a broad stakeholder group including existing and prospective students, parents, employers, government, and university employees such as professors and staff. The resulting quality dimensions thus included all aspects of the total student experience including preenrollment, enrollment, in-class experiences, extracurricular activities, and institution-based resources and services.

As Tam [30] showed, however, these different stakeholders have contradictory definitions and models of quality as well as the purpose of education in general. These contradictory definitions go to the heart of what a university’s mission should be: to teach students, to conduct research and create new knowledge, or to contribute to society [61].

To resolve this, Tam [30] proposed that all quality aspects must focus on the student’s learning and educational development and that all other aspects of quality must be peripheral to this main objective. Quality is thus defined as the transformation in the student caused by education. This has been referred to as the value added or institutional impact approach where changes in students’ performance are measured in order to evaluate the performance of a university [62].

According to Astin [63], “true quality resides in the institution’s ability to affect its students favourably, to make a positive difference in their intellectual and personal development” (p.11). While institutional dimensions of quality are necessary, they should be secondary to the student dimensions of quality related to student achievement [64].

Martin et al. [10] also adopted the student transformation viewpoint when doing a meta-analysis of the effect of entrepreneurship education and training on increasing the human capital of the students. They investigated the effect of entrepreneurship education on increasing learning outcomes

related to knowledge and skills, attitudes, and intention as well as startup outcomes.

Gedeon [35] followed instructional design methods to create the Entrepreneurship Program Design Framework (EPDF), which expands Fayolle and Gailly’s [3] Teaching Model Framework into an institutional and environmental ecosystem. He defined entrepreneurship education as follows: “entrepreneurship education encompasses holistic personal growth and transformation that provides students with knowledge, skills and attitudinal learning outcomes. This empowers students with a philosophy of entrepreneurial thinking, passion, and action-orientation that they can apply to their lives, their jobs, their communities, and/or their own new ventures” ([35], pp 238.)

Following the EPDF and defining student transformation as changes in knowledge, skills, and attitudes, all other program quality goals can be seen as either input factors (professors, courses, facilities, support, etc.) or output performance (number of startups, average starting salary, % employment, etc.). Placing quantifiable student transformation as the primary goal of an entrepreneurship education program provides a continuous process improvement (CPI) framework that may be used to analyze the literature to identify and categorize alternative stakeholder quality expectations in order to set program goals. The specific goal-setting framework comprises the following:

- (1) Primary goals: central to student transformation (knowledge (“Head”), skills (“Hand”), and attitudes (“Heart”) learning outcomes)
- (2) Input goals: factors that support student transformation (such as faculty qualifications, resources, facilities, assignments, courses, pedagogy used, etc.)
- (3) Output goals: related to success of the program or external impact (such as number of students, number of awards won, or number of new companies launched, etc.)

With this CPI framework, the existing literature concerning stakeholder expectations of quality can be reviewed.

## 3. Quality Expectation Analysis of Alternative Stakeholder Groups

*3.1. Quality Definition as Assessed by Accreditation Agencies.* Accreditation agencies implement a comprehensive approach to articulating stakeholder quality metrics, documenting program objectives, and implementing a process of continuous improvement against these metrics [65]. The primary business school accreditation agency in North America is the American Assembly of Collegiate Schools of Business [27], whereas EQUIS is the quality assurance accreditation standard run by the European Foundation for Management Development [28]. These organizations provide a system of quality assessment and set quality standards in order to help universities measure where they are on the path to excellence, identify gaps, and stimulate solutions [66]. Entrepreneurship programs housed within business faculties within most large

TABLE 1: Classification of quality expectations of alternative stakeholders.

Stakeholder	Primary goals central to student transformation	Input factor goals	Output goals	Not directly related to student transformation
EQUIS	Chapter 2: skills and assurances of learning	Chapter 1: strategy and governance Chapter 3: students & job placement services Chapters 4-5: faculty quality & research output Chapter 8: admin resources Chapters 9-10: international and corporate connections	Chapter 7: contribution to community	
AACSB	Standards 16, 18, 19, 21: continuous improvement & assurances of learning	Standards 1 & 4: mission Standards 3, 6, 7, 14: student acceptance and retention Standards 2, 8, 9, 10, 11, 12, 13: staff and faculty sufficiency Standards 5 & 8: financial strategies		
Employers	Key skills learned	Proof of capacity (high entrance scores)	Prestige of the school	Company relations with the school
Government	Key skills, attitudes, & intent to start new company (e.g., ASTEE)		Number of startups Number of jobs Increase in economy	
Students		Entry requirements Assurance, reliability, empathy, responsiveness, tangibles	Good job	
Faculty		Good management Faculty mentors		Collegiality Tenure process Salary
Business school deans		Number of courses	Alumni exploits Number of startups Number of innovations Impact on community	Number of publications Outreach to scholars
Magazines and award programs		Entry requirements (e.g., GMAT score) Number of courses Faculty qualifications Percent of entrepreneurs in faculty Resources for students (prizes, mentors, and clubs)	Number of startups Starting salaries of graduates	Research funding obtained by faculty
Malcolm Baldrige Award Program	Performance results	Strategy & leadership Process management, measurement, & analysis Student, stakeholder, and market focus Faculty and staff focus		
USASBE		Complete and comprehensive		Innovative, unique Transferrable and sustainable

or highly ranked universities worldwide are accredited to the standards set forth by one of these organizations [67].

Table 1 categorizes the standard requirements of both agencies into the goal-setting framework and compares these

with the quality expectations of the other stakeholder groups assessed in this article. As can be seen, the AACSB and EFMD's EQUIS standards heavily focus on input factor goals related to institutional impact or value add. Virtually

TABLE 2: Goal-setting framework.

Goals	References
<i>Learning outcomes</i>	[31]
Lifelong learning skills	[32–36]
Communication skills	[32, 33, 35–38]
Teamwork skills	[32, 33, 35–39]
Social capital skills (persuasion, negotiation, networking)	[36–38, 40]
Creativity and innovation skills (alertness, opportunity spotting)	[36–39, 41]
Guerilla skills (bootstrapping, acquisition of resources, planning under uncertainty)	[9, 35–38, 42, 43]
Motivational skills (psychological capital, empowerment)	[36, 44, 45]
Entrepreneurial thinking skills (independent and critical thinking, self-management, adapting)	[9, 33, 36–38, 46, 47]
<i>Attitudes, beliefs, values, and intent</i>	
Entrepreneurial desirability	[35, 36, 38, 48, 49]
Self-efficacy	[36, 38, 39, 47, 49–51]
Internal locus of control	[36, 38, 39, 47, 49]
Values	[52]
Entrepreneurial intent	[36, 38, 39, 47, 49, 53–55]
Clarity of mission statement	[28, 38, 39]
<i>Faculty qualifications and behaviours</i>	
Percent with Ph.D. degrees (academically qualified)	[27, 28]
Percent with entrepreneurial experience	[56, 57]
Intellectual contributions (or number of publications)	[27, 28]
SERVQUAL or SERVPERF (assurance, reliability, empathy, responsiveness)	[58, 59]
<i>Resources to support students</i>	
Student entrepreneurship clubs	[57]
Business plan competition amount	[57]
<i>Incoming student population</i>	
Entry requirements	[27, 28, 33, 57]
Number of scholarships	[57]
<i>Output goals related to growth or external impact</i>	
Number of students	[57]
Number of courses	[57]
Awards won	[57]
Community impact	[13]

every aspect of a program is assessed from the quality of the strategy/mission to student services, faculty intellectual contributions, and social impact [27, 28].

Osseo-Asare and Longbottom [68] identified several major limitations in applying the EFMD model to higher education including the fact that EFMD is too prescriptive, too time-consuming, and too subjective. Barnett [69] has also pointed out that conflicting views of quality by different stakeholders result in conflicting performance indicators. Furthermore, measuring these indicators is controversial and, at best, only provides information about the past and provides limited insight into what should be modified or improved [64].

Accreditation has also been widely criticized for diverting universities away from teaching by placing such a large emphasis on research (e.g., [70–73]). As a result, the agencies have shifted to a mission-driven basis of accreditation as opposed to a one-size-fits-all standard [74]. Even though universities may now designate teaching as their major mission for accreditation, it is more difficult to measure teaching productivity and implementing accreditation for teaching-intensive universities remains problematic [75, 76]. Thus, regardless of a university's purported mission, it appears that accreditation results in the demand for annual increases in the number of publications by faculty at accredited institutions [77]. As summarized by Roberts et al. [78], “for good or bad the emphasis on research remains... and teaching efforts give way to increased research efforts.”

The effort and cost of accreditation are significant. “In short, pursuing AACSB is not a pleasurable exercise for a business school from both internal and external political views. The annual incremental cost increases for even a small school, including salary and benefits, can easily exceed \$500,000 per year” [78]. Although most programs will have lower costs, it is evident that implementing the standard may not be worth the extensive documentation required, especially for a smaller program.

One may thus question whether the costs, potential to divert the university from its teaching mission, and onerous reporting are worth the effort, especially if one considers the possibility that “to most people, the status of being academically accredited does not imply that the educational institution is appreciably superior to the average institution...” ([75], pp 348-349). In a survey of faculty at accredited institutions, however, Roberts et al. [78] found that, “despite this shift from teaching to research, and the increased job stress, and no positive impact on teaching, the respondents, on average, indicated strongly that accreditation was worth the effort.” More recent studies also confirm these results [79].

Clearly, there are benefits to accreditation regardless of the negatives. The value add quality aspects of student transformation related to learning outcomes are particularly well quantified by both EQUIS (in Chapter 2) and AACSB (in Standards 16, 18, 19, and 21). Each program must identify specific student learning outcomes (e.g., communication skills and numeracy) and how they are measured. Each course within the program must then specify how these outcomes are taught and measured. Programs then track their students'

performance over time and identify continuous improvement through implementing new course content, pedagogies, or teaching methods. In this way, quality is measured as the value add or cumulative improvement in learning outcome assessments achieved by a student from start to finish of the curriculum [80].

By focusing on the primary goals related to student transformation, a program may achieve the benefits of the TQM process without the onerous, expensive, and/or potentially negative consequences of full accreditation which focuses on secondary input factors [81].

*3.2. Quality Definition as Assessed by Employers.* One of the primary purposes of higher education is to prepare students to enter the workforce and contribute to the national economy [82]. This high level qualitative objective related to employer satisfaction is generally translated, as shown in Table 1, into ensuring that students have the requisite intellectual capacity and flexible and adaptable skills [83]. Hesketh [33] found that employers will proactively seek out and give preference to universities that they perceive as providing graduates with better intellectual capability as evidenced by higher entrance requirements or greater university prestige.

Although several authors contest the notion that teaching key transferable skills required by employers is applicable to the mission of higher education, most universities acknowledge this as a key qualitative objective [84]. The number of studies and potential list of skills desired by employers are extensive and contradictory, including as many as 62 different skills [33]. The National Committee of Inquiry into Higher Education in the UK focused this down into four key skills: communication skills, numeracy, use of information technology, and learning how to learn [32]. Other researchers have found that problem-solving, teamwork, and self-management were more desired by employers than numeracy or information technology skills [33]. An Australian government study taking place at around the same time [85] found that employers rated creativity and flair, enthusiasm, and independent and critical thinking as the most important key transferable skills [46].

The specific list of key skills chosen for an entrepreneurship degree program will normally include many of these key skills. Regardless of which skills are chosen as learning outcome goals, the NCIHE concluded that “all institutions of higher education should aim for student achievement in key skills” ([32], p. 135).

*3.3. Quality Definition as Assessed by Government.* Governments have discovered that entrepreneurship is one of the most powerful growth engines of the economy [14]. They have responded to this societal need by funding new entrepreneurship programs and support infrastructure [1]. In 2000, the Lisbon European Council set the objective of transforming EU productivity through creation of a culture of entrepreneurship and innovation. In 2006, the European Parliament specified entrepreneurial skills as a key lifelong learning competence for all citizens. In 2016, Bacigalupo et al. identified 3 entrepreneurial competence areas, 15 specific

competencies, an 8-level progression model, and 442 learning outcomes. Their EntreComp framework provides one of the most comprehensive stakeholder consultations and detailed analysis of entrepreneurial learning outcomes available [36].

Unfortunately, education in general has a very indirect measurable impact on the economy [86]. In the case of entrepreneurship education, the effect is even more distal as students may take several years before they gain enough practical experience to consider starting up a new company [87].

As a result, various authors have instead measured the impact of education on entrepreneurial intent and its antecedent attitudes (as shown in Table 1) rather than measuring the economic impact [88]. Survey instruments are ideal for measuring student transformation of beliefs, attitudes, values, and intent, all of which are known antecedents to entrepreneurial behavior and may be measured and modified during the educational process [48].

To address government interest in measuring these skills, Moberg, et al. [49], with funding from the European Community, Competitiveness and Innovation Framework Programme, developed Assessment Tools and Indicators for Entrepreneurship Education (ASTEE). The ASTEE survey provides validated scales for measuring student's self-perception of entrepreneurial knowledge, skills, and attitudes.

**3.4. Quality Definition as Assessed by Students.** Student satisfaction is sometimes referred to as the humanistic approach to educational quality evaluation, in contrast to the mechanistic approach which is conducted by experts and agencies such as AACSB and EQUIS [89]. The most widely used survey instruments are based on the SERVQUAL instrument and SERVPERF [59]. Both instruments measure five dimensions of service quality: reliability, empathy, assurance, responsiveness, and tangibles [90]. Despite the large number of projects associated with these instruments, they have met with only limited success [91]. One of the key limitations identified has been the lack of outcome quality attributes such as whether students get good jobs [89].

Chua [58] created an input-process-output framework of quality classification. Using this scheme, questions related to student selection and entry requirements (inputs) and good job placement and academic performance (outputs) are included along with standard SERVQUAL-style questions related to content, professors' knowledgeability, concern for students, and social activities (process).

In general, as shown in Table 1, none of these approaches to measuring student perception of quality measure student transformation or learning outcomes. Students are never directly asked if they learned anything or improved personally. They are instead asked about indirect indicators such as SERVQUAL's tangibles (e.g., "the school office is equipped with modern technology"), reliability (e.g., "I can depend on the school office's promises"), or responsiveness (e.g., "school office staff/faculty give me prompt service") [58].

**3.5. Quality Definition as Assessed by Faculty.** There is a large body of literature related to faculty satisfaction, stress, and

morale [92]. As shown in Table 1, the primary sources of faculty satisfaction or dissatisfaction are generally recognized as collegiality, salary, mentoring, management (department heads and/or deans), and the process related to promotion and tenure [92, 93]. Of these, collegiality has been found to be the most important issue to faculty [92–94]. Student transformation, learning outcomes, and success do not appear to be significant issues in any of these studies.

**3.6. Quality Definition as Assessed by Deans of Business Schools.** In most universities, the dean has a major influence on what the program objectives should be. Vesper and Gartner [13] surveyed the deans of over 1,000 business schools worldwide to determine what they viewed as the primary indicators of program quality. As shown in Table 1, they found that for business school deans the top ranking criterion is the number of entrepreneurship courses offered followed by number of faculty publications, impact on community, alumni exploits, innovations, alumni startups, and outreach to scholars.

As pointed out by the authors of that study, these ranking criteria are more than a bit problematic and should be viewed with much skepticism [13]. For example, several of these criteria focus on nebulous outcomes that are not necessarily tied to the curriculum (e.g., impact on the community or alumni exploits). They also imply that quantity equals quality and bigger is somehow better (e.g., number of faculty publications or number of startups).

Quality of education or learning outcomes do not appear anywhere on the business school deans' list of program ranking criteria [13]. A more recent study on the role of accreditation found that deans continue to emphasize the importance of faculty quality and acquisition of resources (input goals) and community interaction (output goals) [79].

**3.7. Quality Definition as Assessed by Magazines and Award Programs.** One of the primary mechanisms by which students select which program to attend is magazine rankings [95]. There is a reinforcing cycle of success where achieving high magazine ratings results in better students who help the university gain better ratings and win more awards [96]. Magazines that rank and/or issue awards to entrepreneurship programs include Fortune, Small Business, Princeton Review [56], US News, Entrepreneur.com [57], and Success.

Vesper and Gartner [13] found that magazines' entrepreneurship rating metrics, as shown in Table 1, had only "tenuous links" to what they were trying to measure: (a) qualifications of faculty, (b) variety and depth of entrepreneurship curriculum, (c) academic standards, and (d) quality and depth of resources.

Dill and Soo [97] found that there is an emerging international consensus on measuring quality in higher education among magazines that rate universities. "One of the leading determinants of a good university is the quality of its incoming students. . . The quality of the faculty and research is another prominent shared measure, which is assessed primarily by staff qualifications and the ability to attract research grants. . . In contrast to these input measures, assessments

of the teaching and learning process seem to get much less attention" ([97], pg 499-500).

Despite the fact that magazines may agree with each other about how to measure university quality, "a more serious problem with the national magazine rankings is that from a research point of view, they are largely invalid. That is, they are based on institutional resources and reputation dimensions, which have only minimal relevance to what we know about the impact of college on students" ([98], p. 20).

The United States Association of Small Business and Entrepreneurship [99] is comprised primarily of university entrepreneurship professors. The ranking criteria for its award program for the Excellence in Entrepreneurship Education-Model Entrepreneurship Programs are indicated in Table 1.

Finally, the Malcolm Baldrige National Quality Award [100] Education Performance Excellence Criteria have emerged as a theoretically validated model for implementing continuous quality improvement in universities [101, 102]. The 33 criteria can be categorized into the seven general areas listed in Table 1 following Badri et al. [103]. Not surprisingly, as this award arises from the TQM perspective, it is quite similar to the AACSB and EQUIS standard frameworks.

#### 4. Setting Goals Using the Framework and Implementing a Measurement System

By categorizing the large range of diverse and contradictory definitions of quality using the goal-setting framework, we can better identify commonalities between alternative stakeholder expectations. As shown in Table 2, all stakeholder desires associated with student transformation relate to changes in learning outcomes (i.e., knowledge, skills, and attitudes).

The central role of quantifying, measuring, and continuously improving student learning outcomes is clearly articulated in EQUIS (Chapter 2) and AACSB (Standards 16, 18, 19, and 21). Both standards provide good overall guidance for how to assess the impact of education on student transformation. The Malcolm Baldrige Award also places a significant emphasis on the process and knowledge management system around how the university measures, analyzes, and continuously improves the students' performance or accumulation of learning outcomes [100]. They are all, however, entirely silent on which specific learning outcomes a program should strive for, and some have claimed that there has been little development in the field of assessment practices [104].

Each entrepreneurship program must thus articulate its own list of learning outcomes which depends on its strategy, student population, local employment opportunities, and startup environment. These learning outcomes transcend and cut across the entire curriculum, so that in addition to learning specific course knowledge (e.g., accounting, marketing, and business planning) students transform by improving specific skills (e.g., communication, problem-solving, and teamwork) [31].

Table 2 thus provides a representative list of entrepreneurship program learning outcomes along with reference citations. Although any such list will be subject to heated

debate, focusing on learning outcomes will provide a superior measurement of quality rather than measuring the number of courses available (as suggested, e.g., by deans and magazines).

The overall scholarship on assessment of learning outcomes has made significant progress along with progress in the accreditation system [26]. The Joint Committee on Standards for Educational Evaluation (JCSEE) for program evaluation [105] and student evaluation [106] are excellent starting points for understanding how to implement learning outcome measurements [107]. These two standards of evaluation are related since measuring student outcomes will reflect on the success or failure of the educational program itself [108].

There are three required levels of assessment: (a) testing of individuals to assign student grades, (b) assessment of groups of individuals for the purpose of instructional planning, and (c) evaluation of instructional methods and/or the overall program over time [109]. These three levels require different methods and may conflict with one another [110]. The primary purpose of the standards relates to evaluation of the overall program and not the assignment of individual grades or instructional planning [108]. These two alternative objectives may be brought into alignment through the course-embedded method [111].

Of the six primary approaches to educational evaluation, the Kirkpatrick framework remains the most accepted and influential [112]. Kirkpatrick [113] specified three categories of student learning: knowledge, skills, and change of attitude. Knowledge and skills are assessed during class under the learning outcomes just discussed. However, affective or attitudinal beliefs are primarily assessed outside of class via indirect methods such as surveys (e.g., ASTEE), rating scales, and retrospective techniques [114].

Most entrepreneurship programs will have as a goal helping prepare their students for a career as an entrepreneur [115]. Education for an entrepreneurial career should transform students' attitudes, beliefs, and values such that they view entrepreneurship as a desirable and feasible career, regardless of whether they initially pursue employment [116].

There are well-known and validated attitudinal antecedents to entrepreneurial behavior (such as entrepreneurial intent, desirability, feasibility, perceived behavioural control, and self-efficacy) with existing scales and survey methods to measure the impact of education on this aspect of student transformation [54, 55, 88]. Table 2 provides a potential list of such attitudes, beliefs, and values as well as reference citations.

As can be seen in Table 1, there is a far greater range of quality expectations for the secondary goals related to institutional input factors. While accreditation will mandate the program to set goals for the full range of metrics, Table 2 provides a representative list along with references on how to implement a measurement system for each goal regardless of whether or not the degree program is seeking accreditation and/or TQM practices.

The critical role of strategy, mission, and governance is clearly recognized by EQUIS and AACSB as well as the Malcolm Baldrige Award as a way to resolve conflicting goals and drive operational tactics. This is precisely the reason why

these organizations rewrote their standards in the first place to become mission-driven [74, 76]. Potentially conflicting goals between, for example, emphasis on research versus teaching are resolved through a clear mission statement and strategy that then drives the remaining tactical goals.

Unfortunately, poorly worded, vague, or inherently contradictory mission statements are interpreted differently by competing stakeholders. Thus, for example, some stakeholders may incorrectly interpret EQUIS Chapters 4-5 or AACSB Standards 2, 8, 9, 10, 11, 12, and 13 as demanding greater numbers of publications regardless of the mission statement [77, 78].

The solution is to write clearer mission statements, so this is listed in Table 2 as an important input factor goal. The mission statement will help resolve conflicts that arise because different stakeholders have different expectations for input factors such as faculty qualifications and resources available. Deans expect professors to produce large numbers of publications, whereas students want professors to be reliable, responsive, and empathetic. Magazines expect professors to have had experience as an entrepreneur, whereas the accreditation agencies want professors to have a Ph.D. to achieve "AQ" (academically qualified) status. Clearly, the program's mission and strategy will drive the difficult goal-setting process required to resolve these conflicting expectations. This point was recently made by Turgut-Dao et al. [39]: "we found that critical stakeholder consensus is improved when entrepreneurship is defined in terms of action-based learning, interdisciplinary project work, and personal development. Entrepreneurship thus represents a unique pedagogical teaching method – "teaching through entrepreneurship" (e.g. Samwell, 2010) that may be embraced by service learning community volunteers and social innovators as much as innovative scientists and for profit businesses" ([39], pp 3).

Finally, most programs will also have aspirations related to the growth and impact of their programs. These output metrics are often the easiest to measure and may be extracted from the various stakeholder expectations in Table 1 such as number of startups, average student starting salaries, alumni exploits, and impact on the community. Table 2 provides a sample list of output program goals.

## 5. Implementing Continuous Process Improvement

The first phase in implementing CPI is to identify and measure the desired student transformation goals (learning outcome goals) as well as key input and output goals. At the single class/course level, an instructor would select key learning outcome goals, for example, business model canvas and pro forma financial projections (Head), opportunity spotting and planning under uncertainty (Hand), and entrepreneurial desirability and intent (Heart). The instructor would then create assignments that directly measure these [107]. In addition to a business plan assignment, they might consider a separate self-reflective assignment to better measure the skill of opportunity spotting [39]. Finally a survey of the students'

attitudes might be added (e.g., [49]). The instructor can then alter different inputs such as textbooks, guest speakers, and simulations and compare these results with these changes to prior class results to continuously improve the course.

At the program level, the curriculum committee will normally be responsible for selecting the required learning outcomes (my university's entrepreneurship degree program has ten) and then ensuring they are introduced, reinforced, and measured across the different required courses for the degree [38]. The committee must review the resulting data and identify potential changes that will improve outcomes. If accreditation is also involved, there will be additional reporting and auditing requirements.

First we must determine whether the measurements are reliable and valid. Then we must determine whether the input factors are correlated with changes in student transformation and output goals. Then we must determine which input factors to potentially change.

It is a daunting task and quantitative measures alone may not be sufficient despite the many references in Table 2 which are making progress toward refining constructs, scales, and assignments. In my department, the curriculum committee reviews the data but then spends time discussing individual cases and using qualitative input before making final decisions regarding program changes. We have several research programs underway to refine our measures and longitudinally track student transformation with the goal of improving our CPI processes.

## 6. Conclusions

TQM provides fundamental underpinning for setting entrepreneurship education course and program goals regardless of whether or not the university chooses to seek accreditation. As described in this paper, stakeholders can have surprisingly divergent opinions on what the goals of a program should be. Placing student transformation at the center of the program helps align stakeholder interests and set goals. In addition, by clearly setting input and output goals, as well as student transformation goals, a program can implement a continuous process improvement cycle to better understand the effect of input goals on student transformation and performance output.

Tremendous progress has been made in defining potential student transformation learning goals related to knowledge, skills, and attitudes (including attitudes related to starting a company such as entrepreneurial intent). Although each program must set its own goals and measure learning outcomes, the body of literature related to designing a program, articulating a mission, and setting these goals is becoming more robust.

Those interested in setting goals for a single entrepreneurship course may consider selecting a small number of learning outcomes from Table 2. Most introductory entrepreneurship courses would include creativity and innovation skills (alertness and/or opportunity spotting). The Turgut-Dao [39] reference provides a good example of how one course measured these learning outcomes and tracked them for continuous process improvement.

I would argue that entrepreneurship education no longer lacks rigor or best practices. In contrast, there are now many tools, assessment methods, and published sources that can help entrepreneurship faculty design their entrepreneurship programs.

## Conflicts of Interest

The author declares that there are no conflicts of interest regarding the publication of this paper.

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