Fostering Entrepreneurial Opportunity Identification Capability in Higher Education

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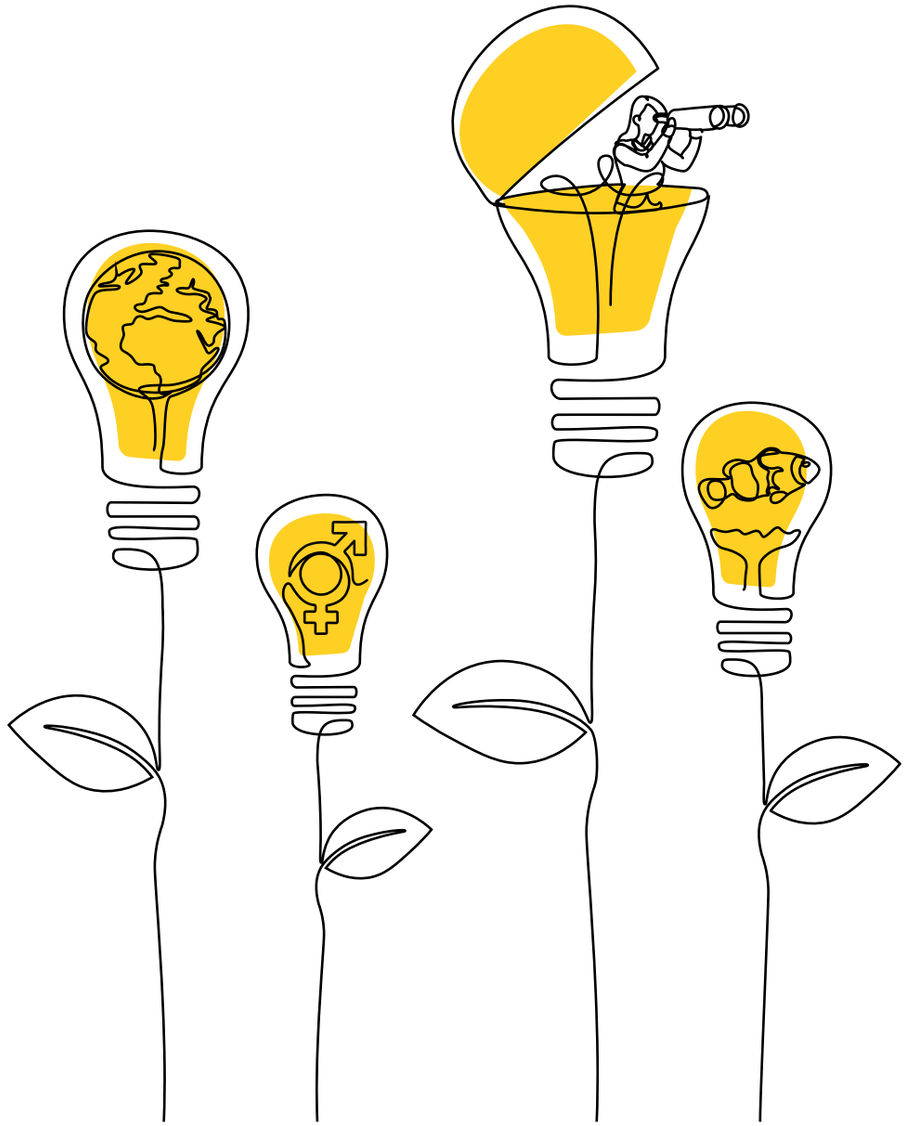

Propositions

1. Curriculum alignment with philosophical views on opportunities is crucial for developing opportunity identification capability.

   (this thesis)

2. Constructive alignment should be the backbone of any entrepreneurship education program.

   (this thesis)

3. Educational systems should evolve to nurture the innovation lifecycle, from ideation to pragmatic realization.
4. Pursuing a second PhD in a new field boosts interdisciplinary expertise.
5. Ensuring fair employment practices for skilled immigrants demonstrates a commitment to global citizenship.
6. Compulsory media literacy education in schools is key to combating misinformation in society.

Propositions belonging to the thesis, entitled

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Mohammadreza Farrokhnia
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Fostering Entrepreneurial Opportunity Identification Capability in Higher Education

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Mohammadreza Farrokhnia

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Dedicated to my loving wife, *Behnoosh*, my life's greatest support, and to *Baran*, our daughter, the light of our lives

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CHAPTER

1

General Introduction

1.1. Introduction

Entrepreneurship has been viewed as a key contributor to economic growth (Volery & Mazzarol, 2015) due to its potential to create new businesses (Agwu et al., 2017) and equip individuals with the knowledge and skills required for the growth of these businesses (Koryak et al., 2015). Based on the Entrepreneurship Education (EE) Framework, also known as EntreComp, entrepreneurship is defined as:

> *"...a transversal competence, which can be applied by citizens to all spheres of life from nurturing personal development, to actively participating in society, to (re) entering the job market as an employee or as a self-employed person, and to starting up ventures." (Bacigalupo et al., 2016, p.6).*

That is to say, entrepreneurship and entrepreneurial competencies are no longer viewed as key elements only for the business environments and those involved (European Commission, 2008). It is relevant to all as a capability enabling all individuals—whether as business founders, innovative employees, or proactive citizens—to address and provide solutions to societal challenges. This shift in perspective is also echoed by major international reports such as the European Commission (2008) and OECD's Entrepreneurship360 initiative (Lackéus, 2015) advocating for EE to be at the core of any nation's education policy, propelling EE to become one of the core subjects addressed in universities worldwide (Loi et al., 2022).

In general, EE programs in higher education have a "dual" function, aligning with the narrow and broad definition of entrepreneurship (see Lackéus, 2015). As per the narrow definition, it aims to equip university students with the capability for opportunity identification, business development, self-employment, venture creation, and growth, essentially preparing them to become "entrepreneurs" (Lackéus, 2015). This function is justifiable as conventional graduate careers have become very limited in the last 20 years (Jones et al., 2021), and even more so in recent years due to the career shocks that the Covid-19 pandemic caused worldwide (Akkermans et al., 2020). Consequently, a growing number of university graduates nowadays are opting to launch their own businesses (Osmani et al., 2021) and, as a result, need education to improve their entrepreneurial capabilities (Ratten & Jones, 2021).

Additionally, in a broader sense, EE can assist university students in enhancing their personal development, creativity, self-reliance, initiative-taking, and action orientation to become more "entrepreneurial" (Lackéus, 2015). In this view of EE, the aim is not only to prepare "an entrepreneurial person" who may become self-employed and an owner of an enterprise but also a person who can pursue entrepreneurship

and innovation as an employee and/or be a person who exhibits "enterprising behaviour" (Gibb, 2002). This interpretation of EE emphasizes the cultivation of what is often termed an "entrepreneurial mindset" (Ratten & Jones, 2021). Possessing such a mindset allows university students to "create value by recognizing and acting on opportunities, making decisions with limited information, and staying adaptable and resilient in frequently uncertain and complex situations" (Daspit et al., 2021, p. 6). This may help them to better cope with change and uncertainty resulting from the complex and high-impact societal issues they face (Baggen et al., 2021).

1.1.1. Opportunity Identification as Core Entrepreneurial Capability

Regardless of whether one views EE through a narrow or broad lens, fostering opportunity identification (OI) capability[1] seems to be at the core. This comes as no surprise as OI serves as the starting point of any entrepreneurial activity (Ardichvili et al., 2003), where new ideas are formed and progressively evolve into business opportunities capable of creating value for customers, end-users, or society (Lans et al., 2018; Lumpkin & Lichtenstein, 2005). In light of this, OI capability can be defined as "an individual's ability to identify, nurture, and transform novel ideas into viable business opportunities that effectively meet societal demands".

The OI capability plays a critical role in successful entrepreneurship and new venture creation (Mitchelmore & Rowley, 2010). Moreover, it has been shown to be crucial for those aiming to strengthen their resilience in navigating uncertainty (Shepherd et al., 2007), embrace surprises (Sarasvathy et al., 2014), and generate creative solutions to emerging challenges (Gielnik et al., 2012). Given these insights, OI is regarded as a core entrepreneurial capability (Bacigalupo et al., 2016) and has been a significant focus in the scholarly study of entrepreneurship (George et al., 2016).

In general, there is a consensus among scholars that the OI capability is not a natural gift that only some people possess (see Baron, 2004; Baron & Ensley, 2006) and that it can be developed through teaching (DeTienne & Chandler, 2004; Fiet, 2002). This viewpoint has generated significant interest from researchers over the last 20 years (Filser et al., 2020) and precipitated a large number of studies that investigated the role of a range of possible antecedents in developing this capability (e.g., Gaglio & Katz, 2001; George et al., 2016; Ozgen & Baron, 2007; Shane, 2000). Several scholars have also reported successful practices for fostering university students' capability

1 There has been an intensive debate about the terms "competence" and "capability" and, a tentative conclusion of that debate is that these terms can be used interchangeably (Mulder, 2017). In this project, the term "capability" is used in conjunction with OI, as it is a broader term (Gardner et al., 2008) and conveys an ability with a more dynamic and flexible nature rather than the more refined and static form that "competence" might suggest (refer to Nagarajan & Prabhu, 2015 for further details).

to identify business opportunities (e.g., DeTienne & Chandler, 2004; Fiet & Patel, 2008; Muñoz et al., 2011).

1.2. Problem Statements

Over the past few decades, there has been a significant rise in the number of EE programs at universities worldwide (Henry, 2020; Yi & Duval-Couetil, 2021). At their core, these programs aim to guide students through the essential stages of entrepreneurial activity (Fayolle, 2013), allowing them to experience and address the uncertainties and complexities inherent in the entrepreneurial journey (Motta & Galina, 2023). In this context, fostering the OI capability, as a means to empower them to handle uncertainties and transform them into innovative solutions and value-creating avenues, has consistently emerged as a pivotal topic in EE programs at universities (Nab et al., 2010).

The OI capability has a complex nature, as many factors play a role in identifying business opportunities (Ardichvili et al., 2003). Improving such a complex learning outcome requires constructively aligned entrepreneurship programs wherein more explicit attention is paid to the pedagogy (i.e., the "how"), making a meaningful connection between the inputs (i.e., the learning objectives, students, and curricular content) and outputs (i.e., the learning outcomes and the impact and assessment thereof) (Baggen et al., 2021). Nevertheless, what is observed in practice often deviates from these theoretical insights. Reflecting on my own experiences as an entrepreneurship lecturer, I have noticed that EE courses often lean heavily on the theoretical aspects of OI. In these courses, students are typically introduced to the importance of OI in the entrepreneurial journey and its underlying theories. Yet, there is often no explicit effort to genuinely enhance their OI outcomes. The only practical component of such courses is often limited to organizing traditional (unguided) brainstorming sessions—sometimes even before the courses begin. During these sessions, students are tasked to come up with an idea and then refine it—either individually or in groups—over subsequent sessions, ultimately crafting a business plan based on that idea and pitching it in front of others.

A reason for such a discrepancy between theory and practice might stem from a lack of comprehensive understanding of the essential components required in EE programs to effectively foster OI capability among university students (McNally et al., 2018; Ozgen & Minsky, 2013). These components are the ones emphasized by Fayolle and Gailly (2008) in their proposed generic teaching model for EE, which also forms the theoretical basis for the current research project (see Figure 1-1).

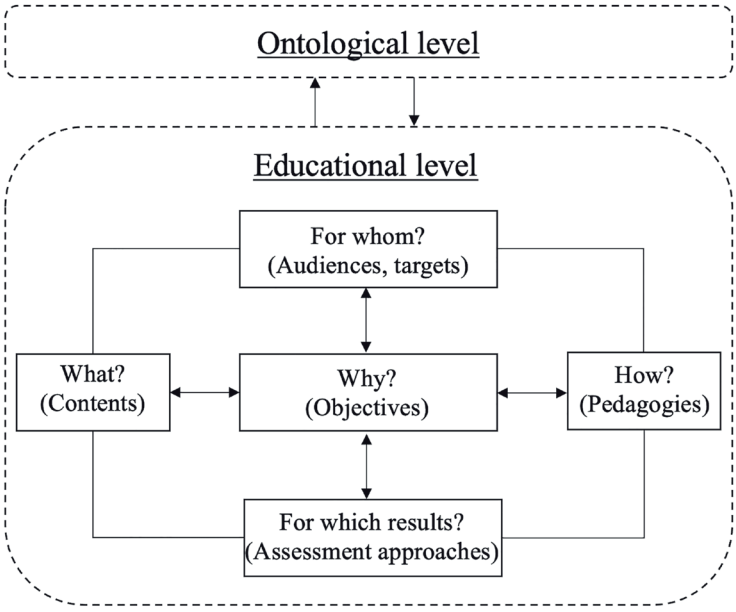

Figure 1-1. The generic teaching model for EE - adopted from Fayolle and Gailly (2008)

A teaching model is defined as "the representation of a certain type of setting designed to deal with a pedagogical situation in function of particular goals and objectives, that integrates a theoretical framework justifying this design and giving it an exemplary character" (Béchard & Grégoire, 2005a, p. 107). Driven by this definition and inspired by Biggs's (1996) principle of constructive alignment, Fayolle and Gailly (2008) suggested that to craft an effective EE program, educators must pay close attention to two inextricably linked levels: *ontological* and *educational*. Both of these levels will be detailed further next, with particular emphasis on the existing gaps in the literature concerning the enhancement of OI capability, in general, and in the context of higher education.

1.2.1. Ontological Level

The rapid increase in EE programs has been accompanied by increasing concern regarding the programs' fragmented nature (Thrane et al., 2016), stemming from a lack of a clear theoretical foundation (Byrne et al., 2014; Wu & Gu, 2017). Scholars assert that EE programs employ diverse paradigms with disparate ontological views on the nature of entrepreneurship (Béchard & Grégoire, 2005b; Blenker et al., 2011), different conceptions of entrepreneurial learning and pedagogy (O. Hägg & Peltonen, 2011), and various teaching approaches that sometimes misalign with the adopted ontological perspective (Paloniemi & Belt, 2015). These concerns are also prominently reflected by Fayolle and Gailly (2008) at the ontological level of their proposed

generic teaching model for EE. They posited that to have an effective EE, educators must determine and be aware of their philosophical perspectives on the topic at hand. This is because, such perspectives play a pivotal role in bridging entrepreneurship and education, translating essential elements of learning theories into effective teaching methods in the EE field (Bell & Bell, 2020; Hannon, 2006; Kyrö, 2015).

The importance of taking into account the adopted philosophical perspective becomes especially critical when aiming to foster OI capability. There is an ongoing philosophical debate among scholars about business opportunities. Some view opportunities as objective entities within the market, waiting to be discovered by individuals —this is termed the *discovery perspective* (Fiet, 2002; Kirzner, 2005; Shane, 2012). Others perceive them as subjectively constituted entities created by individuals—this is termed the *creation perspective* (Alvarez et al., 2013; Alvarez & Barney, 2013; Sarasvathy et al., 2003). These contrasting perspectives have a critical role in shaping the educational components of an EE program designed to enhance OI capability. However, to date, there has been limited attention given to the educational implications of these philosophical perspectives and determining the most appropriate learning theories and teaching methods to cultivate OI capability based on each philosophical stance. Bridging this gap in the literature constitutes the *first* objective of the current research project.

1.2.2. Educational Level

At the educational level, Fayolle and Gailly (2008) posited that due to the multifaceted nature of EE — encompassing diverse audiences, objectives, curricular contents, and pedagogical methods — it is imperative to design EE programs that adhere to principles of constructive alignment. Accordingly, they suggest a thorough consideration of the essential educational components of any learning environment, emphasizing the need to address five essential questions in this order: (1) "*Why* (objectives, goals)?", (2) "*For whom* (targets, audiences)?", (3) "*For which results* (evaluations, assessments)?", (4) "*What* (contents, theories)?", and (5) "*How* (methods, pedagogies)?". This stance is based on Biggs's (1996) principle of constructive alignment, which asserts that optimal learning is achieved when teaching and evaluative methods resonate with the targeted objectives, taking into account individual and environmental factors that might influence the learning process.

With regard to fostering university students' OI capability, the academic literature offers a rich range of instructional strategies. Researchers have focused on various objectives, ranging from enhancing students' creative thinking skills (DeTienne & Chandler, 2004; Karimi et al., 2016a) to deepening their knowledge of market and customer problems (Arentz et al., 2013; Cohen et al., 2020), and from stimulating

empathy (Khalid & Sekiguchi, 2018) to increasing motivation (Shepherd & DeTienne, 2005). To effectively achieve these objectives, educators must carefully consider student needs and the broader environment that might influence the learning process. This also requires informed decisions about measuring progress, determining which curricular content is most relevant, and, importantly, selecting the most effective teaching methods.

The foregoing underscores the necessity of having an evidence-informed framework that can provide a comprehensive overview of available empirical findings regarding the essential educational components and their interrelations. These need to be considered when developing constructively aligned EE programs effective in enhancing OI capability amongst students. Since 2000, numerous studies have been conducted to explore and enhance OI capability among university students (Filser et al., 2020). However, there is currently no cohesive overview of these findings, leaving the field scattered and dispersed. While previous reviews have made significant theoretical contributions to understanding OI in general (e.g., George et al., 2016; Hansen et al., 2011, 2016), they do not offer a comprehensive insight into "*why*" some individuals, in particular students, can better identify business opportunities than others (Ozgen & Minsky, 2013). Furthermore, there is still limited evidence demonstrating "*how*" EE programs should be structured, considering the five essential educational components, to effectively nurture this capability (McNally et al., 2018). Addressing these gaps and offering such a framework is the *second* objective of this research project.

1.2.2.1. The "How" component

The teaching methods employed in an EE program pertain to the "how" component of the generic teaching model for EE under the educational level. In crafting an effective EE program, once the objectives are set and specific constraints identified, the next step involves choosing the suitable teaching method(s) to effectively meet those objectives (Fayolle & Gailly, 2008). For EE programs that aim to foster students' OI capability, enhancing creative thinking skills is one of the most commonly targeted objectives (e.g., DeTienne & Chandler, 2004; Lindberg et al., 2017a; Muñoz et al., 2011, 2020; Nab et al., 2013). This emphasis is based on the widely accepted view among scholars that creativity is crucial in the OI process (e.g., Ardichvili et al., 2003; Dimov, 2007; Hills et al., 1999) and that enhancing creativity could heighten individuals' sensitivity to their surroundings when searching for potential business opportunities (DeTienne & Chandler, 2004). Given this perspective, it is not surprising that brainstorming has become a popular teaching method in entrepreneurship courses (Pittaway, 2023), especially those aiming to improve students' business OI outcomes (e.g., DeTienne & Chandler, 2004; Lindberg et al., 2017b; Carrier, 2008). This technique has been regarded as one of the most effective methods to stimulate creativity in various contexts,

particularly in those that involve solving complex and ill-defined problems (Göçmen & Coşkun, 2019), such as engineering (Hsu et al., 2018), management (Doran & Ryan, 2017), and entrepreneurship (Zane & Zimbroff, 2021).

Despite the recognized potential of the brainstorming technique to facilitate business OI, its current implementation in EE programs seems to be ineffective. The brainstorming technique typically consists of two stages aligned with the "divergent-convergent continuum" (Al-Samarraie & Hurmuzan, 2018). The primary goal of the divergent stage - also referred to idea generation - is to produce as many ideas as possible (Ritter & Mostert, 2018) by retrieving and combining various aspects of existing knowledge into new ideas (Mumford et al., 1991; Nijstad & Stroebe, 2006). The optimal outcome in this stage is often regarded as having a pool of ideas with high originality (Guilford, 1950). In EE programs aimed at facilitating OI, there is a significant emphasis on the divergent stage, which is typically facilitated through "interactive" brainstorming sessions. This involves participants actively engaging in verbal and face-to-face interactions, sequentially generating and sharing ideas with others (Al-Samarraie & Hurmuzan, 2018). However, a considerable body of research in the field of creativity has demonstrated that interactive groups tend to produce fewer and less original ideas compared to an equal number of individuals brainstorming independently (e.g., Boddy, 2012; Mullen et al., 1991; Paulus et al., 1995; Rietzschel et al., 2006). This so-called "productivity loss" (Diehl & Stroebe, 1987) has been attributed to various challenges associated with verbal, face-to-face brainstorming, including production blocking, evaluation apprehension, and social loafing (Siemon, 2023).

Furthermore, as mentioned earlier, an optimally designed brainstorming session extends beyond the divergent stage, which focuses solely on generating ideas. A crucial subsequent step is the convergent stage, where individuals evaluate their ideas to identify the most appropriate ones (Boddy, 2012; Rietzschel et al., 2006). This perspective is also supported by entrepreneurship literature on OI, which describes it as a multi-step creative process (Dimov, 2007), including at least two critical phases: idea generation and idea evaluation (Vogel, 2017). In the idea generation phase, numerous business ideas are generated, but only those that pass the evaluation phase are seen as potential opportunities (Baručić & Umihanić, 2016; Girotra et al., 2010). Despite the importance of the convergent stage for effective brainstorming sessions aimed at facilitating business OI, it receives less emphasis in EE programs (Karimi et al., 2016a). EE programs often require students to select an idea from their idea pool without providing them with explicit guidance. This oversight is problematic as students, with their limited knowledge and experience in entrepreneurship, may prioritize the "newness" or "uniqueness" of their ideas based on a "gut-level" belief

in their potential (Baron & Ensley, 2006) over essential criteria that determine their appropriateness, such as "problem-solution fit" and "feasibility" (Khalid & Sekiguchi, 2018; Prandelli et al., 2016). This tendency can limit their ability to identify viable business opportunities (Baron & Henry, 2010; Ucbasaran et al., 2003).

The aforementioned limitations in the current implementation of brainstorming in EE programs underscore a pivotal question: How should brainstorming sessions be organized to effectively facilitate business OI? As its *third* objective, the current research project aims to address this question, particularly by drawing insights from the vast body of studies conducted in the field of creativity on how to design effective brainstorming sessions (see Al-Samarraie & Hurmuzan, 2018; Maaravi et al., 2021). In particular, the main idea is to tap into the potential of computer technologies to develop an online brainstorming session that would provide theory-driven support to elevate students' divergent and convergent thinking outcomes during the OI process, as detailed in the next section.

1.3. Research Questions

1.3.1. Research Question 1

Thus far, there have been limited efforts to explore the educational implications of the two main philosophical perspectives on business opportunities (i.e., opportunity discovery and creation). Therefore, the first objective of this PhD dissertation is to investigate the relationship between these perspectives and learning theories in the field of education, based on their shared philosophical roots, and to propose a conceptual framework determining how OI capability can be improved based on different philosophical perspectives and relevant learning theories. This accounts for the first research question in this dissertation which is addressed in Study 1 described in Chapter 2 and reads as follows: *What are the most appropriate teaching and learning theories aligned with the opportunity discovery and creation perspectives on business opportunities?*

In light of this, a conceptual study was carried out, adopting an approach similar to that of previous conceptual studies (e.g., Ghura et al., 2017; Otache, 2019; Politis, 2005). First, an extensive review of the existing literature on various philosophical perspectives of entrepreneurial opportunities is conducted to determine their respective ontological and epistemological stances. Subsequently, these stances were compared with those of various learning theories in the field of education. Based on this comparison, a conceptual framework was then proposed, accompanied by discussion and conclusions regarding how entrepreneurship educators and researchers might use it to select appropriate teaching methods to foster OI capability that aligns with their adopted philosophical perspective.

1.3.2. Research Question 2

Up until now, no effort has been made to synthesize the individual and environmental factors that influence university students' identification of business opportunities. Moreover, although many studies have explored the teaching of OI among university students, there is still no comprehensive overview of findings determining the essential educational components of a successful EE program for developing OI capability. Therefore, the second aim of this PhD dissertation is to provide an overview of this field, synthesise the findings, and propose a framework for factors that influence and constitute the results of EE programs aimed at fostering students' OI capability. This accounts for the second question in this dissertation which is addressed in study 2 described in Chapter 3: *Based on the current state of the art, what factors influence and constitute the results of EE programs aimed at fostering university students' OI capability?*

To address the second research question, a systematic review study was conducted, using Fayolle and Gailly's (2008) generic teaching model for EE as a theoretical framework to guide the review. This framework helped formulate five research questions aligned with its proposed five key educational components of an effective EE program, i.e., (1) "Why (objectives, goals)?", (2) "For whom (targets, audiences)?", (3) "For which results (evaluations, assessments)?", (4) "What (contents, theories)?", and (5) "How (methods, pedagogies)?". For the review, a systematic search strategy employed three sets of keywords: one set refers to entrepreneurial capability, i.e., opportunity identification, one set to the goal of the study, and one set to the study context. Multiple electronic databases (Scopus, Web of Science, ABI Inform/ProQuest, JSTOR, and ERIC) were searched, and relevant publications were chosen based on specific inclusion criteria. In total, 44 empirical studies (out of 945 peer-reviewed articles) on OI, spanning from 2000 to 2022, were analyzed to highlight the foci of the past 20 years. Based on their findings, an evidence-informed framework is proposed in the third chapter consisting of five essential and interrelated educational components that educators should consider when designing programs to enhance university students' OI capability. Each of these interconnected components is discussed in relation to various facets of the targeted outcome, followed by suggestions for future research.

1.3.3. Research Questions 3 and 4

In response to the challenges associated with interactive, face-to-face brainstorming sessions, and to harness the benefits of both group and individual brainstorming, some creativity scholars have proposed the idea of "*hybrid brainstorming*" (Korde & Paulus, 2017). This approach involves individuals alternating between individual and group idea generation during the divergent stage of a brainstorming session (Brown & Paulus, 2002). This would allow both unconstrained ideation in individual brainstorming and the stimulation of additional ideas by exposure to the ideas of others (Korde &

Paulus, 2017). In general, empirical findings suggest that brainstorming in hybrid settings leads to superior outcomes compared to those in either individual or group settings, particularly in terms of the total number of ideas generated (e.g., Girotra et al., 2010; Korde, 2014; Korde & Paulus, 2017; Leggett et al., 1996; Paulus et al., 2015). However, research findings indicate that, despite their potential to increase the number of ideas, hybrid settings still fail to enhance the originality of the ideas when compared to those generated in individual or group settings (Korde, 2014; Korde & Paulus, 2017; Paulus et al., 2015).

A possible reason for these findings might be that improving originality as a quality criterion requires additional support that can effectively assist individuals to break free from conventional thinking (Rietzschel, 2018) and guide them toward generating ideas with higher originality (Althuizen & Reichel, 2016). This claim is also reinforced by the dual-pathway to creativity model (DPCM) proposed by Nijstad et al. (2010). The DPCM posits there are two distinct but non-exclusive cognitive pathways for generating original ideas: *persistence* and *flexibility*. The persistence pathway is exhibited through the generation of numerous ideas within a limited number of categories, also known as "within-category fluency" (Nijstad & Stroebe, 2006). On the other hand, the pathway of flexibility is demonstrated through utilizing broad cognitive categories and frequently alternating among these categories (Dreu et al., 2011). According to scholars, these pathways require individuals to be mentally stimulated and involved (Dreu et al., 2011), for which the provision of certain process constraints (or support) such as rules, task structure, and instructions plays a crucial role (Nijstad et al., 2021).

Guided by the DPCM, Study 3 in the current research project, described in Chapter 4, aims to identify effective support mechanisms to enhance the originality of outcomes in hybrid brainstorming sessions within the entrepreneurship context. To achieve this, it builds on prior empirical research aimed at identifying an optimal sequence for structuring these sessions, especially the works of Korde (2014) and Korde & Paulus (2017). The study empirically examines the impact of two computer-mediated supports — the SCAMPER prompts and the sharing of individually generated ideas — on the originality of business ideas generated during an online hybrid brainstorming session addressing the real-life issue of sustainability.

According to the DPCM one approach to enhance the originality of brainstorming outcomes is to increase individuals' persistence and perseverance in searching their associative memory, thereby encouraging them to follow the persistence pathway. In this regard, SCAMPER appears to be a suitable technique, as it systematically guides individuals through a set of questions aimed at problem-solving (Moreno et al., 2016), namely: (1) Substituting parts, (2) Combining elements, (3) Adapting

to improve, (4) Modifying features, (5) Putting to other uses, (6) Eliminating unnecessary aspects, and (7) Rearranging or reversing components. This technique could potentially improve brainstorming outcomes by mentally stimulating individuals to delve deeper into their knowledge base. However, research findings on its impact on brainstorming outcomes are mixed. While some studies have shown that using the SCAMPER technique to solve a (design) problem can yield more original ideas than using brainstorming alone (Moreno et al., 2016; Rahimi & Shute, 2021), there is empirical evidence suggesting that typical brainstorming outperforms those using the SCAMPER technique in terms of generating ideas with higher originality (Chulvi et al., 2012, 2013). A possible reason for such mixed findings could be the varied ways in which the SCAMPER technique has been implemented across studies. Moreover, although this technique has shown promise in enhancing the outcomes of creative tasks across various disciplines, its application has yet to be explored within the context of entrepreneurship. Therefore, Chapter 4 begins by examining studies that use the SCAMPER technique to identify design principles for its effective implementation. The technique is then incorporated in the form of seven prompts into an online hybrid brainstorming session to empirically investigate the third main research question of this dissertation, which reads as follows: *What is the impact of providing SCAMPER prompts during a hybrid brainstorming on the originality of the business ideas generated, as opposed to brainstorming without any additional support?*

Another approach to enhancing brainstorming outcomes is to activate the flexibility pathway, encouraging individuals to consider different perspectives and explore broad cognitive categories (Nijstad & Stroebe, 2006). This may lead to the formation of novel and remote associations in memory, thereby resulting in more original ideas (Dreu et al., 2008). In this context, as outlined in the associative memory model by Nijstad and Stroebe (2006), sharing ideas from others appears to be one way to activate the flexibility pathway during group brainstorming. The shared ideas can serve as external cues that, if attended to, could activate problem-relevant knowledge and new semantic categories in memory. However, this theoretical premise has not been consistently supported by empirical evidence (see, for example, Diehl & Stroebe, 1987, 1991; Paulus et al., 2015; Ziegler et al., 2000). A possible reason for this discrepancy between theory and practice is that during group brainstorming sessions, individuals may not pay sufficient attention to the ideas shared by other members (Dugosh & Paulus, 2005). Additionally, participants may not thoroughly process these shared ideas (Paulus et al., 2013), failing to invest the time and effort required to understand and build upon them through active discussions (Maaravi et al., 2021). Chapter 4 also aims to address these shortcomings by effectively facilitating idea sharing during group brainstorming, leveraging the potential of computer technologies. The chapter then empirically explores the impact of the designed environment on the originality

of brainstorming outcomes in an entrepreneurship context, investigating the answer to the fourth main research question of this dissertation: *What is the impact of sharing individually generated ideas with group members during a hybrid brainstorming on the originality of the business ideas generated, compared to the condition where sharing individually generated ideas is not facilitated?*

To address the aforementioned research questions in Chapter 4, an empirical study of an exploratory nature was conducted in a real educational setting, involving 94 students from both undergraduate (BSc) and postgraduate (MSc) programs. These students were participating in two university courses specifically designed to explore future career opportunities and enhance their entrepreneurial skills. Initially, students were randomly divided into 31 groups, 29 of which had three members each, and two of which had two members. These groups were then randomly assigned to one of three conditions: (1) Control Condition (9 triads and 1 dyad, n = 29), (2) Experimental Condition 1 (10 triads and 1 dyad, n = 32), or (3) Experimental Condition 2 (11 triads, n = 33). The control condition involved a hybrid brainstorming session with an individual-group-individual sequence, using only general brainstorming rules to guide the students. In Experimental Condition 1, the design was similar, but students were encouraged to employ the SCAMPER technique after five minutes of free brainstorming during the individual phases. Experimental Condition 2 followed the same design as Experimental Condition 1, except that individually generated ideas from the first phase were shared with group members during the group phase. All conditions focused on sustainable development as their problem case for generating business ideas, and all participants used an online platform called "The Ideation Hub" (https://ideation-hub.nl) for brainstorming. This platform was specifically designed for this PhD project to guide participants through a structured brainstorming process and effectively implement the proposed supports.

1.3.4. Research Question 5

The findings of the empirical study in Chapter 4 offered new insights into designing effective hybrid brainstorming sessions in EE programs aimed at improving OI capability. The proposed instructional design model yielded promising results, producing not only a greater number of business ideas but also ideas of higher originality. However, as a sign of strong OI capability—similar to that of expert entrepreneurs—one should also be able to discern ideas with higher appropriateness within the idea pool. This is defined as those ideas with higher problem-solution fit and feasibility in the entrepreneurship field (Khalid & Sekiguchi, 2018; Prandelli et al., 2016). Making such evaluative judgments requires rich entrepreneurial knowledge and experience, which university students often lack. Therefore, additional support mechanisms are

needed to help students during this convergent phase of the OI process, where the evaluation of generated business ideas takes place.

The first strategy prompts individuals with descriptive statements that highlight the key aspects of each criterion, specifying the specific elements and characteristics that should be present or absent and considered correct or incorrect. Whereas, the second strategy pertains to providing key examples (usually those from experts) chosen to be typical of designated levels of quality or competence. To date, several studies have demonstrated the positive impact of these supports on individuals' evaluative decision-making across disciplines. These impacts include enhancing a product's competitive and business potential (Martinsuo & Poskela, 2011), improving the quality and speed of evaluative decision-making processes during new product development (Eling et al., 2015), and enhancing novices' capacity to judge the quality of a scientific report (Yucel et al., 2014) and their evaluative judgment (Chong, 2021). Nevertheless, no studies have yet explored the impact of such support mechanisms on business idea evaluation outcomes. Moreover, research is lacking on the combined effect of these two support mechanisms on the quality of evaluative decision-making outcomes. This PhD dissertation aims to shed light on the impact of these supports, both individually and in combination, on business idea evaluation outcomes through an empirical study. This accounts for the fifth main question in this dissertation, which is addressed in Study 4 as described in Chapter 5: *What is the impact of describing evaluation criteria and presenting an exemplar on university students' ability to discern original business ideas with higher appropriateness within their idea pools?*

From the 94 students who participated in the previous empirical study, 80 students—comprising both undergraduate (BSc) and postgraduate (MSc) cohorts—were guided towards the business idea evaluation stage to participate in an empirical study with a 2x2 factorial design. The four conditions in this design were as follows: Control (neither criteria nor exemplar provided), Criteria, Exemplar, and Both (criteria and exemplar provided). Participants were randomly assigned to these conditions and asked to evaluate the three business ideas they had previously selected. The objective was to determine which form of support—criteria, exemplars, both, or neither—most effectively assisted the participants in accurately ranking the ideas, taking into account their originality and appropriateness. The effects of various forms of incorporating the support mechanisms on students' ability to evaluate their generated business ideas are presented in Chapter 5 of this dissertation. This is followed by in-depth explanations for these results, implications, limitations, and recommendations for further research.

Finally, the Chapter 6 of this dissertation the overall conclusions are described and discussed. This chapter opens with a summary of the main findings, followed by dis-

cussions of all chapters in concert. Next, the strengths and weaknesses of the studies are discussed along with methodological and theoretical issues. Chapter 6 concludes the dissertation by presenting some of the limitations of this PhD research, challenges and recommendations for future research, and implications for theory and practice.

1.4. Outline of This Dissertation

Figure 1.2 shows how the 4 studies reported in chapters 2, 3, 4, and 5 come together along with their corresponding variables. These four chapters can be read independently and have already been published/submitted as separate articles in international peer-reviewed scientific journals. Furthermore, Figure 1.2 gives a summary of the different phases and the main variables of this PhD book.

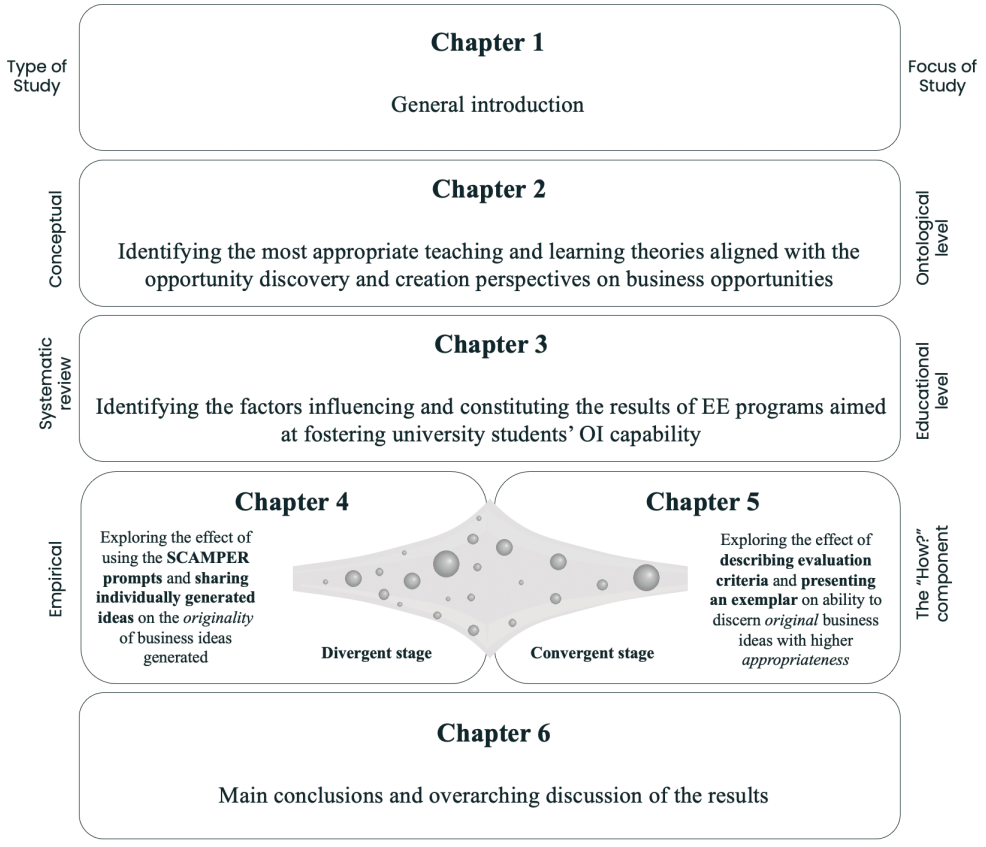

Figure 1.2. Representation of the chapters of this dissertation

CHAPTER

2

Bridging the Fields of Entrepreneurship and Education: The Role of Philosophical Perspectives in Fostering Opportunity Identification*

*This chapter is published as:

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Abstract

The number of entrepreneurship education (EE) programs that aim to foster opportunity identification (OI) as a key entrepreneurial capability has grown considerably in the past few decades. However, these EE programs mostly lack a robust theoretical framework that could help educators and researchers select teaching approaches in line with their philosophical perspectives. This study proposes a theory-driven framework for fostering OI by bridging entrepreneurship and education fields, considering the ontological and epistemological assumptions that exist in both fields. The proposed framework includes different philosophical perspectives on entrepreneurial opportunities and strategies for identifying opportunities (i.e., opportunity discovery and creation) coupled with the most relevant learning theories and teaching approaches for fostering OI. Based on this framework, behaviorism and cognitivism are the most consistent learning theories with the opportunity discovery perspective's philosophical assumptions, and social constructivist learning theory is more appropriate for developing EE programs based on the opportunity creation perspective. This framework suggests that for developing an efficacious EE program to improve individuals' OI performance, different perspectives on the emergence of opportunities and learning should be combined and integrated into a consistent, constructively aligned EE program. The paper concludes with implications for the theory and practice in the entrepreneurship education field.

2.1. Introduction

Over the past few decades, entrepreneurship has substantially become an essential economic, social, and often-researched subject worldwide (Ratten & Jones, 2021). Entrepreneurship is no longer only viewed as a key element for the business environments and those involved (European Commission, 2008). As also mentioned in the OECD report on entrepreneurship in education (Lackéus, 2015) and the European entrepreneurship competence framework or "EntreComp" (Bacigalupo et al., 2016), the development of entrepreneurial competencies and mindsets is now embedded in policy to foster the entrepreneurial capacity of all citizens (Sánchez, 2013).

The viewpoint that teaching entrepreneurship can be beneficial for all citizens has contributed to a significant increase in the number and status of Entrepreneurship Education (EE) programs in universities worldwide (Kuratko, 2005; Yi & Duval-Couetil, 2021) to develop individuals' entrepreneurial competencies (Oosterbeek et al., 2010; Pittaway & Cope, 2007). Several scholars presented different lists of competencies that should be taught in EE programs (e.g., Fiet, 2001; Man et al., 2002; Okolie et al., 2021). In this regard, given the importance of identifying potential opportunities in the early stage of the entrepreneurial process (Lans et al., 2018), many scholars asserted that Opportunity Identification (OI) is one of the key entrepreneurial capabilities of any successful entrepreneur or entrepreneurial citizen (e.g., Ardichvili et al., 2003; Baggen et al., 2015), and thus, it should be a central topic in EE programs (Lumpkin et al., 2004). OI is defined as an individual's ability to identify ideas and transfer them to potential products, processes, or services that have value for customers, end-users, or society (Baggen et al., 2015; Lumpkin & Lichtenstein, 2005).

With the emergence of Shane and Venkataraman's (2000) individual-opportunity nexus theory in the entrepreneurship literature, increasing attention has been paid to the role of individuals in the OI process (Dimov, 2003). Based on this theory, for entrepreneurial activity to occur, there should be a recursive interaction between the context (i.e., source of opportunities) and individuals (Sarason et al., 2006). Moreover, Shane and Venkataraman's theory caused a shift in static models that view entrepreneurial behaviours as resulting only from particular inherent traits (Fortunato & Alter, 2011). For instance, OI capability is not assumed anymore as a natural gift that only some individuals possess (Muñoz et al., 2011), but rather it is argued that OI is a cognitive ability (Baron, 2004; Baron & Ensley, 2006) that can be developed through teaching (Saks & Gaglio, 2002). This argument considerably increased the number of EE programs aimed at exploring and fostering OI capability (Filser et al., 2020). However, the rapid increase in EE programs has been accompanied by increas-

ing concern regarding the programs' fragmented nature (Thrane et al., 2016) due to a lack of a clear theoretical basis (Byrne et al., 2014; Wu & Gu, 2017). According to scholars, EE programs use different paradigms with disparate ontological views on the nature of entrepreneurship (Béchard & Grégoire, 2005b; Blenker et al., 2011), different conceptions of entrepreneurial learning and pedagogy (O. Hägg & Peltonen, 2011), and various teaching approaches that even mismatch the adopted ontological perspective (Paloniemi & Belt, 2015). In this regard, several scholars have argued that the EE field needs a robust conceptual framework that is transparent and strongly connected with its philosophical nature (Blenker et al., 2011; B. Jones & Iredale, 2010; Pittaway & Cope, 2007).

Responding to this call, scholars so far have proposed several conceptual frameworks based on translating and reconceptualizing knowledge within entrepreneurship to the EE field (e.g., O'Connor, 2013; Thrane et al., 2016). However, Fayolle (2013) asserted that robust conceptual foundations of the EE field should be drawn from the integration of knowledge in both entrepreneurship *and* education fields, as EE is at the crossroads of these two fields. More importantly, while EE is a fast-growing but relatively young, underdeveloped field, educational science has a long history that EE can leverage to develop and underpin its teaching approaches (Bell, 2021). As such, some scholars believe that since both education and entrepreneurship fields share similar philosophical perspectives (i.e., paradigms), these perspectives have value for bridging entrepreneurship and education fields by translating relevant aspects of the learning theories into optimal teaching approaches in the EE field (Bell & Bell, 2020; Hannon, 2006; Kyrö, 2015). This endeavour of bridging the entrepreneurship and education fields may offer improved guidelines for entrepreneurship educators through the contrasting landscapes of teaching approaches (Ramsgaard, 2018), resulting in stronger, conceptually sound, and theory-based EE programs.

In this regard, the primary purpose of this conceptual work is to examine the educational implications of the two main philosophical perspectives in the entrepreneurship field concerning entrepreneurial opportunities (i.e., opportunity discovery and creation). This would be done by exploring the relationship between these two perspectives and learning theories in the education field based on their shared philosophical roots. The result would be a conceptual framework that would inform entrepreneurship educators and researchers about the most appropriate learning theories and teaching approaches for fostering OI based on each philosophical perspective. More importantly, many scholars have elaborated on the discovery perspective in relation to OI and education, but less attention has been paid to the creation perspective in this regard (Nab et al., 2013). This is problematic, given the increasing attention for so-called *wide* EE programs in which individuals learn in authentic, entrepreneurial, and

educational environments that challenge them to think creatively, experiment, and tolerate uncertainties in creating value for others (Baggen et al., 2021). In such wide EE programs, it is crucial to create value in interaction with the real world and with others. Thus, the thought behind wide EE programs closely relates to the creation perspective towards OI – also, from this perspective, opportunities occur in the process of social interaction. Therefore, next to elaborating on the discovery perspective in relation to learning theories in EE context, what makes this study unique, is that it also explores conceptual linkages between the creation perspective as a philosophical, conceptual ground for wide EE programs.

The remainder of this paper proceeds as follows. First, in line with the previous conceptual studies (e.g., Ghura et al., 2017; Otache, 2019; Politis, 2005), an extensive review of the available literature is conducted on different philosophical perspectives of entrepreneurial opportunities. Based on the literature review, the conceptual framework is then presented with some discussion and conclusion of how future entrepreneurship educators and researchers might use it to develop programs to foster OI. Finally, the paper ends with several implications for theory and practice.

2.2. Literature Review

This section describes each perspective based on their ontological and epistemological assumptions and elaborates on how these perspectives can be positioned in relation to one another. In addition, we propose proper teaching approaches to foster OI based on the most related learning theory associated with each philosophical perspective, together with reporting several empirical findings to support our claims.

2.2.1. Opportunity Discovery Perspective

Scholars believe that an opportunity exists when competitive imperfections exist in product or factor markets (Venkataraman, 1997) that generate the potential of economic wealth (Eckhardt & Ciuchta, 2008). From the discovery perspective, these competitive imperfections are assumed to arise exogenously from technological changes, political changes, social changes, or other attributes of the context in which a market exists that individuals could discover (Shane, 2003; Shane & Venkataraman, 2000). The emphasis on exogenous forces suggests that the discovery perspective is based on the *realist* ontology (Chiles et al., 2010; Miller, 2007), meaning that opportunities exist as objective phenomena independent of individuals (Alvarez & Barney, 2007; Berglund, 2007).

While ontology raises questions about the nature of reality in the world (Denzin & Lincoln, 2005), within a philosophical perspective, epistemology determines how

humans make meaningful sense of the world (Levers, 2013). In the discovery perspective, individuals either make choices based on rational decision-making (i.e., *positivist* epistemology) or use their subjective interpretations of past experience and knowledge to discover the opportunities (i.e., *post-positivist* epistemology) (Chiles et al., 2010). Based on these two epistemologies, entrepreneurship scholars distinguished three approaches for discovering opportunities, i.e., *active search*, *fortuitous discovery*, and *passive search,* associated with each epistemological assumption (Chandler et al., 2003; DeTienne & Chandler, 2004).

2.2.1.1. Active search strategy for discovering opportunities

The active search strategy proponents put forward the idea that entrepreneurs can discover profitable opportunities through purposeful, deliberate, and conscious searching (Chandler et al., 2003). The search can be stimulated either because of a short failure in a perfectly competitive market (i.e., *neoclassical economics view*) or heterogeneous distribution of specific information and resources (i.e., *information economics view*) (Chandler et al., 2003; Fiet, 2002; Sarasvathy et al., 2005). Although both views assume that objective opportunities exist in the markets, they have different assumptions about how individuals can actively interact with the sources of opportunities to discover them.

2.2.1.1.1. Neoclassical economics view. The neoclassical economics view is in line with the conception of markets as an "allocative process" (Sarasvathy et al., 2005), wherein the role of entrepreneurs is to match known products with existing demand (Miller, 2007). The neoclassical theory is developed around the assumption of perfect information (Gowdy & Olsen, 1994), which means all individuals in the market have complete information before launching a business (Fiet et al., 2013). This viewpoint has root in the *positivist* epistemology (Chiles et al., 2010; Suddaby et al., 2015), assuming that it is possible for each and every individual in the market to clearly perceive and define an objective they want to accomplish (DeTienne & Chandler, 2004) and systematically search for profitable opportunities within a market that meet that objective through deductive reasoning, causal explanation, statistical inference, and risk calculation (Chandler et al., 2011; Sarasvathy, 2001).

Relevant learning theory. Behaviorism is the most consistent learning theory with the neoclassical view of the active search strategy. Behaviorism finds roots in realist ontology and positivist epistemology (Schuh & Barab, 2008). The focus of teaching approaches associated with the behaviorism perspective is on the external observation of individuals' behavior in response to external stimuli and the lawful and causal relations between them (Boghossian, 2006; Chiesa, 1992; Ertmer & Newby, 2013). In behaviorism, educators use teaching approaches that involve mechanical processes

and systematic steps (Löbler, 2006). In such behaviorist approaches, the main assumption is that individuals only need objectivist knowledge acquired through a didactic approach to do their job efficiently (Bell, 2021).

Implications for EE. Scholars argue that the behaviorist teaching approaches are more suitable for career and technical education programs, which require a certain standard of performance (Byrne & Toutain, 2012; Löbler, 2006) and for teaching "*about*" entrepreneurship (Bell, 2021). Behaviorist approaches are also in line with Béchard and Grégoire's (2005a) *supply model* of EE, wherein teachers are conceived as lecturers and presenters of information, such as the steps that learners should take to achieve a specific goal, and learners are more or less passive recipients of that information. The imprint of behaviorist thinking on EE can also be seen in some studies aimed to support OI. Given the importance of risk calculation in the neoclassical view of opportunity discovery, Nab et al. (2014) reported that teaching individuals how to estimate opportunity risks is an essential strategy of expert teachers for teaching business OI. Besides, scholars employed other behaviorist approaches for fostering OI, not necessarily based on the neoclassical active search viewpoint but in line with its positivist epistemology. For instance, Promsiri et al. (2018) reported that providing information about technological changes in the market (as sources of opportunities) by the teacher served as external stimuli that positively affected both the number and the content of the generated ideas. In some studies, educators passively taught individuals theoretical knowledge about entrepreneurship and the OI process (e.g., Muñoz et al., 2020; Nab et al., 2013), how to generate ideas (e.g., Nab et al., 2013), and how to write a business plan (e.g., Musteen et al., 2018). According to Honig and Karlsson (2004), developing a business plan "…is a rational activity that assists the owners of new firms (entrepreneurs) to earn larger profits through efficiency gains and/or increased sales" (p. 35). Thus, scholars refer to writing business plans as an example of a causation approach in EE programs (Chandler et al., 2011; Fisher, 2012). In some studies, educators also asked individuals to write business plans to support the OI process (e.g., Kickul et al., 2010; Lindberg et al., 2017b; Nab et al., 2013).

In conclusion, to support individuals' OI capability through behaviorist teaching approaches, educators should transfer two types of knowledge necessary for identifying potential opportunities: (1) declarative knowledge, such as knowing the theories and principles behind entrepreneurial OI, and (2) procedural knowledge, such as knowing the steps to generate business ideas, write a business plan, and/or calculating the risks. Learners, on the other hand, should memorize the presented knowledge through repetitive drilling on simple to complex learning tasks and by receiving educators' informative feedback (i.e., reinforcement) based on their observable behavior (Anderson & Dron, 2011; Guey et al., 2010). An example of observable behavior could be

writing a business plan for a potential opportunity. In this regard, as noted by Ertmer and Newby (2013), the educator should provide individuals with explicit information on how to execute the proper observable response (e.g., by specifying the steps for writing a business plan and its essential elements) and the conditions under which that response should be made (e.g., by letting them know when to write a business plan in the OI process)."

2.2.1.1.2. Information economics view. In contrast to the neoclassical view, Stigler's (1961) information economics view abandoned the implicit assumption of perfect information and introduced the concept of imperfect information into economics (Lin, 2005). Based on this viewpoint, information is asymmetrically distributed in the market (Hayek, 1945), and thus acquiring information involves a costly search process (Sarasvathy et al., 2005). In this situation, an optimal search for discovering a profitable opportunity is the one with the minimum expected search costs (Fiet, 2002). Some scholars argued that individuals could conduct an optimal search if they systematically search for signals in a domain where they are knowledgeable (Fiet, 2002; Fiet et al., 2004; Fiet & Patel, 2008). Based on this viewpoint, prior knowledge and subjective interpretations of past experience are essential for an active search for profitable opportunities (see Baron, 2006). Thus, the information economics view of active search embraces some form of subjectivism and a post-positivist epistemology toward discovering opportunities, allowing for the individual's perceptions and experiences to have a more prominent role in the OI process.

Relevant learning theory. The learning theory that is in line with the post-positivist epistemology has roots in cognitivism (Engeström & Sannino, 2012; Jacobs & Farrell, 2001), wherein the mind is viewed as an information-processing system (Schuh & Barab, 2008). According to cognitivism, teachers should make knowledge meaningful by helping learners organize and relate new information to existing knowledge in their memory (Ertmer & Newby, 2013), highlighting the importance of cognitive frameworks such as knowledge structures (i.e., mental schema) (Cooper, 1993). Cognitivism emphasizes providing individuals with authentic learning experiences wherein they could face new knowledge that is not in their existing knowledge structures or conflicts with them (i.e., disequilibrium state) (Powell & Kalina, 2009). From the cognitivist perspective, learning happens when learners can solve this disequilibrium state by assimilating the new knowledge and accommodating it in their existing knowledge (Piaget, 1972). Cognitivist learning environments promote individual learning opportunities, as in behaviorism (Powell & Kalina, 2009); however, learners' active involvement in knowledge acquisition and integration is crucial (Yilmaz, 2011). Feedback is also essential, but teachers use it only to guide learners toward more accurate mental connections (Ertmer & Newby, 2013).

Implications for EE. The teaching approaches based on cognitivism align well with Béchard and Grégoire's (2005a) *demand model* of EE, which is often associated with educational activities emphasizing individuals' active exploration and experimentation. The EE research within this psychological school of thought mainly concerns the role of prior knowledge in enabling and/or limiting the development of new expertise (Béchard & Grégoire, 2005b). Several scholars proposed that OI can be associated with particular knowledge structures (e.g., Baron, 2004; Gaglio & Katz, 2001; Muñoz et al., 2011) that can be developed over time by gaining experience in a particular domain (Baron, 2006). In this regard, some empirical studies showed that teaching approaches that improve individuals' OI-related knowledge structure could significantly enhance their ability to discover profitable opportunities when actively searching for them. For instance, the findings of different studies indicated that training individuals to select information channels based on their prior knowledge and to update their consideration sets by processing the information could enable them to discover more wealth-generating ideas when searching systematically for business opportunities (e.g., Fiet, 2002; Fiet et al., 2007; Fiet & Patel, 2008). Fiet (2002) defined consideration sets as a particular group of information channels based on one's specific prior knowledge. Cohen et al. (2020) also developed a teaching method called IDEATE based on Kolb's (1984) experiential learning theory to search for opportunities actively. The experiential learning theory systematically takes individuals through four stages: concrete experience, reflective observation, abstract conceptualization, and active experimentation, and has roots in cognitive psychology (Healey & Jenkins, 2000; Hedin, 2010). According to Cohen et al. (2020), the IDEATE method helped individuals go beyond their existing knowledge and capabilities and discover more innovative business ideas through a systematic search strategy than individuals in the passive search group.

In conclusion, the proponent of the active search strategy highlighted the importance of individuals' prior knowledge and experiences in discovering profitable opportunities. Thus, cognitive teaching approaches that plan the instruction based on individuals' prior knowledge and experiences would be the most appropriate approaches to improve individuals' OI capability when actively searching for opportunities in a market. In such cognitivist entrepreneurship classrooms, educators should act as facilitators that encourage individuals to systematically search for potential opportunities in a market while providing them with learning opportunities that enable them to explore their current knowledge. According to Dimov (2003), exploring knowledge structures would help individuals find and fill their knowledge gaps about the market, enabling them to perceive existing opportunities better.

2.2.1.2. Fortuitous discovery of opportunities

Fortuitous discovery is characterized by low systematization, intentionality, and unrestricted searching (Kaish & Gilad, 1991; Kirzner, 1973). Although the proponents of this strategy believe that opportunities are objectives and available to all (Chandler et al., 2003), they argue that it is impossible to initiate an optimal systematic search due to the heterogeneous distribution of information among individuals (Baumol, 1993; Casson, 1995) and because the search domain is unbounded (Kirzner, 1997), leaving alertness as the only alternative for discovering opportunities (Kaish & Gilad, 1991; Kirzner, 1997). Therefore, alertness plays a significant role in this perspective (Kirzner, 1973), even helping to differentiate entrepreneurs from non-entrepreneurs (Alvarez & Barney, 2007). Kirzner (1973, 1979) characterized individuals who were more alert to have an "antenna" that permits them to recognize market gaps with limited clues.

Later, Kirzner (2005) explained further the role of alertness in opportunity discovery by distinguishing between information-knowledge and action-knowledge. He asserted that two individuals might acquire the same information from outside, but only one might realize it and turn that information into action through his/her alertness. In other words, alertness enables individuals to perceive and process the acquired information subjectively to better spot profitable opportunities (Arentz et al., 2013). This viewpoint is also in line with the post-positivism epistemology (Chiles et al., 2010) that is critical of individuals' ability to know reality with certainty because of flawed human intellectual mechanisms (Sarason et al., 2006; Trochim, 2000). To explain this inability, Kirzner spoke of "the deep fog of ignorance that surrounds each and every decision made in the market" (Kirzner, 1989, p. 11). Therefore, to discover opportunities that move markets toward equilibrium, individuals must push back this metaphorical fog and reduce collective ignorance (Miller, 2007).

Implications for EE. Scholars believe that it is not possible to propose teaching approaches based on this perspective for fostering OI (DeTienne & Chandler, 2004; Fiet, 2002; Fiet et al., 2013) because this perspective views opportunity discovery as a "luck-based" approach (Demsetz, 1983) that relies on alertness as some individuals' unique characteristic which enables them to consistently scanning their environment to discover opportunities (Kaish & Gilad, 1991). However, in some previous empirical studies, scholars implemented some strategies to support individuals in the alertness group, such as asking them to collect real samples of alertness-based discoveries (e.g., Fiet & Patel, 2008) or to read some articles on the importance of alertness for OI (e.g., Fiet et al., 2007).

2.2.1.3. Passive search strategy for discovering opportunities

The passive search strategy shared the same ideas of the fortuitous discovery view of opportunity discovery, assuming that individuals do not actively search for discovering opportunities (DeTienne & Chandler, 2004). The passive search is also based on the assumption that individuals' alertness plays an essential role in discovering opportunities that objectively exist in the market (Chandler et al., 2003). However, in contrast with the fortuitous discovery viewpoint that considers alertness as an immutable characteristic that only some individuals possess, the proponent of passive search strategies believed it is possible to heighten individuals' sensitivity to their surroundings when passively searching for potential opportunities in a market (DeTienne & Chandler, 2004).

Relevant learning theory. The passive search strategy is developed based on the Kirznerian economics theory, with a post-positivist epistemology. Thus, the learning theory in line with this search strategy is also cognitivism (Vaghely & Julien, 2010). The proponents of the passive search strategy believe that entrepreneurial alertness rests, at least partly, on different cognitive capacities such as prior knowledge and experiences (Ardichvili et al., 2003; Shane, 2003), creativity (Ardichvili et al., 2003), and general mental ability (Gielnik et al., 2012). Thus, teaching approaches that improve these cognitive capacities could heighten their alertness toward specific information in the environment, enabling them to spot more potential opportunities by processing the acquired information.

Implications for EE. Previous scholars employed several cognitivist teaching approaches to support individuals' passive search for opportunities. For instance, Arentz et al. (2013) reported that helping individuals acquire related knowledge of ways to serve markets and customer problems through role-playing could help them discover more business ideas. According to scholars, well-established knowledge structures enable individuals to process information subconsciously (Vaghely & Julien, 2010) and be more alert for perceiving meaningful patterns in diverse events or trends (Baron, 2006). Similarly, Shepherd and DeTienne (2005) showed that enriching individuals' specific knowledge about the market could help them identify more business opportunities. In the same vein, some scholars referred to users' perspective-taking as an effective educational intervention that could develop individuals' market knowledge and heighten their alertness toward discovering opportunities users need (e.g., Khalid & Sekiguchi, 2018; Prandelli et al., 2016).

DeTienne and Chandler (2004), based on their passive search view to opportunity discovery, posited that it is possible to increase the likelihood of discovering opportunities by helping individuals operate at a "consciously heightened state of sensitivity

to the environment" (p. 244), wherein creativity plays a significant role (Ardichvili et al., 2003). Based on this argument, a vast body of empirical studies included different techniques such as brainstorming (DeTienne & Chandler, 2004; Lindberg et al., 2017b), brainwriting (DeTienne & Chandler, 2004), nominal group technique, and mind mapping (Carrier, 2008), creative problem-solving exercises (Muñoz et al., 2011, 2020), SCAMPER[2] and slice and dice techniques (Nab et al., 2013) in EE programs to support individuals' creative thinking reporting that these techniques had positive effects on individuals' capability to identify opportunities. Saks and Gaglio (2002) also reported that even asking practising entrepreneurs to have a structured walking exercise in which they had to report on what they see or hear people saying could heighten their sensitivity to the environment, helping them discover more opportunities in a passive approach.

In conclusion, both the passive search strategy and the information economics view to active search strategy demand cognitivist teaching approaches in order to develop individuals' OI capability. However, in the passive search strategy, educators do not encourage individuals to initiate a systematic search within a market. They would only employ cognitivist approaches that could heighten their sensitivity to the environment. The typical examples of such approaches could be improving individuals' related knowledge structure through authentic experiences such as job fairs (e.g., DeTienne & Chandler, 2004), role-playing (e.g., Arentz et al., 2013), and/or perspective-taking (e.g., Prandelli et al., 2016) and enhancing their creativity (e.g., DeTienne & Chandler, 2004). Moreover, entrepreneurship educators who want to develop EE programs to facilitate the OI capability based on cognitivism should account for individuals' cognitive (e.g., prior knowledge, creativity) and psychological (e.g., motivation, attitude) differences that play a role in the OI process.

2.2.2. Opportunity Creation Perspective

The creation perspective can be traced to studies in the radical subjectivist Austrian economics view (e.g., Lachmann, 1986; Shackle, 1979) that extended the notion of subjectivism from alertness to include "imagination" about the future (Berglund, 2007). The creation perspective minimizes the role of the environment (DeTienne & Chandler, 2004) and views opportunities as being created *endogenously* as a result of individuals' efforts and actions (Baker & Nelson, 2005; Klein, 2008). In this perspective, opportunities do not exist objectively before the individuals' initiative (Miller, 2007), and they are assumed to be *subjective* phenomena (Klein, 2008; Wood & McKinley, 2010). Thus, the creation perspective has a *relativist* ontology (Chiles et al., 2010). Relativism believes that reality is a finite subjective experience (Denzin & Lincoln, 2005), and nothing exists outside of human thought (Levers, 2013). The

2 The acronym for Substitute, Combine, Adapt, Modify, Put to other uses, Eliminate, Rearrange

epistemological assumption in line with the creation perspective's relativist ontology is constructivism (Chiles et al., 2010; Refai et al., 2015). The constructivist epistemology proposes that truth and reality are intertwined with social context (Allen, 1994), putting forward the idea that there are multiple realities that are socially constructed by groups of individuals (Willig, 2008).

The importance of social context is also acknowledged in the creation perspective when scholars refer to opportunities as socially negotiated and created constructs (Berglund, 2007; Wood & McKinley, 2010). According to Sarasvathy and Dew (2005), entrepreneurs' tasks are not limited only to discovering latent opportunities in the market but also to creating business opportunities through a social process. From the creation perspective, it is impossible to collect information ex-ante about some opportunities because they have not been created yet (Alvarez & Barney, 2007). This lack of information makes it impossible for individuals to evaluate and analyze the risks associated with opportunities (Maine et al., 2015), causing high *uncertainty* regarding their outcome (Alvarez & Barney, 2007). In this situation, scholars asserted that sharing and discussing ideas with trusted networks (such as family, friends, and mentors) play an essential role in objectifying and developing further the subjectively generated ideas (R. J. Jones & Barnir, 2019; Wood & McKinley, 2010).

The notion of uncertainty in the OI process clearly connects to Sarasvathy's (2001) effectuation theory. The effectuation theory describes the decision-making processes of entrepreneurs who have to deal with high levels of uncertainty. In uncertain situations, it is very hard to *predict* the future (i.e., causal thinking); therefore, entrepreneurs tend to *control* the future by using means at their immediate disposal (i.e., effectual thinking). Entrepreneurs aim to create value and achieve imagined ends – which can change over time, depending on what happens along the entrepreneurial journey – via continuous interactions with a committed network of stakeholders. In her work, Sarasvathy (2001) contrasts effectual thinking with causal thinking. The latter relies on prediction and rational analysis to reach predefined outcomes (Linton & Klinton, 2019; Maine et al., 2015) – which is more similar to the discovery perspective, in which opportunities are searched for systematically as if they can be 'found' and the OI process can be organized or planned in some way.

Relevant learning theory. Social constructivism is the most consistent learning theory with the creation perspective (Alvarez & Barney, 2010) due to its relativist ontology and constructivist epistemological view to the OI process. Vygotsky (1986) described social constructivism based on the idea that knowledge cannot be isolated from social and cultural contexts. Based on this school of thought, learning is a process of constructing meaning through social interactions (Bell & Bell, 2020). In social

constructivism, learners play an active role in constructing their knowledge when interacting with other persons in their Zone of Proximal Development (ZPD) (Powell & Kalina, 2009), while teachers act mainly as a facilitator and coach during the learning process (Bell, 2021; Boghossian, 2006). The ZPD is defined as the difference between what a learner can do independently and what can be achieved by interaction with a more competent person, such as his/her teacher or a more experienced person (Adams, 2006).

Implications for EE. Social constructivist teaching approaches are in line with Béchard and Grégoire's (2005a) *competence model* of EE which highlights the importance of individuals' active participation in the co-construction of their knowledge through communication and discussion. The social constructivist approaches also comply with the teaching "*through*" entrepreneurship as an effective EE approach to support opportunity creation (Linton & Klinton, 2019). Teaching "through" entrepreneurship is a typically experiential approach where individuals engage in an actual entrepreneurial activity to improve their entrepreneurial competencies and mindsets (Gibb, 2002; Kyrö, 2005). According to Lackéus (2015), teaching "through" entrepreneurship can be relevant to all individuals at all education levels, making it a suitable teaching approach in line with wide EE's promises.

Scholars employed several social constructivist approaches for fostering individuals' capability to identify opportunities mainly by facilitating self-directed learning (e.g., Lindberg et al., 2017a), team working (e.g., Hytti et al., 2010; Kim et al., 2018), and co-participation in a community of practice (e.g., Kubberød & Pettersen, 2018; Musteen et al., 2018). These experiential-based social constructivism approaches mostly exposed individuals to different ideas and knowledge through the learning process, which could later help them to come up with more potential ideas by combining the acquired new knowledge (Lindgren & Packendorff, 2009) and "joining together at points of mutual understanding" (Refai et al., 2015, p. 331). Also, some scholars referred to design thinking as important teaching "through" approach that can help individuals improve their OI capability based on the creation perspective (Linton & Klinton, 2019; Sarooghi et al., 2019). Design thinking is grounded in a non-linear and human-centered practice (Mansoori & Lackéus, 2019) that favors a creative focus on a collaborative and iterative learning process (Nielsen & Stovang, 2015). Promsiri et al. (2018) reported that asking individuals to follow the design thinking process could help them create more viable business ideas.

Moreover, since the enactment process plays an essential role in the creation of business opportunities, some scholars posited that the teaching approaches that help individuals to form opportunities through an enactment process such as effectuation could

be efficacious in fostering OI based on the creation perspective (Alvarez & Barney, 2010; Zhu et al., 2020). Sarasvathy's notion of effectuation clearly implies elements of social constructivism (Nab et al., 2013) and embraces the idea of opportunity creation (Berglund, 2007; Cohen et al., 2020). In this regard, Zhu et al. (2020) showed that individuals trained by the means-oriented approach of effectuation could generate more business ideas of higher quality than individuals who only practised thinking creatively through various exercises. Based on Sarasvathy's (2001) "bird-in-hand" principle[3] of effectuation, Zhu et al. (2020) asked individuals in the effectuation group to define their resources by asking themselves means-oriented questions such as, "who am I?", "what do I know?", and "who do I know?". Afterwards, Zhu and his colleagues asked them to integrate their resources and form business opportunities by communicating and discussing their ideas with potential customers. Interestingly, Zhu et al.'s (2020) study illustrated that generating ideas based on their own resources results in more ideas that have a higher chance to be acted upon – which makes sense, as the ideas align with the personal background and interest of the participants.

In conclusion, entrepreneurship educators who adopt a social constructivist teaching approach to improve OI capability should provide individuals with opportunities to actively interact with other persons, such as the educator, peers, and/or expert entrepreneurs, while involved in actual entrepreneurial activity as in teaching "through" entrepreneurship. The authenticity of learning experiences would enable individuals to transfer their learning from one context (e.g., market) to another (Ertmer & Newby, 2013). During the learning process, educators, as more knowledgeable persons, should play the role of facilitators who provide timely support based on individuals' needs (Powell & Kalina, 2009). However, the provided support should be decreased gradually to let individuals learn independently (Amineh & Asl, 2015) and to encourage their self-directed learning (Lindberg et al., 2017b). Team working and collaboration are essential in social constructivist learning environments as they allow individuals to perform learning tasks that they would be unable to complete individually (Gillies, 2016), helping them progress within their ZPD (Tudge, 1992). Through peer collaboration, individuals could learn from each other and promote a shared understanding of the market they want to create an opportunity for (e.g., Musteen et al., 2018). Expert entrepreneurs and business advisors could also support individuals during the OI process by giving them feedback on their identified business ideas from a practical perspective and/or helping them develop product prototypes (e.g., Heinonen et al., 2011; Lindberg et al., 2017b).

3 Based on this principle, effectual entrepreneurs create value by looking at the resources that are available to them at the moment.

2.3. Discussion and Conclusion

Despite the wide-reaching conversations about the role of pedagogy in EE, there is still little consensus on what teaching approaches are most appropriate for specific learning goals within EE programs (Barnard et al., 2019; Pittaway, 2009; Sirelkhatim et al., 2015). In this regard, scholars argued that philosophical perspectives play an essential role in determining the teaching approaches that entrepreneurship educators choose for developing particular entrepreneurial knowledge and competencies (G. Hägg & Kurczewska, 2020; Hannon, 2005). Entrepreneurship educators face two philosophical perspectives about opportunities for developing OI, i.e., opportunity discovery and creation. Also, there are different strategies (i.e., active search, fortuitous discovery, and passive search) within the discovery perspective, and each embraces different ontological and epistemological assumptions, again having consequences for the role of the individual in OI. This paper has linked these two philosophical perspectives with the most compatible learning theories in the education field based on their ontological and epistemological assumptions, providing entrepreneurship educators and researchers a theory-driven conceptual framework that shows what learning theory better underpins and supports each perspective (see Figure 2-1). This aligns with the notion of constructive alignment, as introduced by Biggs (1996) and further developed for the entrepreneurship field by Fayolle and Gailly (2008) in their teaching model framework, wherein they stressed the importance of aligning the ontological level with the educational level. That is exactly where the proposed framework can play a key role, as it bridges the fields of entrepreneurship and education. The framework is also supported by empirical studies showing how educators could employ teaching approaches associated with each learning theory in practice to support and facilitate the OI process.

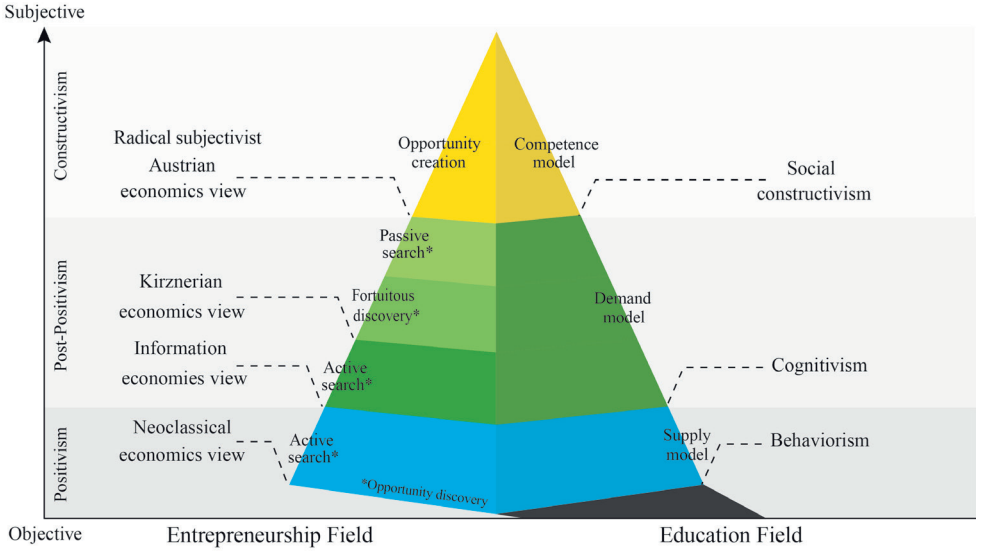


Figure 2-1. The proposed conceptual framework for bridging the entrepreneurship and education field

Figure 2-1 shows the development of philosophical perspectives in entrepreneurship and education fields over time. Although entrepreneurship and education are different fields of research, it is interesting to note that in both fields, comparable developments are observable – from a strong focus on the object and the content (as in "Neoclassical economics view of active search' and 'behaviorism') towards a strong emphasis on the person (as in 'opportunity creation' and 'social constructivism'). Over time, the complex interplay between the individual and his/her environment has been acknowledged more strongly in both entrepreneurship and education fields. As such, the process in which opportunities are identified – shaped, refined, and acted upon in the co-creation process – increasingly becomes the main point of attention, instead of the opportunity itself as a (static) outcome of the OI process.

When looking at the separate layers of the framework, the teaching approaches based on the behaviorist learning theory are the most compatible approaches that comply with the neoclassical view of active search with realism ontology and positivist epistemology. In this perspective, entrepreneurship educators typically try to improve individuals' knowledge about how to calculate the risk of a discovered opportunity to make a rational decision about exploiting that opportunity. Béchard and Grégoire's (2005a) supply model of EE that emphasizes the transmission of knowledge (e.g., lecturing "about" entrepreneurial process and theories) and application of procedures (e.g., developing business plans) are also in line with the neoclassical view of the active search strategy.

Both the information economics view to active search strategy and the passive search strategy share the same learning theory (i.e., cognitivism) aligned with their philosophical assumptions; however, they view the OI process differently. The proponents of information economics view to active search strategy believe that individuals should systematically search for objective opportunities and update their knowledge by processing the received information (Fiet, 2002; Fiet & Patel, 2008). In this view, the cognitivist teaching approaches that enable individuals' active exploration and experimentation play an essential role in improving their OI performance and outcomes (Cohen et al., 2020). These approaches align with Béchard and Grégoire's (2005a) demand model of EE and Kolb's (1984) experiential learning theory. However, based on the passive search strategy, individuals passively discover business opportunities through unintentional and unrestricted searching wherein their alertness plays a substantial role. In contrast with the fortuitous discovery strategy that views alertness as a unique individual characteristic, the passive search proponents argue that alertness is a cognitive ability that can be heightened through teaching approaches that develop some related cognitive capacities and processes such as creativity (Ardichvili et al., 2003; DeTienne & Chandler, 2004), knowledge structure, and information processing skills (Arentz et al., 2013; Baron, 2006). However, the proponents of the information economics view to active search criticized the creativity improvement approaches in the passive search strategy, arguing that these approaches rely on individuals' existing knowledge structure (Cohen et al., 2020), and thus they are more suitable for those with high domain expertise and industry experience (Gielnik et al., 2014).

Finally, social constructivist teaching approaches that emphasize individuals' meaning-making through communication and discussion are the most consistent approaches with the opportunity creation perspective's relativist ontology and constructivist epistemology. In this perspective, opportunities are assumed to be socially negotiated and created constructs, especially for dynamic contexts that involve higher uncertainty (see Hmieleski et al., 2015). Here, an interesting connection is observable with Sarasvathy's (2001) effectuation theory, in which dealing with uncertainty is key. Whereas the discovery approach resembles causation in the effectuation theory, the creation view resembles effectuation. In opportunity discovery, opportunities are identified in existing markets with lower levels of risks and higher expected returns (Maine et al., 2015; Miller, 2007; Sarasvathy, 2001) – which requires a planned-based, future approach, as discovery implies that it is possible to predict the future and find certain opportunities. Nevertheless, in opportunity creation, complexity and uncertainty are key elements of the OI process – requiring a resource-based approach in which different goals (i.e., opportunities) can emerge, be acted upon, and created over time, which is at the core of effectual thinking. In this regard, scholars referred to design thinking and effectuation as two teaching approaches based on the creation perspec-

tive that could help individuals better deal with the uncertainty they face through the opportunity creation process.

Last but not least, our proposed conceptual framework suggests that the philosophical perspectives, views on opportunities, and learning theories do not exclude one another but can exist next to each other. Accordingly, Dutta and Crossan (2005) argued that even though objective and subjective views on opportunities seem to conflict, they can co-exist and complement one another. Whereas the objective view mostly focuses on the cognitive side of OI, the subjective view accounts for the social situatedness of opportunities. Vogel (2017) showed in his model that opportunities can have different triggers – explainable from both objective and subjective perspectives. Similarly, many scholars argued that in a real entrepreneurial process, both active and passive search strategies (Baron, 2006), discovery and creation perspectives (Alvarez & Barney, 2010; Short et al., 2010), or causation and creation approaches (Chandler et al., 2011; Maine et al., 2015) play a role in identifying opportunities, suggesting that entrepreneurship research should move toward a middle ground position (Karimi et al., 2016b). This also applies to the teaching approaches that educators employ to support entrepreneurial learning. Scholars posited that the behaviorist teaching approaches within a EE program could provide individuals with theoretical information and procedural knowledge about the topic at hand (Bell, 2021), forming a solid ground for higher-order social constructivist approaches (Bell & Bell, 2020). This view also aligns with Béchard and Grégoire's (2005a) *hybrid teaching models* for EE.

2.4. Implications for Theory and Practice

This conceptual study can contribute to the literature by addressing calls to connect educational theory and EE practice (Fayolle et al., 2016; Harrison & Leitch, 2005), to provide entrepreneurship educators and researchers with a conceptual framework by integrating the knowledge within both the entrepreneurship and education field (Fayolle, 2013), and to conceptualize how educational philosophies can be integrated into EE to support entrepreneurial learning (Bell & Bell, 2020). In line with previous scholars (e.g., Byrne & Toutain, 2012; Cope, 2005), we believe that applying learning lenses to entrepreneurship would further enlighten our understanding of entrepreneurial processes, which is essential for designing and developing EE programs. In addition, the proposed framework provides future educators and teachers new insights into how OI can be developed in education contexts based on different philosophical perspectives and relevant learning theories.

In general, the central message of the proposed framework for future educators and researchers is that for developing an efficacious EE program to support individuals'

OI performance and outcome, both views should be combined in the program where different perspectives on the emergence of opportunities and different perspectives on learning come together. This view is also evident in some of the previous studies that aimed to support individuals' OI performances wherein they incorporated different teaching approaches based on different learning theories, from the passive teaching of theoretical knowledge on OI to facilitating self-directed learning through experiential learning, social interactions, and continuous self-reflection.

Here there are several opportunities for future studies as well. For example, according to Cohen et al. (2020), a possible avenue for future research would be comparing the effectiveness of active versus passive search strategies in developing individuals' ability to identify business opportunities. In addition, as suggested by previous scholars (Hansen et al., 2016), another study could compare teaching approaches based on the discovery perspective with approaches based on the creation perspective. Moreover, since some scholars believe that individuals benefit from multiple perspectives during the OI process (Chetty et al., 2018), another possible research direction could be exploring the combination of both perspectives in an EE program to foster OI.

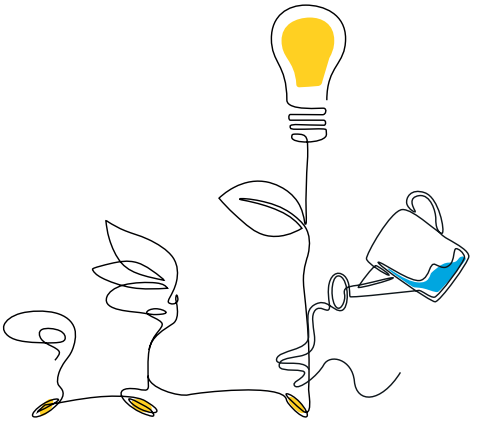
As mentioned earlier, the amount of complexity and uncertainty in the OI process is high when approached from a creation, social constructivist perspective – requiring matching, effectual processes (Sarasvathy, 2001). With the changing approach towards OI in educational programs, a changing approach to research in the EE field also seems desirable. Whereas in positivist epistemology, it is believed that we can explore social sciences similar to how scientists study physical phenomena through quantitative research methods (Johnson & Onwuegbuzie, 2004), constructivist epistemology highlights the importance of the qualitative methods to provide in-depth insights and understanding of the context–phenomena relationship (Moser & Korstjens, 2017). As a result, similar to our argument for the importance of hybrid teaching models in the EE field, future scholars should also move toward a middle-ground position by considering both quantitative and qualitative methods (i.e., mixed-method) in conducting their studies in the field. The mixed-method studies could offer the possibility of capturing the complex learning processes that come into play in EE programs, especially those that adhere to a creation view on OI, building upon the social constructivist learning theory. Moreover, as the research on EE programs adhering to the creation view in relation to effectuation theory is limited, qualitative research designs, supported by quantitative measures, also fit the more exploratory character of what is currently needed in the field.

Last but not least, while the proposed framework offers a comprehensive overview of various learning theories and their associated teaching methods for developing OI

based on each philosophical perspective, it does not fully address all the essential educational components of a constructively aligned learning environment. This includes learning objectives, influential individual and environmental factors, measurement approaches, and curricular content. Therefore, there remains a need for a complementary study that can further extend this framework and provide deeper insights into how EE programs should be structured to effectively foster university students' OI capability. This will be addressed in Study 2 of the current research project which is described in the next chapter.

CHAPTER

3



Fostering University Students' Opportunity Identification Capability: A Systematic Literature Review*

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Abstract

Fostering university students' Opportunity Identification (OI) capability has received much attention from entrepreneurship scholars. However, there is a lack of comprehensive understanding of "*why*" some students can better identify business opportunities and "*how*" their OI capability can be improved. This review aims to synthesize the research findings on university students' OI capability to answer the above questions and propose an evidence-informed framework to guide entrepreneurship educators when developing programs designed to enhance OI capability. In this regard, 44 empirical studies (out of 945 peer-reviewed articles) on OI, dating from 2000 through 2022, were reviewed. The findings were systematically categorized by answering five essential questions raised by the adopted teaching model framework, i.e., "why?", "for whom?", "for which results?", "what?", and "how?". The findings indicate that students' prior knowledge, entrepreneurial alertness, and creativity are respectively the most influential factors in the OI process. Moreover, it has been found that developing students' OI capability requires guiding them through three distinct stages, namely, triggering, idea generation, and idea evaluation, within a constructively aligned learning environment. The chapter concludes by presenting several suggestions and directions for future research.

3.1. Introduction

Entrepreneurship is viewed as a key contributor to economic growth (Jeraj & Antoncic, 2013) due to its potential to establish new businesses (Rideout & Gray, 2013) and equip individuals with the knowledge and skills necessary for scaling up these businesses (Koryak et al., 2015). Therefore, policymakers worldwide advocate for the integration of entrepreneurship education (EE) into national education policies at different levels (Lackéus, 2015; O'Connor, 2013). In particular, there is a growing emphasis on providing EE at the university level (Fretschner & Lampe, 2019). This is justifiable given the limited opportunities available for conventional graduate careers over the past two decades (O. Jones et al., 2021), leading to an increasing number of university graduates starting their own businesses (Osmani et al., 2021). As such, EE programs are required to empower them and enhance their entrepreneurial capabilities (Ratten & Jones, 2021).

In the past few decades, the number of EE programs and related research has grown considerably (Turner & Gianiodis, 2018). Many scholars reported the positive effect of EE programs on university students' entrepreneurial intentions and competencies across disciplines (Ip et al., 2018; Pittaway & Cope, 2007). Moreover, entrepreneurship research has invested heavily in identifying the relevant entrepreneurial capabilities essential for future entrepreneurs (Bernal & Liñán, 2018). In this regard, opportunity identification (OI) has been recognized as one of the key entrepreneurial capabilities (Ardichvili et al., 2003; Lans et al., 2018) and has consequently become a central topic in EE programs (Lumpkin et al., 2004), especially in higher education (Nab et al., 2010).

Scholars define OI as an individual's ability to identify ideas and transfer them to products, processes, or services that have value for customers, end-users, or society (Baggen et al., 2016; Lumpkin & Lichtenstein, 2005). Many scholars believe that OI capability is not a natural gift that only some people possess (Baron & Ensley, 2006), and it can be developed through teaching (Fiet, 2002; Saks & Gaglio, 2002). Thus, there must be factors that can be changed during the learning process to make individuals more capable of identifying opportunities (Muñoz et al., 2011). This viewpoint has received a lot of research attention since 2000 (Filser et al., 2020) and precipitated many studies that investigated the role of a range of possible antecedents in developing OI capability, such as creativity (Gielnik et al., 2012), social networks (Gholami et al., 2021; Ozgen & Baron, 2007), and prior knowledge (Shane, 2000). Many scholars have also reported successful practices that foster university students' capability to identify business opportunities (e.g., DeTienne & Chandler, 2004; Fiet & Patel, 2008).

There is a fast-growing body of research that explores the teaching of OI and this rapid growth has led to difficulties in accumulating and systematizing findings (George et al., 2016). Although previous reviews have made significant theoretical contributions to understanding OI in general (e.g., George et al., 2016; Hansen et al., 2011, 2016), they fall short of offering a comprehensive insight into "*why*" some students can better identify business opportunities than others (Ozgen & Minsky, 2013). Moreover, there is still limited evidence demonstrating "*how*" this capability should be taught in entrepreneurship courses (McNally et al., 2018). This review aims to fill the gap by proposing an evidence-informed framework, contributing to an understanding of what helps and hinders OI among university students. The review thus informs entrepreneurship educators about the design of EE programs that can effectively foster university students' OI capability.

3.1.1. Research Questions

In line with Hägg and Gabrielsson's (2019) review study, Fayolle and Gailly's (2008) generic teaching model for EE was adopted as a theoretical framework to guide this review and to help formulate the research questions. This framework is inspired by Biggs's (1996) principle of constructive alignment, suggesting that optimal learning is achieved when teaching and assessment methods align with the learning outcomes students need to achieve. Accordingly, Fayolle and Gailly (2008) argued that to develop an efficacious EE program, entrepreneurship educators should design the program around five questions addressed in this order: (1) "why?", (2) "for whom?", (3) "for which results?", (4) "what?", and (5) "how?". Accordingly, the following research questions are formulated to guide this systematic review:

RQ1. What learning objectives can be targeted to foster university students' OI capability?
RQ2. What individual characteristics and environmental factors affect university students' OI?
RQ3. What measurement approaches should be used to assess university students' OI capability development?
RQ4. What content should be included in programs that aim to foster university students' OI capability?
RQ5. How should education be conducted in programs that aim to foster university students' OI capability?

3.2. Method

This study follows a systematic review method as a replicable and transparent review process to provide a clear understanding of advancements in the small business and

entrepreneurship field (Kraus et al., 2021). The Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) framework (see Moher et al., 2009) was adopted and used to develop a review protocol that included information about *identification*, *screening, eligibility*, and *analysis* for conducting the study.

3.2.1. Identification Phase

This review used a systematic search strategy based on three sets of keywords that overlapped with the research questions: one set refers to entrepreneurial capability, i.e., opportunity identification, one set to the goal of the study, and one set to the study context. In the first step, synonyms or related keywords for each set were identified using Merriam-Webster's Online Thesaurus combined with George et al.'s (2016) review to find the most used terms for OI capability. The final search words used within each set are shown in Table 3-1.

Table 3-1. Final keywords used in the query

Sets	Keywords
Capability	"opportunity identification", "opportunity recognition", "opportunity detection", "opportunity perception", "opportunity seeking", "opportunity discovery", "opportunity creation", "opportunity search", "opportunity formation", "spotting opportunity", "discerning opportunity"
Goal	"improving", "developing", "fostering", "promoting", "supporting", "teaching", "enhancing", "learning", "training", "educating", "instructing", "exploring", "influencing", "impacting", "affecting"
Context	"higher education", university, college, graduate, postgraduate, undergraduate, student, youth

In the second step, the sets were overlapped with the Boolean operator "AND" and the related asterisks marked keywords within each set were combined using "OR" to arrive at the final search string. The search keywords might appear in an article's title, keywords, and/or abstract. The leading researcher conducted the literature search in February 2022 using the following bibliographical databases that were also suggested by Fan et al. (2022) for conducting reviews in the entrepreneurship field: *Scopus*, *Web of Science (WoS)*, *ABI Inform/ProQuest*, *JSTOR*, and *Education Resources Information Center (ERIC)*. As part of the first set of inclusion criteria, the search parameters were set to focus on peer-reviewed scientific journals used as a proxy for 'validated knowledge' (Liñán and Fayolle, 2015) and include only English-language articles. The search was also limited to articles published from 2000 onwards due to the growing interest among scholars since then (Filser et al., 2020), resulting in 945 articles after removing 265 duplicated articles.

3.2.2. Screening Phase

In the next phase, the titles and abstracts of the 945 retrieved articles were screened to identify potentially relevant articles. Based on the second set of inclusion criteria, only articles included that were (1) empirical in design, (2) conducted in the higher education context, and (3) aimed at fostering and/or exploring OI capability. In total, 884 articles were excluded since they were either: (1) a review, theoretical, or conceptual article; (2) conducted in secondary education or non-university EE programs; or (3) unrelated topics (e.g., exploring the effect of OI on individuals' entrepreneurial intention, readiness, or behaviour).

3.2.3. Eligibility Phase

In this phase, the remaining 61 full-text articles were thoroughly read to find the most suitable and relevant. Under the third set of inclusion criteria, articles were deemed eligible to be included for content analysis: (1) they were conducted with higher education students; (2) they addressed at least one aspect of an EE program (e.g., learning objectives, factors affecting individuals' OI, learning outcomes, content, and/or pedagogical approach). The studies conducted with entrepreneurs, full-time employees, or interested academians (e.g., teachers and scientists) participating in professional development programs at universities were identified and excluded from the review during this phase. In the next step, the first and the second authors assessed the quality of the remaining 53 articles (eight qualitative, 42 quantitative, and three mixed methods) using Theelen et al.'s (2019) criteria (see Appendix 3-1). For the quality appraisal, the remaining articles were evaluated based on various criteria and scored between 0 (i.e., no elaboration) and 3 (i.e., extensive elaboration). In total, nine articles (three qualitative and six quantitative) were excluded for further analysis after quality appraisal (with a mean score below 2), which resulted in 44 articles deemed eligible for content analysis. The steps followed in selecting relevant articles are depicted in an adapted PRISMA flow diagram shown in Figure 3-1.

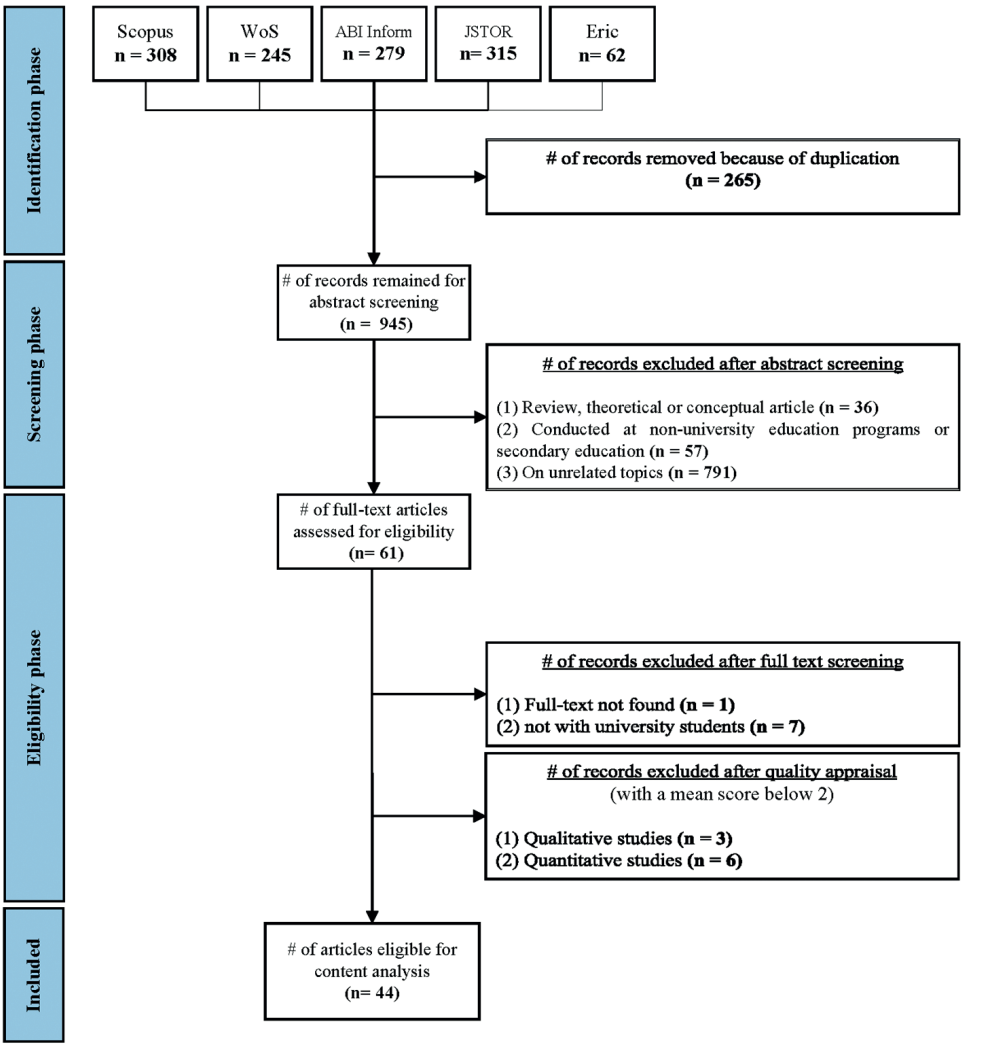


Figure 3-1. The adapted PRISMA flow diagram

3.2.4. Analysis Phase

The selected articles were entered into ATLAS.ti 8 for content analysis. In the first step, the researchers read each article and formulated summary phrases that captured its specific findings regarding OI capability and other relevant information answering the research questions. These summaries reflected the main findings qualitatively. For instance, a summary phrase could be "The prior knowledge of customer problems leads to identifying more opportunities and opportunities that are more innovative". Articles were also coded to extract general information such as country of study, type

of study, sample size, gender, etc. Following this, a coding scheme was developed in two phases explained below.

In the first phase, the researchers developed an initial version of the coding scheme inductively, in a group discussion, using the educational dimensions of the adopted generic teaching model framework (Fayolle & Gailly, 2008). The purpose of this phase was to provide a theory-based structure to ground the categories observed. In the second phase, the coding scheme was applied to the selected articles, which resulted in refined codes and sub-codes. The first researcher applied an iterative process of testing the codes, iteratively summarizing the data, identifying new codes, connecting codes to one another, developing new themes, and applying the revised codes, until reaching a saturation point (i.e., no new codes or themes were generated). During this process, other members of the research team checked the themes and codes independently of the lead researcher. Finally, each code was operationally defined so that any coder could identify relevant content. To establish coding reliability, the first and second authors randomly picked four articles (= 9%) and blind-coded them. Cohen's Kappa statistic was used to examine the inter-rater reliability, testing the coding quality. The test indicated a high agreement between reviewers' coding (κ = .86, p < .001), which confirmed the reliability of the final coding scheme. After finalizing the coding scheme, the lead researcher coded all identified articles to synthesize their findings (see Appendix 3-2 for the final coding scheme).

3.3. Results

More detailed information was obtained regarding the empirical research on university students' OI capability through close review and coding of the selected articles. A complete list of the 44 included articles is provided in Table 3-2. Most of the reviewed articles (n = 30) were published from 2016 to 2022, showing an increase in attention from scholars in recent years. The reviewed articles were distributed in different peer-reviewed journals. The distribution of journals reflects the interdisciplinary nature of the topic, including journals that primarily publish in the fields of educational research (e.g., *Innovations in Education and Teaching International* and *Studies in Higher Education*), entrepreneurship research (e.g., *Entrepreneurship Theory and Practice* and *Journal of Business Venturing*), or both (e.g., *Education and Training* and *Academy of Management Learning and Education*).

Table 3-2. A complete list of the reviewed articles

Author(s) and year	Country of study	Type of analysis	Sample size	Gender (*N*)	Educational level	Field of Study	Type of course	Type of learning	Time of the measurement	Research focus
Arentz et al. (2013)	USA	Mixed	64	Male (40)/ Female (24)	N/A	N/A	Elective	Individual	Shortly after	Fostering OI
Baggen, Mainert, et al. (2017)	Netherlands	Quantitative	113	Male (36)/ Female (77)	Graduate	Non-Business	-	-	-	Exploring OI
Baggen, Kampen, *et al.* (2015)	Netherlands	Quantitative	257	Male (103)/ Female (154)	Graduate/ Undergraduate	Non-Business	-	-	-	Exploring OI
Carrier (2008)	USA	Qualitative	12	N/A	N/A	Business	Elective	Collaborative	Shortly after	Fostering OI
Cohen et al. (2020)	USA	Quantitative	149	Male (67)/ Female (82)	Undergraduate	Business	Compulsory	Individual	Shortly after	Fostering OI
Costa *et al.* (2016)	Netherlands	Quantitative	70	Male (21)/ Female (49)	Graduate/ Undergraduate	Non-Business	-	-	-	Exploring OI
Costa *et al.* (2018)	Portugal/ Germany	Quantitative	283	Male (126)/ Female (157)	All	Both	Elective	Both	Shortly after	Fostering OI
Craig and Johnson (2006)	USA	Quantitative	103	N/A	Graduate	Both	-	-	-	Exploring OI
DeTienne and Chandler (2004)	USA	Quantitative	130	Male (70)/ Female (57)	Undergraduate	Business	Compulsory	Both	Shortly after	Fostering OI
DeTienne and Chandler (2007)	USA	Quantitative	95	Male (53)/ Female (42)	Undergraduate	Business	-	-	-	Exploring OI
Eller *et al.* (2020)	Germany	Quantitative	107	Male (30)/ Female (77)	All	Both	-	-	-	Exploring OI
Fiet and Patel (2008)	USA	Quantitative	31	Male (21)/ Female (10)	Graduate	Business	Elective	Individual	Shortly after	Fostering OI
González and Husted (2011)	Mexico	Quantitative	168	Male (106)/ Female (62)	Graduate	Business	-	-	-	Exploring OI
Heinonen et al. (2011)	Finland	Quantitative	117	Male (62)/ Female (55)	Undergraduate	Business	-	-	-	Exploring OI

Hytti *et al.* (2010)	Finland	Quantitative	117	Male (62)/ Female (55)	Undergraduate	Business	Compulsory	Collaborative	Shortly after	Both
Karimi et al. (2016a)	Iran	Quantitative	68	Male (19)/ Female (49)	Undergraduate	Non-Business	Elective	Collaborative	Shortly after	Fostering OI
Karimi et al. (2016b)	Iran	Quantitative	205	Male (86)/ Female (119)	Undergraduate	Non-Business	Both	Collaborative	Shortly after	Both
Khalid and Sekiguchi (2018)	Japan/Pakistan	Quantitative	251	Male (187)/ Female (64)	Undergraduate	Business	Elective	Individual	Shortly after	Fostering OI
Kickul *et al.* (2010)	USA	Quantitative	138	Male (73)/ Female (65)	Graduate	Business	-	-	-	Exploring OI
Kim *et al.* (2018)	Korea	Quantitative	203	Male (148)/ Female (55)	Undergraduate	Both	-	-	-	Exploring OI
Kubberød and Pettersen (2018)	Norway	Qualitative	8	Male (7)/Female (1)	Graduate	Non-Business	N/A	Individual	0-5 years after	Both
Li *et al.* (2015)	China	Quantitative	208	Male (129)/ Female (79)	Graduate/ Undergraduate	Both	-	-	-	Exploring OI
Lim et al. (2021)	Malaysia	Quantitative	247	Male (91)/ Female (156)	Undergraduate	Business	-	-	-	Exploring OI
Lindberg et al. (2017a)	Sweden	Quantitative	73	Male (41)/ Female (32)	Undergraduate	Business	Compulsory	Collaborative	Shortly after	Fostering OI
Lindberg et al. (2017b)	Sweden	Quantitative	100	Male (41)/ Female (59)	N/A	Business	Compulsory	N/A	Shortly after	Fostering OI
Mehdizadeh et al. (2021)	Iran	Quantitative	127	Male (65)/ Female (62)	Undergraduate	Non-Business	-	-	-	Exploring OI
Muñoz *et al.* (2011)	UK	Mixed	15	Male (5)/Female (10)	Undergraduate	Business	Elective	Collaborative	Shortly after	Fostering OI
Muñoz, *et al.* (2020)	Chile	Qualitative	13	Male (8)/Female (5)	Postgraduate	Non-Business	Elective	Collaborative	Shortly after[a]	Fostering OI
Musteen *et al.* (2018)	USA/UK/ Spain	Qualitative	86	N/A	Undergraduate	N/A	N/A	Collaborative	Shortly after	Fostering OI
Nab *et al.* (2013)	Netherlands	Mixed	23	Male (13)/ Female (10)	Graduate	Non-Business	Compulsory	Both	Shortly after	Fostering OI

Nam and Xiong (2021)	Korea	Quantitative	508	Male (200)/ Female (308)	Graduate/ Undergraduate	Non-Business	-	-	-	Exploring OI
Ngah et al. (2020)	Malaysia	Quantitative	225	Male (90)/ Female (135)	Undergraduate	Non-Business	-	-	-	Exploring OI
Oftedal et al. (2018)	Norway/ Sweden/ Finland/UK/ USA	Quantitative	196	Male (69)/ Female (127)	Graduate/ Undergraduate	Business	-	-	-	Exploring OI
Othman and Othman (2020)	Malaysia	Quantitative	152	Male (37)/ Female (115)	Graduate	Non-Business	-	-	-	Exploring OI
Ploum *et al.* (2018)	Netherlands	Quantitative	96	Male (45)/ Female (51)	Undergraduate	Non-Business	-	-	-	Exploring OI
Ploum *et al.* (2019)	Netherlands	Quantitative	398	Male (189)/ Female (209)	Undergraduate	Non-Business	-	-	-	Exploring OI
Prandelli et al. (2016)	Italy	Quantitative	137	Male (n/a)/ Female (n/a)	Graduate	N/A	N/A	Individual	N/A	Both
Promsiri *et al.* (2018)	Thailand	Quantitative	120	N/A	Undergraduate	N/A	N/A	Individual	Shortly after	Fostering OI
Ramsgaard and Østergaard (2018)	Denmark	Qualitative	33	N/A	Graduate	Non-Business	Elective	Individual	Shortly after	Fostering OI
Sahai and Frese (2019)	Singapore	Quantitative	73	Male (36)/ Female (37)	Undergraduate	Business	-	-	-	Exploring OI
Shepherd and DeTienne (2005)	USA	Quantitative	78	N/A	Graduate	Business	N/A	Individual	Shortly after	Fostering OI
St-Jean *et al.* (2017)	Canada/ Belgium/ France/ Algerian	Quantitative	1540	Male (36)/ Female (37)	All	Both	-	-	-	Exploring OI
Vandor and Franke (2016)	Austria	Quantitative	46	Male (22)/ Female (24)	Graduate	N/A	-	-	-	Exploring OI
Wang *et al.* (2019)	China	Quantitative	466	Male (102)/ Female (364)	Graduate/ Undergraduate	Both	-	-	-	Exploring OI

Note. N = Number of students; N/A= Not Available, [a]In this study, students' OI competence was also measured 0-5 years after the study.

Most studies have been conducted in the USA (*n* = 11) and Europe, e.g., The Netherlands (*n* = 6), Sweden (*n* = 3), and Finland (*n* = 3). Many articles (*n* = 36) contain quantitative data analysis, while *five* articles contain an analysis of qualitative data, and only *three* articles used both qualitative and quantitative, i.e., mixed methods. The educational context of the reviewed articles varied among students in undergraduate (*n* = 25), graduate (*n* = 19), and postgraduate (*n* = 4) degree programs. Regarding the participants' field of study, 15 studies were done with business students (e.g., in management, entrepreneurship, business, and marketing programs), 17 studies recruited non-business students (e.g., engineering, social science, and environmental science programs), and *seven* studies were conducted with both business and non-business students. Most studies (n = 23) aimed only to *explore* the effects of individual characteristics or environmental factors on students' OI capability. Additionally, 17 studies focused exclusively on *fostering* university students' OI capability within an EE program. While *four* studies focused on both fostering and exploring the students' OI capability.

It is important to note that the RQ2 was answered by accumulating the studies' findings focused on exploring OI capability (*n* = 27), while other research questions were answered based on the studies' findings aimed at fostering university students' OI capability (*n* = 21).

3.3.1. The Learning Objectives to Foster Students' OI Capability

The objective of all 21 selected articles was to improve university students' capability to identify business opportunities as one of the main attributes of a successful entrepreneur. To achieve this objective, the content analysis of selected articles revealed that scholars targeted different specific objectives based on *cognitive*, *affective*, and *social* factors that play a role in identifying opportunities (see Table 3-3).

Table 3-3. Outline of findings related to factors that EE programs targeted as learning objectives to foster university students' OI capability

Category	Sub-category	Citation	Percentage
Cognitive	Creative thinking skills	Carrier (2008); DeTienne and Chandler (2004); Karimi et al. (2016a); Lindberg et al. (2017a, 2017b); Muñoz et al. (2011, 2020); Nab et al. (2013); Promsiri et al. (2018)	42.9 %
	Market knowledge	Arentz et al. (2013); Cohen et al. (2020); Costa et al. (2018); Fiet and Patel (2008); Shepherd and DeTienne (2005); Promsiri et al. (2018)	28.6 %
Social	Perspective-taking	Prandelli et al. (2016); Khalid and Sekiguchi (2018)	9.5 %
	Networking	Hytti et al. (2010); Kubberød and Pettersen (2018); Musteen et al. (2018); Ramsgaard and Østergaard (2018)	19.0 %
Affective	Empathic concern	Khalid and Sekiguchi (2018)	4.8 %
	Motivation	Shepherd and DeTienne (2005)	4.8 %

3.3.1.1. Cognitive objectives

The most targeted cognitive objective for improving students' capability to identify opportunities was creative thinking skills (42.8 %). Scholars reported that developing students' creativity skills could improve their perceived OI capability (Lindberg et al., 2017) and their ability to discover a greater number of ideas (DeTienne & Chandler, 2004; Karimi et al., 2016a; Promsiri et al., 2018) that are more innovative (DeTienne & Chandler, 2004; Karimi et al., 2016a). Moreover, Lindberg et al. (2017b) reported that creativity exercises and activities could help students develop specific mental frameworks that contribute to students' OI capability by increasing their alertness to new opportunities. Some scholars showed that applying convergent and divergent thinking styles could help students develop a richer OI mental frame (Muñoz et al., 2011) which enables them to identify more innovative opportunities (Muñoz et al., 2011, 2020; Promsiri et al., 2018).

Another cognitive objective frequently targeted (28.5 %) is market knowledge. Arentz et al. (2013) showed that enriching students' knowledge of ways to serve markets and customer problems, as different kinds of specific human capital, could heighten their alertness, increasing their ability to discover more business ideas. They argued that accumulating relevant knowledge would help individuals think more intuitively and be more interested in discovering opportunities. Similarly, some scholars reported that improving students' specific human capital could lead them to identify more opportunities (Shepherd & DeTienne, 2005), which were also more innovative (Cohen et al., 2020; Shepherd & DeTienne, 2005). Fiet and Patel's (2008) findings indicated that students who actively selected a particular group of information channels that fit their prior specific knowledge discovered more opportunities with wealth-generating potential. Similarly, Costa et al. (2018) reported that asking students to explore their knowledge about the technological, social, political, and economic changes in their surroundings could help them later identify a more viable business opportunity in a presented scenario compared to a control group.

Some studies highlighted the importance of students' perspective-taking for identifying potential business opportunities (9.5 %). According to Prandelli et al. (2016), asking students to take a person's perspective in a scenario-based study helped develop their cognitive understanding of the person's needs, wants, and preferences, and increased their intrinsic motivation to find an appropriate solution. Their findings indicated that the user perspective-taking process affected the feasibility, desirability, and market alignment of identified opportunities. Similarly, Khalid and Sekiguchi (2018) reported that students who took a user perspective could discover higher-quality ideas than students who did not.

3.3.1.2. Social objectives

Scholars reported the positive effect of networking, in the form of establishing a community of practice consisting of students (Musteen et al., 2018) or students and experts (Kubberød & Pettersen, 2018; Ramsgaard & Østergaard, 2018), on students' (self-perceived) capability to identify business opportunities. Musteen et al. (2018), for example, reported that forming teams consisting of students from different countries working on the same entrepreneurial project could help develop cross-cultural competencies and knowledge, further improving students' perception of internationally viable opportunities. Hytti et al. (2010) showed that students' collaboration with their peers can enhance the effect of intrinsic motivation on students' perceived OI capability. Scholars also reported that using internships to establish a community of practice between students and experts could play a role in bridging the theory-practice gap, developing students' professional identity, and improving their ability to identify potential opportunities (Kubberød & Pettersen, 2018; Ramsgaard & Østergaard, 2018)

3.3.1.3. Affective objectives

Khalid and Sekiguchi (2018) asserted that empathic concern, or the affective (i.e., feeling-related and emotional) component of empathy, can enhance the effect of perspective-taking on opportunity discovery. They argued that empathic concern leads to the feeling of compassion, defined as the motivation or desire to help others, which further increases the likelihood of discovering opportunities that favour other people's needs and problems. Their findings supported the idea, demonstrating that using both perspective-taking and empathic concern, improves the feasibility, desirability, and market alignment of discovered ideas when compared to perspective-taking only.

Shepherd and DeTienne (2005) reported that strengthening students' motivation by promising financial rewards helped with the discovery of more business opportunities. They also showed that students with a high level of market knowledge would be more intrinsically motivated to discover opportunities, meaning that their motivation is not solely driven by financial reward. This finding further highlighted the importance of specific human capital in the OI process.

3.3.2. The Influential Individual Characteristics and Environmental Factors

As shown in Table 3-4, the review of 27 articles aimed at exploring OI capability highlighted different individual characteristics and environmental factors that impact students' capability to identify entrepreneurial opportunities and should be considered when developing EE programs.

3.3.2.1. Individual characteristics

Students' prior knowledge (18.5 %) and entrepreneurial alertness (14.8 %) were the most reported cognitive characteristics that played a role in the OI process. Many scholars reported that students' prior knowledge could directly (González & Husted, 2011; Li et al., 2015; Lim et al., 2021) and indirectly (Li et al., 2015; Mehdizadeh et al., 2021; Prandelli et al., 2016) affect their perceived OI and the quantity and quality of their identified opportunities. More specifically, scholars showed that different types of prior knowledge have different roles in students' OI capability. For instance, González and Husted (2011) reported that students with higher general human capital (i.e., knowledge acquired through formal education and/or work experience applicable to more than one job or firm) could identify more opportunities. Their findings indicated that students who possessed both higher levels of specific (e.g., knowledge of customer needs) and general human capital could identify more opportunities that were also more innovative. According to Prandelli et al. (2016), although students' knowledge of markets, as a specific human capital, negatively correlated with their OI capability, it could positively moderate the relationship between user perspective-taking and students' OI. Li et al. (2015) showed that students' specific human capital in terms of knowledge of markets and means to serve could indirectly affect their OI through its influence on alertness. Similarly, Mehdizadeh et al. (2021) reported that in addition to its strong positive direct effect, students' specific human capital could indirectly improve their perceived OI by affecting their entrepreneurial alertness.

Table 3-4. Outline of findings related to individual characteristics and environmental factors

Category		Sub-category	Citation	Percentage
Individual characteristics	Cognitive	Prior knowledge	González and Husted (2011); Li et al. (2015); Lim et al. (2021); Mehdizadeh et al. (2021); Prandelli et al. (2016)	18.5 %
		Entrepreneurial alertness	Li et al. (2015); Lim et al. (2021); Mehdizadeh et al. (2021); Nam and Xiong (2021)	14.8 %
		Innovative behaviour and creativity	Heinonen et al. (2011); Kim et al. (2018); Ngah et al. (2020)	11.1 %
		Problem-solving skills	Baggen, Mainert et al. (2017); Kim et al. (2018)	7.4 %
		Cognitive style	Kickul et al. (2010); Nab et al. (2013)	7.4 %
		Tendency toward automaticity	Sahai and Frese (2019)	3.7 %
	Psychological	Attitude toward entrepreneurship	Costa et al. (2018); Eller et al. (2020); Karimi et al. (2016b)	11.1 %
		Moral antecedents	Eller et al. (2020); Ploum et al. (2019); Ploum et al. (2018)	11.1 %
		Entrepreneurial emotion	Othman and Othman (2020)	3.7 %
		Motivation	Hytti et al. (2010)	3.7 %
	Socio-demographic	Educational level	Baggen, Kampen, et al. (2017); Oftedal et al. (2018)	7.4 %
		Field of study	Craig and Johnson (2006); Kubberød and Pettersen (2018)	7.4 %
		Gender	DeTienne and Chandler (2007); Oftedal et al. (2018)	7.4 %
Environmental factors	-	Social networks	Mehdizadeh et al. (2021); Nam and Xiong (2021); St-Jean et al.(2017); Wang et al. (2019)	14.8 %
		University supports	Mehdizadeh et al. (2021); Oftedal et al. (2018); Vandor and Franke (2016)	11.1 %

Students' attitudes toward entrepreneurship (11.1 %) and moral antecedents (11.1 %) were the most frequently reported psychological factors playing a role in identifying entrepreneurial opportunities. Scholars reported that students' strong feelings toward entrepreneurship could directly (Karimi et al., 2016b) and indirectly (Costa et al., 2018; Eller et al., 2020) affect their OI capability. Eller et al. (2020) showed that students' entrepreneurial attitude positively moderates the relationship between solution identification and sustainable opportunity identification. They asserted that higher entrepreneurial attitudes enable students to identify particular features of solutions that can be developed into potential businesses. Also, concerning sustainable opportunity identification, scholars reported that students' moral antecedents, such as their moral competencies (Ploum et al., 2018, 2019), pro-environmental behaviour values (Ploum et al., 2018), and awareness of adverse consequences of existing envi-

ronmental conditions (Eller et al., 2020), have a positive effect on the number of ideas identified for sustainable development.

The findings also indicated the significant role of students' socio-demographic characteristics in OI. Baggen, Kampen et al. (2017) reported that master's students scored significantly higher than bachelor's students in all aspects of the OI competence assessment test. In the same vein, Oftedal et al.'s (2018) findings also indicated that master's students had a higher ability to see opportunities than bachelor's students. They related this result to master students' higher entrepreneurial knowledge acquired through EE programs. The findings of the current review study also highlighted the differences between business, engineering, and social sciences students concerning OI capability. Craig and Johnson (2006) showed that engineering students perceive less proficiency in identifying business opportunities than their business-trained counterparts due to their lower entrepreneurial alertness. Kubberød and Pettersen (2018) reported that engineering students could benefit from relatively easy absorption into the practice while doing an internship in a high-tech start-up, and they would rely more on problem-solving approaches for solving existing problems, leading them to identify fewer novel opportunities but ones that the experts in their team desired. In contrast, social science students had to experiment and follow trial-and-error approaches to identify opportunities, helping them develop unexpected solutions and new ideas. Finally, some scholars reported the effect of gender on students' perceived OI capability (Oftedal et al., 2018) and the kinds of general and specific human capital they utilized when identifying opportunities (DeTienne & Chandler, 2007).

3.3.2.2. Environmental factors

Several scholars reported the effect of university students' membership in social networks (Mehdizadeh et al., 2021; Nam & Xiong, 2021), network embeddedness (Wang et al., 2019), and contact with business mentors (St-Jean et al., 2017) on their perceived OI capability. Their findings indicated that social networks could directly affect students' OI capability as it enables them to acquire more entrepreneurship information, improving their human capital (Mehdizadeh et al., 2021; Nam & Xiong, 2021). Mehdizadeh et al. (2021) showed that having social networks could also indirectly affect students' ability to identify opportunities by improving their entrepreneurial alertness. Some scholars reported that university students' network scale (i.e., the number of members in their social networks) (Nam & Xiong, 2021; Wang et al., 2019) and network intensity (i.e., the closeness of their relationships) (Wang et al., 2019) have a positive effect on their perceived ability to identify entrepreneurial opportunities. St-Jean et al.'s (2017) findings, however, specified that networking by itself does not necessarily impact university students' OI, and it is essential to be in touch with persons who are more knowledgeable in the field, via business mentoring.

Scholars also reported that university support, such as providing students with entrepreneurship courses and initiatives (Mehdizadeh et al., 2021; Oftedal et al., 2018) and allowing them to have cross-cultural experiences (Vandor & Franke, 2016), can positively affect their ability to identify entrepreneurial opportunities. Mehdizadeh et al. (2021) showed that students' perceived university support concerning entrepreneurial activity can indirectly affect their perceived OI capability through alertness, human capital, and social capital. Oftedal et al. (2018) reported that initiatives that improve the attractiveness of entrepreneurial careers (e.g., meeting with entrepreneurial role models) significantly impact students' capability to recognize opportunities. In addition, Vandor and Franke's (2016) findings indicated that students' cross-cultural experiences resulting from universities' exchange programs can improve their ability to discover arbitrage opportunities and creatively recombine resources to identify profitable business opportunities.

3.3.3. The Measurement Approaches of Students'OI Capability

The findings indicated that scholars employed several *objective* and/or *subjective* measurement approaches for assessing students' OI capability development. Moreover, two themes emerged when analyzing the objective measurement approaches: (1) measuring the *quantity* of ideas and (2) evaluating the *quality* of ideas (see Table 3-5). The descriptive analysis of findings revealed that the measurement was conducted shortly after the study in most studies reviewed (19 out of 21).

3.3.3.1. Objective measurement approaches

Several scholars measured the students' OI capability by assessing the quality and/or quantity of the generated ideas, respectively, by counting the total number of generated ideas (i.e., also known as fluency) and calculating their *average* quality based on specific criteria. The content analysis of selected articles showed that scholars employed two different criteria set for evaluating ideas' quality: *general creativity criteria,* such as innovativeness and novelty and/or more *business-related criteria,* such as alignment with market needs, feasibility, cash flow, and manageable risk. Despite the favorability of these objective measurement approaches in the reviewed articles, Muñoz et al. (2011) argued that these approaches should be augmented or replaced by more innovative methods utilizing visual representations, which are useful in unveiling the tacit aspects of OI capability. They used a visualization technique called mind mapping to illustrate the changes in students' OI mental frames from the beginning to the end of their study.

Table 3-5. Outline of findings related to the measurement approaches of university students' OI capability

Category	Sub-category	Citation	Percentage
Objective measurement	*Quantity of business ideas*	Arentz et al. (2013); DeTienne and Chandler (2004); Fiet and Patel (2008); Karimi et al. (2016a); Muñoz et al. (2011, 2020); Promsiri et al. (2018); Sahai and Frese (2019); Shepherd and DeTienne (2005)	42.9 %
	Number of ideas		
	Quality of business ideas		
	Innovativeness	Cohen et al. (2020); DeTienne and Chandler (2004); Karimi et al. (2016a); Muñoz et al. (2011); Nab et al. (2013); Sahai and Frese (2019); Promsiri et al. (2018); Shepherd and DeTienne (2005)	38.1 %
	Alignment with market needs	Costa et al. (2018); Khalid and Sekiguchi (2018); Nab et al. (2013); Prandelli et al. (2016)	19.0 %
	Feasibility	Khalid and Sekiguchi (2018); Nab et al. (2013); Prandelli et al. (2016)	14.3 %
	Desirability	Khalid and Sekiguchi (2018); Prandelli et al. (2016)	9.5 %
	Wealth generating potential	Costa et al. (2018); Fiet and Patel (2008)	9.5 %
	Manageable risk	Costa et al. (2018)	4.8 %
	Novelty	Promsiri et al. (2018)	4.8 %
	OI mental frames	Muñoz et al. (2011)	4.8 %
Subjective measurement	Self-perceived OI capability	Carrier (2008); Costa et al. (2016); Hytti et al. (2010); Karimi et al. (2016b); Kubberød and Pettersen (2018); Lindberg et al. (2017a, 2017b); Muñoz et al. (2020); Musteen et al. (2018); Nab et al. (2013); Ramsgaard and Østergaard (2018)	52.4%

3.3.3.2. Subjective measurement approaches

The review's analysis showed that many scholars adopted different subjective measurement approaches, such as OI capability questionnaires (e.g., Karimi et al., 2016b; Muñoz et al., 2020), self-reported data in interviews (Musteen et al., 2018; Ramsgaard & Østergaard, 2018), students' entrepreneurial OI self-efficacy (e.g., Lindberg et al., 2017b). Munez et al.'s (2011) findings, however, indicated that although many students thought their capability improved due to taking part in the course, this did not appear to be reflected in their OI mental frame changes.

3.3.4. The Content of Programs Aimed to Foster Students' OI Capability

The findings indicated that scholars were not transparent about their EE programs' content. In most reviewed articles, the curricula content was only generally described in terms of course names and topics in different sessions. Despite this shortcoming, an in-depth review of some articles revealed that scholars included different kinds of content with *professional*, *spiritual*, and *theoretical* dimensions in their EE program to facilitate students' OI capability development (see Table 3-6).

Table 3-6. Outline of findings related to the content of EE programs aimed to foster OI capability

Dimension	Type of content	Citation	Percentage
Professional	Know-how	Carrier (2008); Costa et al. (2018); Cohen et al. (2020); DeTienne and Chandler (2004); Karimi et al. (2016a); Karimi et al. (2016b); Lindberg et al. (2017a, 2017b); Muñoz et al. (2011, 2020); Musteen et al. (2018); Nab et al. (2013)	57.1 %
	Know-what	Cohen et al. (2020); Promsiri et al. (2018)	9.5 %
Theoretical	-	Karimi et al. (2016a); Lindberg et al. (2017a, 2017b); Muñoz et al. (2011. 2020); Nab et al. (2013)	28.6 %
Spiritual	Know-why	Karimi et al. (2016b)	4.8 %
	Know-when	Lindberg et al. (2017b)	4.8 %

3.3.4.1. Professional content

The professional content of EE programs relates specifically to practical knowledge (i.e., *know-how*) and a lesser extent, to theoretical knowledge (i.e., *know-what*) crucial for initiating an entrepreneurial activity. The most included content in the reviewed EE programs (57.1 %) belongs to practical knowledge that scholars used in the form of action-oriented exercises to help students to learn how to generate ideas (e.g., DeTienne & Chandler, 2004; Nab et al., 2013), write a business plan (e.g., Lindberg et al., 2017a; Musteen et al., 2018), develop business opportunity prototypes and criteria (Costa et al., 2018; Nab et al., 2013), improve the quality of opportunities (e.g., Cohen et al., 2020), and work efficiently as a team to identify creative ideas (Lindberg et al., 2017a). A few scholars in the reviewed articles (9.5 %) also included know-what knowledge in their EE programs to help university students respond better to a given entrepreneurial situation, such as informing them about what makes ideas valuable (e.g., Cohen et al., 2020) and what they need to consider as a source of change to develop opportunities (e.g., Promsiri et al., 2018).

3.3.4.2. Theoretical content

The theoretical content relates to the theories and scientific knowledge that are useful for understanding the entrepreneurial phenomenon and providing a basis for the other kinds of content. The content analysis of articles showed that theoretical knowledge was the second most common content (28.6 %) included in the EE programs in the forms of improving students' knowledge of basic theories "about" entrepreneurship (Lindberg et al., 2017a) and central theories and research related to creativity and OI (e.g., Muñoz et al., 2020; Nab et al., 2013).

3.3.4.3. Spiritual content

The spiritual content in the EE programs is meant to help individuals know *why* they should be an entrepreneur and act entrepreneurially and *when* is the right time for them to go ahead with an entrepreneurial project, considering their knowledge and resources. Some scholars also referred to including spiritual content in their EE programs by inviting entrepreneurs as guest speakers to influence their students' entrepreneurial attitudes and intentions (Karimi et al., 2016b) and asking external entrepreneurs to give students feedback to help them establish the best time to develop their projects further (Lindberg et al., 2017b).

3.3.5. The Pedagogical Approaches of Programs Aimed to Foster Students' OI Capability

The content analysis of the studies revealed that scholars employed several *teaching approaches* and *learning activities* in line with targeted learning objectives to improve students' capability to identify opportunities (see Table 3-7).

Table 3-7. Outline of findings related to the pedagogical approach of EE programs aimed to foster OI capability

Category		Sub-category	Citation	Percentage
Teaching approaches	Teaching for	Workshops	Carrier (2008); Cohen et al. (2020); Costa et al. (2018); DeTienne and Chandler (2004); Karimi et al. (2016a); Lindberg et al. (2017a, 2017b); Muñoz et al. (2011, 2020); Nab et al. (2013); Promsiri et al. (2018)	52.4 %
		Role-playing	Arentz et al. (2013); Cohen et al. (2020); Costa et al. (2018); Karimi et al. (2016b); Khalid and Sekiguchi (2018); Prandelli et al. (2016); Shepherd and DeTienne (2005)	33.3 %
	Teaching about	Team working	Hytti et al. (2010); Musteen et al. (2018)	9.5 %
		Lecturing	Karimi et al., (2016a, 2016b); Lindberg et al. (2017a, 2017b); Muñoz et al. (2011, 2020); Nab et al. (2013); Ramsgaard and Østergaard (2018)	38.1 %
		Writing business plan	Karimi et al. (2016a, 2016b); Lindberg et al. (2017a, 2017b); Musteen et al. (2018); Nab et al. (2013)	23.8 %
		Guest speaker	Karimi et al. (2016b); Nab et al. (2013); Costa et al. (2018)	14.3 %
	Teaching through	Mentoring	Hytti et al. (2010); Muñoz et al. (2011, 2020); Lindberg et al. (2017a, 2017b)	23.8 %
		Internships	Kubberød and Pettersen (2018); Ramsgaard and Østergaard (2018)	9.5 %
Learning activities	-	Self-reflection	Costa et al. (2018); Heinonen et al. (2011); Lindberg et al. (2017a, 2017b); Muñoz et al. (2011, 2020); Nab et al. (2013); Ramsgaard and Østergaard (2018)	38.1 %
		Peer-evaluation	Cohen et al. (2020); Costa et al. (2018); DeTienne and Chandler (2004); Musteen et al. (2018); Nab et al. (2013)	23.8 %
		Securing ideas	DeTienne and Chandler (2004); Fiet and Patel (2008); Karimi et al. (2016a); Promsiri et al. (2018)	19 %
		Elevator pitch	Cohen et al. (2020); DeTienne and Chandler (2004); Karimi et al. (2016a); Muñoz et al. (2011)	19

3.3.5.1. Teaching methods

The most used teaching method in the reviewed articles was teaching "*for*" entrepreneurship, which mainly focused on providing students with practical skills (e.g., teamwork, problem identification, idea generation, and idea evaluation) and knowledge (e.g., specific human capital) required to identify entrepreneurial opportunities. Scholars offered workshops that provided exercises such as the "Marshmallow Challenge" to help students practice teamwork (Lindberg et al., 2017a) and "the 5Ws plus H" and the "Bugs Report" to improve their problem identification skills (Karimi et al., 2016a). Regarding the latter, some offered a workshop to help students find problems by reading newspapers and searching on the internet (Lindberg et al.,

2017a) or discussing the characteristics of so-called "migraine headache" problems in contrast with problems addressing a matter of inconvenience or a "nice-to-have" item (Cohen et al., 2020). Many scholars offered several creativity workshops to develop students' idea generation skills using hands-on exercises such as brainstorming (DeTienne & Chandler, 2004; Lindberg et al., 2017b), brainwriting (DeTienne & Chandler, 2004), nominal group technique and mind mapping (Carrier, 2008), creative problem-solving (Muñoz et al., 2011, 2020), SCAMPER and slice and dice techniques (Nab et al., 2013). Promsiri et al. (2018) also asked the students to follow a design process wherein they could practice creativity and critical thinking to create viable ideas. Some offered other workshops to students that included learning experiences through which they could develop mental prototypes that were essential for evaluating a business idea's viability (Costa et al., 2018) and selecting quality ideas (Cohen et al., 2020; Nab et al., 2013).

Role-playing based on an entrepreneurial scenario and teamwork were other kinds of teaching "for" approaches used. Role-playing was primarily used to improve student's specific human capital (Arentz et al., 2013; Shepherd & DeTienne, 2005), facilitate user perspective-taking (Khalid & Sekiguchi, 2018; Prandelli et al., 2016), or increase students' awareness of the importance of OI in the entrepreneurship process (Cohen et al., 2020; Costa et al., 2018). According to Costa et al. (2016), the nature of business opportunities discussed in the scenarios determines the specific features of opportunities that are important for individuals. Based on their findings, students focused more on the elements related to customer needs and satisfaction in the scenarios that discussed an opportunity to create a new venture. In contrast, in the scenarios about business reformulation opportunities, the risk element was more important to students. The main purposes of encouraging students to work in teams were to improve students' cross-cultural competencies and knowledge of the market (Musteen et al., 2018) and enhance the effect of intrinsic motivation on their perceived OI capability (Hytti et al., 2010).

The second common teaching method used concerned educating students "*about*" theoretical aspects of entrepreneurship and the OI process and increasing their awareness of entrepreneurship as a potential career choice. Lecturing was the most common teaching "about" method used to transfer basic theories to students about how to prepare a business model (e.g., Karimi et al., 2016b), central theories and research related to creativity and OI (e.g., Muñoz et al., 2020; Nab et al., 2013), and idea evaluation rubrics (e.g., Costa et al., 2018). Some scholars used a non-traditional lecture format to teach students about entrepreneurship theories by asking students to become actively involved in a problem-solving dialogue to clarify the differences

between existing entrepreneurship theories in their pair-wise discussions (Lindberg et al., 2017a, 2017b).

Developing a business plan for presenting identified opportunities to external experts (Lindberg et al., 2017a) and participating in business plan competitions (e.g., Nab et al., 2013) were frequently used teaching methods for helping students learn about the key steps to identify, describe, and analyse a business opportunity. Lindberg et al. (2017b), however, believed that "formal" elements of business plans could impede the participants' creative thinking, promoting idea convergence rather than thinking outside the box. They proposed using non-formal business plans instead of formal ones to support the OI process. Carrier (2008) contended that despite the benefits of developing business plans, this initiative is generally used too early in the teaching process, while students still have vague or poorly defined ideas. Carrier suggested exercises for clarifying students' initial business ideas in an exploration phase before preparing a business plan.

Finally, in some EE programs, scholars invited expert entrepreneurs as guest speakers to their classes (Karimi et al., 2016b; Nab et al., 2013) or showed students videos of well-known entrepreneurs (Costa et al., 2018) to increase their knowledge about the characteristics of potential opportunities (Nab et al., 2013), the key entrepreneurial competencies (Costa et al., 2018) and to inspire them to think about entrepreneurship as a future career (Karimi et al., 2016b).

Allowing students to carry out projects in which they deal with real businesspeople and have real-life entrepreneurial experiences, also known as teaching "*through*" entrepreneurship, was another teaching method used in the reviewed articles. Some invited experienced entrepreneurs (Lindberg et al., 2017b) or business advisors (Hytti et al., 2010) to their courses as a mentor to give feedback on the students' business ideas from a practical perspective (Lindberg et al., 2017b; Muñoz et al., 2011), supported them in developing a product prototype (Lindberg et al., 2017a), helped them to acquire skills such as problem-solving (Muñoz et al., 2011). In some studies, students engaged in a real entrepreneurial process in the organization hosting their internships (e.g., Kubberød & Pettersen, 2018).

3.3.5.2. Learning activities

The study's findings also highlighted the importance of specific learning activities to facilitate OI capability development. Many scholars referred to students' self-reflection as an essential element of EE programs that foster entrepreneurial OI. Ramsgaard and Østergaard (2018) highlighted the critical role of students' continuous reflection on their learning in developing a professional identity. This identity further contributes

to their ability to identify valuable opportunities for the organization hosting the internship. Nab et al. (2013) proposed that students need to conceptualize their OI experiences and use self-reflection to build their own criteria to better identify potential opportunities. They pointed out the importance of understanding the concepts behind heuristics when using idea generation techniques, which can be achieved by reflection and discussion following experiences. Costa et al. (2018) highlighted the importance of students' abstract conceptualization and reflective observation while engaging in real-life experiments to develop their "entrepreneurial creativity". They proposed that students' self-efficacy would increase in an EE program that includes self-reflection. Muñoz et al. (2020) required students to complete a reflective report at the end of the program to assimilate their experiences better.

Peer evaluation was another common learning activity used in the reviewed articles, mostly in the idea evaluation phase (e.g., Costa et al., 2018; Nab et al., 2013). According to Costa et al. (2018), through peer evaluation, students would re-create entrepreneurs' mental frameworks and develop their cognitive abilities to assess the quality of ideas. DeTienne and Chandler (2004) posited that activities as simple as keeping a written opportunity log might significantly enhance students' ability to secure ideas. They argued that learning activities such as the elevator pitch, wherein students should present their ideas to their peers to get feedback, allow students to experience "low-cost failure," which ultimately contributes to their learning and provides a basis for creativity.

3.4. Discussion and Implications for Practice

This review used Fayolle and Gailly's (2008) generic teaching model framework to synthesize the OI research of the last 22 years and combine findings into a single, evidence-informed framework (see Figure 3-2). The framework is designed as a process model, integrating the different building blocks from the generic teaching model framework (Fayolle & Gailly, 2008). The framework includes essential and interrelated dimensions that educators could consider when designing comprehensive, constructively aligned programs aimed at fostering university students' OI capability.

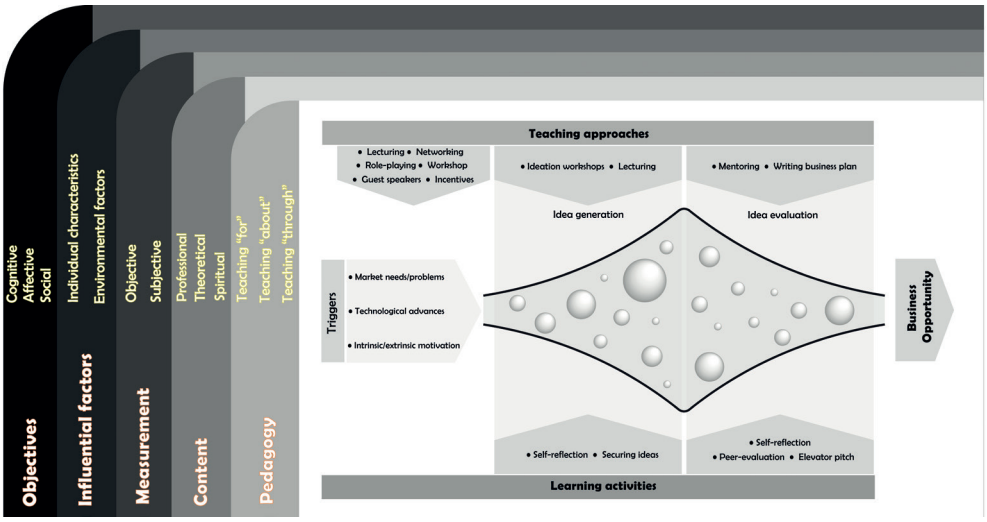


Figure 3-2. The proposed framework for developing EE programs aimed at fostering OI capability

Based on the proposed framework, we suggest that an effective learning environment for fostering OI capability should be organized around three distinct but non-exclusive stages: *triggering, idea generation,* and *idea evaluation*. Each stage should be supported by specific teaching and learning activities primarily driven by the targeted (specific) learning objectives, influenced by various individual characteristics and environmental factors, and nourished by the course content. The framework also shows the importance of aligning measurement approaches with learning objectives and teaching methods.

Next, each stage is explained in more detail, providing insights into how the results of the current review study in relation to the different dimensions can be integrated and used to design constructively aligned EE programs that foster the development of students' OI capability.

3.4.1. Triggering Stage

The role of triggers of idea generation has spurred attention from creativity scholars (Reiter-Palmon & Murugavel, 2018) and some entrepreneurship researchers (e.g., Baron, 2006). This might be because any creative activity necessitates an initial spark or catalyst that not only inspires novel thinking but also propels the process of ideation forward. Such triggers are essential in overcoming the inertia of conventional thought patterns, thereby enabling the emergence of innovative and original ideas that are at the heart of both creative and entrepreneurial endeavors. Based on the current review's findings, there are three distinct strategies to trigger business idea generation among students.

The *first* strategy involves enriching students' knowledge about existing needs and problems in a market, i.e., their specific human capital. This strategy aligns well with the Kirznerian perspective on business opportunities, which posits that opportunity discovery merely requires differential access to existing information (Kirzner, 1997). Based on this perspective, those with a rich knowledge of markets are more interested in identifying business opportunities (Arentz et al., 2013) and are able to generate more business ideas (Canavati et al., 2021) by better connecting the dots (Baron, 2006) and drawing meaningful parallels between problems in the market and the capabilities and resources available to address these problems (Grégoire et al., 2010).

The *second* triggering strategy used is to enhance students' knowledge of technological changes and provide them with exercises to explore changes occurring due to these new technologies. This strategy aligns with a Schumpeterian perspective (Bulut et al., 2013; Vogel, 2017), suggesting that innovation stems from new knowledge outside the market (Buenstorf, 2007). As changes in technology, political forces, regulation, macro-economic factors, and social trends occur they trigger new ideas in the form of "external enablers" (Davidsson et al., 2020). In this view, therefore, the entrepreneurial process does not begin with pre-existing goals; instead, the focus is on what individuals can control and apply (i.e., the resources or means at their disposal) to produce positive or negative (and thus uncertain) outcomes (Ryman & Roach, 2022).

The *third* triggering strategy was stimulating students' "desire" to start their own businesses. According to Vogel (2017), entrepreneurial activity can be initiated if the individual views entrepreneurship as desirable. The desire to act entrepreneurially can result from individuals' intrinsic (e.g., enjoyment, entrepreneurial passion, and the desire for autonomy) and/or extrinsic motivations (e.g., monetary payoff and recognition) (Antonioli et al., 2016; Degeorge & Fayolle, 2011). In the same vein, the current study's findings indicated that increasing students' intrinsic motivation through stimulating their empathy and inviting guest speakers to give an inspirational talk in their classes and extrinsic motivation by providing students with financial rewards can affect a desire to act entrepreneurially and increase engagement with OI.

3.4.2. Idea Generation Stage

The idea generation stage was a distinct part of programs aimed at fostering university students' OI capability. According to creativity scholars, idea generation requires retrieving and combining various aspects of existing knowledge into new ideas using divergent thinking skills (Peterson & Pattie, 2022; Puccio et al., 2020). Although having rich knowledge of the context is essential for triggering idea generation, the ability to think divergently is crucial. Similarly, entrepreneurship scholars acknowledged the

importance of creative thinking skills and the ability to think outside the box in generating business ideas and identifying opportunities (e.g., Ardichvili et al., 2003; Carrier, 2008; Gielnik et al., 2012). Scholars, therefore, suggest facilitating idea generation sessions by providing individuals with methods that stimulate creativity and promote idea generation (Ritter & Mostert, 2018). Similarly, scholars in the reviewed articles strived to develop students' creative thinking skills at this stage to enhance their idea generation outcomes and enable them to generate as many ideas as possible. Different teaching approaches are employed, from lecturing about central theories and research related to creativity to hands-on workshops to enhance students' creative thinking skills and/or teach them how to generate ideas.

Various learning activities are used to support students' idea generation, such as self-reflection and securing ideas. Corbett (2005) argued that students' self-reflection while engaging in real-world experiments would facilitate integrating new information into their existing cognitive frameworks by triggering assimilative learning. Similarly, scholars in the reviewed articles posited that students should complete reflective reports designed to help consolidate their ideation experience (e.g., Heinonen et al., 2011; Muñoz et al., 2020). Securing ideas (e.g., having a written idea log) is viewed to help hold onto ideas generated and is considered a typical skill for successful entrepreneurs (McGrath & MacMillan, 2000), also playing a role in boosting creativity (Epstein, 1996).

3.4.3. Idea Evaluation Stage

The findings suggest that idea evaluation is the final stage of OI. This aligns well with the cognitive psychology perspective on the OI process. Advocates of this perspective argue that OI begins with forming preliminary and imaginary business ideas (Vogel, 2017). These ideas are only vaguely formed (Pryor et al., 2016) as they are under the influence of various "ceaselessly changing factors" (Eckhardt & Shane, 2003, p.341), such as individuals' prior knowledge and experiences (Baron, 2006). To decide on these vague ideas, individuals should engage in idea evaluation (Canavati et al., 2021) and select ideas with a higher chance of being a successful product or business after exploitation (Mendoza-Abarca & Parry, 2017) using their convergent thinking skills (Cropley, 2006). To improve OI capability, therefore, educators should not only provide support for individuals' divergent thinking skills but also support their convergent thinking (McMullen & Kier, 2017).

In the reviewed articles, some educators encouraged students to choose their highest-quality idea after idea generation using intuition, while others provided instructional support to facilitate idea evaluation, such as providing a rubric for idea evaluation, or teaching students how to develop a business model to help them be aware of the

essential attributes of a business opportunity. Some educators also invited experienced entrepreneurs to give feedback on students' ideas. According to Lindberg et al. (2017b), expert feedback is essential to initiate a "structural alignment" process (see Grégoire et al., 2010), as the students have to make sense of the feedback and compare this new information with what they already possess.

3.4.4. Toward Designing Constructively-aligned EE Programs

The synthesis of empirical findings shows that effectively developing OI capability requires supporting a range of cognitive processes occurring in three stages: triggering, idea generation, and idea evaluation. This insight has at least three significant implications for the design of effective EE programs aimed at enhancing university students' OI capabilities, outlined below.

First, and foremost, viewing OI as a multi-stage process underscores the need for incorporating "hybrid teaching models" (see Béchard and Grégoire, 2005) for the comprehensive development of OI capability. In such an approach, the three stages are supported by targeting multiple learning objectives that align with cognitive processes in each stage. This underscores the importance of utilizing diverse measurement approaches (objective and/or subjective), curricular content (professional, theoretical, and/or spiritual), and teaching methods (teaching "for," "about," and/or "through") corresponding to each objective. It is important to note that the choice and combination of teaching methods should be tailored to the unique characteristics and needs of the students. For instance, as demonstrated by Schultz (2021), the combination of teaching "about" and "for" (also known as the supply-demand model) is particularly effective for students with relatively low entrepreneurial intentions. In contrast, for those with higher motivation and entrepreneurial intentions, focusing on teaching "through" (also known as the competence model) appears to be more impactful.

Second, viewing OI as a multi-stage process also highlights the importance of distinguishing between business *ideas* and *opportunities*. The progression through these three stages underscores OI's iterative nature, where initial imaginary ideas, triggered by external or internal factors, gradually develop and transform into viable business opportunities. This aligns with Vogel's (2017) perspective, which posits that business opportunities should not be viewed as isolated insights, but rather as emerging from the continuous shaping and refining of business ideas. Similarly, Dimov (2007) describes opportunity development as a process in which opportunities "emerge in an iterative process of shaping and development" as initial business ideas are "elaborated, refined, changed, or even discarded" (p. 714). By understanding this difference between ideas and opportunities, educators can more effectively guide students in recognizing how certain ideas transform into viable opportunities, while others do not. This approach

not only fosters a deeper comprehension of the idea-to-opportunity transition but also cultivates a more nuanced perspective on the inherent value-generating potential of business concepts. It encourages students to critically evaluate and refine their ideas, understanding that not all ideas automatically translate into profitable opportunities, thereby instilling a mindset geared towards innovation and practical implementation.

Third, the new insights into key stages for business OI emphasize the necessity of dual-level alignment – both *inter-stage* and *intra-stage* – when developing EE programs aimed at fostering OI capability. The inter-stage alignment involves meticulously coordinating educational components within each stage—learning objectives, individual factors, measurement approaches, curriculum content, and teaching methods—to ensure they collectively contribute to achieving the goals of each stage. More significantly, it is essential to recognize these stages as interrelated components of a cohesive process rather than isolated steps. With intra-stage alignment, educators should ensure that the design of each stage not only meets its specific goal but also seamlessly integrates with the preceding and following stages. For instance, the learning objectives and teaching methods in the triggering stage should lay a foundational understanding and curiosity that smoothly transitions into the idea generation stage. Similarly, the idea evaluation stage should build upon the outcomes of idea generation, guiding students to critically assess and refine their own ideas. Moreover, due to the iterative nature of OI, the design of education should permit students to move back and forth between different stages. This approach would help students shift from a mindset of preventing failure to one that appreciates it as a valuable source of feedback and a learning opportunity during entrepreneurial activities (Bolinger & Brown, 2015).

The current study's findings can serve as a starting point and a source of inspiration for establishing such constructive alignments in entrepreneurship courses aimed at enhancing OI capabilities. For instance, in the triggering stage, some programs may focus on increasing students' awareness of current market needs and problems, in alignment with the Kirznerian perspective on opportunities. In this context, educators might employ methods that encourage active exploration and experimentation (Norton & Hale, 2011), such as engaging students in systematically searching their surroundings to identify unmet problems (Lindberg et al., 2017a). Alternatively, some could encourage students to adopt others' perspectives to better understand their needs through role-playing (Khalid & Sekiguchi, 2018), or provide even richer learning experiences by facilitating interactions with real stakeholders, helping students gain deeper insights into their needs and challenges (Kubberød & Pettersen, 2018). Regarding the latter, scholars have shown that such an approach more effectively facilitates perspective-taking and understanding of others, greatly inspiring students to pursue entrepreneurship as a means to create high social impacts (Mooney

& Cockburn, 2023). In either approach, differences in students' ability to identify problems could, however, affect the outcomes. Thus, it is crucial that the chosen curriculum content and teaching methods be carefully aligned with this objective to effectively address such differences. For example, students could be provided with professional content in the form of "know-how" workshops like "the 5Ws plus H" and "Bugs Report" to enhance their problem-identification skills. This could also include training to distinguish between significant problems, akin to "migraine headaches", and less critical issues, such as minor inconveniences or "nice-to-have" items. These distinguishing features can then serve as criteria for measuring the outcome of the triggering stage. Inspired by the findings of the current study, similar arrangements and considerations could be discerned for other stages.

3.5. Limitations and Avenues for Future Research

Despite its valuable contribution to the EE field, using a well-established theoretical framework developed by Fayolle and Gailly (2008) and employing a thorough systematic data collection process (namely PRISMA), this study has several limitations that pave the way for future research. *First*, the proposed framework was primarily based on studies carried out in higher education settings, with a primary focus on exploring/enhancing students' OI capability. This narrow focus raises questions about the applicability of the review study's findings to different groups (such as academics, entrepreneurs, etc.) and contexts outside the university environment. While it is believed that, with certain considerations (particularly regarding influential factors), the findings of the review study may still be applicable to other groups and contexts, conducting a future review study with a broader scope can offer a more comprehensive understanding of how EE courses should be designed to more effectively support the development of OI capability.

Second, the proposed framework was developed solely based on the synthesis of available empirical findings. While it offers a comprehensive overview of findings related to each essential educational component for designing effective EE programs, it falls short of fully demonstrating the interactive nature of these components and their interrelationships. This limitation was primarily due to the scarcity of empirical studies that examined such relationships, determining how, under which conditions, and which teaching approach is more appropriate to facilitate students' learning toward achieving an objective associated with either of the identified stages. As a result, future empirical studies are needed to place specific emphasis on each stage and determine how various educational components should be aligned to assist students in achieving the intended outcome in that particular stage. Such empirical findings could, for instance, explore the type of curricular content (e.g., professional, theoretical,

spiritual) that best supports increasing students' intrinsic motivation - a common objective in the triggering stage - when employing a particular teaching approach. Or studies could examine which teaching approaches best suit students' needs and characteristics. The results of such empirical studies can significantly enhance the comprehensibility of the proposed framework.

Third, and from a broader perspective, a similar issue arises concerning the interrelationships among the various identified stages. This also stems from the absence of empirical studies in the literature that illustrate how the three stages should be strategically positioned to effectively nurture OI capability. For instance, there is a need to understand how setting learning objectives in one stage impacts the selection of objectives in other stages, as well as how performance in each stage influences an individual's performance in subsequent stages. Moreover, while numerous individual characteristics and environmental factors have been identified as factors influencing students' OI outcomes in general, the mechanisms through which they affect the OI process remain unclear. This could be clarified by investigating the influence of these factors on the outcomes of each stage. For example, motivation and attitudes toward entrepreneurship might influence OI performance due to their effect on the outcomes of the triggering stage, whereas creativity and problem-solving skills might exert their influence on OI capability through their impact on idea-generation outcomes. Future empirical studies in these areas would not only help us understand the nature of these relationships, the optimal combination of conditions, the influence of one factor on another, and the stability of such influences but would also further our understanding of how EE programs can be designed more effectively to develop students' OI capability.

In addition to the above research avenues, there are important calls for studies to improve our understanding of each stage identified as outlined in Table 3-8.

Table 3-8. Avenues for future research on fostering university students' OI capability

OI as a multi-stage process
Triggering stage
1. Most studies reviewed tend to investigate the effectiveness of one strategy for triggering idea generation without considering the alternatives. There is thus a need for methodologically rigorous studies comparing the effectiveness of different strategies to their alternatives while taking into consideration the impact of context- and/or person-specific factors (Pittaway & Cope, 2007; Nabi et al., 2017). 2. There is an ongoing debate among scholars about whether a desire to act entrepreneurially is driven by intrinsic, extrinsic, or both types of motivations (see Murnieks et al., 2020). Although some studies explored the effect of stimulating intrinsic (e.g., by stimulating perspective-taking) or extrinsic motivations (e.g., by offering financial rewards) on students' idea generation outcomes, there is a need for studies to explore both forms of motivation simultaneously while controlling for the impact of influential individual and environmental factors. 3. Comparing the influence of various forms of triggers, derived from Kirznerian and Schumpeterian views, on the nature of ideas generated (see De Jong & Marsili, 2015). Given the effect of students' majors on their tendency toward an incremental development of existing products or radically new market-oriented innovations (see Berglund & Wennberg, 2006), an empirical study can explore the influence of students' majors on the effectiveness of triggering idea generation from different perspectives.
Idea generation stage
1. According to the dual pathway to creativity model, "creative performance is a function of cognitive flexibility, cognitive persistence, or some combination of the two" (Nijstad et al., 2010, p. 63). Therefore, future studies should explore creativity training methods that can foster students' cognitive flexibility, preferences, or even both during the idea generation stage (see Peterson & Pattie, 2022). 2. Research findings indicated that workshops that support structured idea generation techniques, such as SCAMPER, TRIZ, and/or C-Sketch, help students generate a greater number of quality ideas (e.g., Shah et al., 2001; Yeo & Quek, 2014) mainly by overcoming "the fixation effect" (Moreno et al., 2016). The current study's findings also revealed a similar effect, i.e., the Einstellung effect, that could impede students' divergent thinking, resulting in the generation of less innovative business ideas. A future study could investigate whether the above techniques help overcome this effect. 3. In most studies reviewed students generated ideas in teams. Creativity scholars have, however, called for a hybrid approach combining individual and group brainstorming sessions (Ritter & Mostert, 2018). Future research could explore the role of different combinations of individual and group settings in identifying business opportunities. 4. Within the reviewed articles there is an emphasis on cognitive learning objectives but less attention is focused on affective objectives. Positive and/or negative affects (i.e., feelings and moods) can, however, enhance individual creativity (Baron, 2008; George & Zhou, 2007) and moderate the impact of an individual's alertness on discovering opportunities (Baron, 2008). Future studies could thus explore more deeply cognitive versus affective learning in the context of idea generation and how it may impact ideation outcomes.
Idea evaluation stage
1. Evaluations of business ideas in the entrepreneurial process can be carried out using an intuitive and/or rational (criteria-based) approach and there is much debate about the benefits of each method within the context of EE (Eling et al., 2015; Magnusson et al., 2014; Pryor et al., 2016). A future study could compare the influence of various approaches and their combinations (e.g., first intuitive and then rational evaluation, and vice versa) on the quality of students' evaluation decisions. 2. Using the criteria-based evaluation approach requires engaging in a deliberate assessment process guided by specific and well-defined evaluation criteria (Magnusson et al., 2014). Several studies have been done to identify the essential criteria that should be used for evaluating business opportunities. There is no consensus among scholars, however, about the essential criteria for making early-stage evaluation decisions in the OI process, especially for use by novices. As such, a future study is needed to identify the essential criteria for evaluating business ideas.

Lastly, the findings indicated that outcomes were mostly measured shortly after participating in a course. The impact on such short-term subjective and/or objective outcomes, however, provides a rather limited view of the effectiveness of EE programs. No study linked students' OI capability improvement to future behaviours. Consequently, it is not possible to tell if fostering students' OI capability leads to a higher rate of employability, increases the number of graduate start-ups and entrepreneurial businesses, and/or improves their ability to cope with uncertainties. Future research measuring the sustainability of training effects over time is needed and work that focuses on higher-level impacts, such as students' societal contribution (Nabi et al., 2017) and firm founding (George et al., 2016) would be valuable. Here, scholars can also consider using self-perceived questionnaires for measuring other key indicators of OI capability, such as optimism and uncertainty/ambiguity tolerance (Nabi et al., 2017), especially if they view OI as associated with the entrepreneurial mindset, which aligns with the broader function of EE programs at higher education institutions (Farrokhnia et al., 2022).

3.6. Concluding Remark

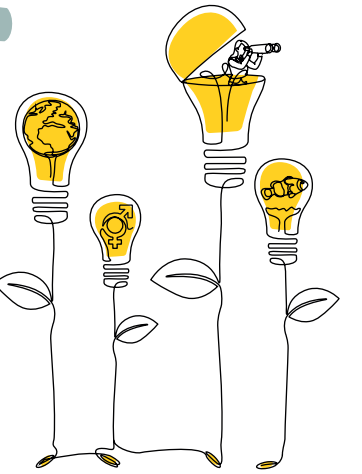
In recent years, there has been an increasing scholarly interest in exploring and fostering higher education students' entrepreneurial OI capability. Guided by a theory-driven teaching model framework, we conducted a systematic review of high-quality empirical studies to thematically organize their findings, proposing an integrative process model as a comprehensive framework. This proposed framework underscores the complex nature of OI capability, necessitating the development of constructively aligned EE programs that encompass three distinct yet interconnected stages: triggering, idea generation, and idea evaluation. The framework is not necessarily prescriptive in nature but allows educators to reflect on their EE programs and design or change them in such a way, that it considers constructive alignment and fits their learning goals. Beyond its practical implications, this study identifies two main ways of moving forward for future researchers. Firstly, the study provides an up-to-date and empirically rooted call for research on higher education students' OI capability. Secondly, by applying a generic teaching model framework, the study offers several research gaps and intriguing and under-emphasized areas for development.

In Studies 2 and 3, the current research projects aimed to provide a comprehensive understanding of essential components and their interrelationships in constructively aligned EE programs designed to foster OI capability. Moving forward to Study 4, which is described in the next chapter, the focus of the current project becomes more specific, targeting one of the key educational components of such EE programs, namely, the "How?" components. In particular, it seeks to identify support mechanisms

that could enhance the originality of ideas generated during the divergent stage of brainstorming sessions, a prevalent teaching approach in EE programs intended to stimulate students' creativity and consequently foster their OI capability. By addressing this, the study aims to fill some of the research gaps highlighted in Table 3-8, thereby contributing to the discourse on optimizing teaching approaches within EE programs.

CHAPTER

4



Improving the Outcomes of Brainstorming Sessions: Exploring the Effect of the SCAMPER Prompts and Sharing Individually Generated Ideas*

* This chapter has resulted in two papers submitted for publication:

Farrokhnia, M., Biemans, H., Baggen, Y., Noroozi, O. (2023). Brainstorming in Hybrid Settings: Exploring the Effect of Group Brainstorming on Individual Performance Outside the Group. (under review)

Farrokhnia, M., Biemans, H., Baggen, Y., Noroozi, O. (2023). Elevating Quality in Computer-mediated Hybrid Brainstorming Sessions: The Effect the SCAMPER Prompts and Sharing Individually Generated Ideas. (under review)

Abstract

Prior research has shown that brainstorming in hybrid (individual and group) settings is superior to individual or group settings in terms of the number of generated ideas. However, findings indicate no significant differences in the quality of ideas generated in various hybrid settings compared to those in individual or group settings. This discrepancy might arise because, unlike quantity, enhancing the quality of outcomes requires the implementation of support mechanisms beyond standard brainstorming rules. Guided by the dual pathway to creativity model, this quasi-experimental study examines the impact of two computer-mediated supports: the SCAMPER prompts and the sharing of individually generated ideas, on the originality of ideas produced during different phases of a computer-mediated hybrid brainstorming session with an individual-group-individual sequence. Participants included 94 students, comprising both undergraduate (BSc) and postgraduate (MSc) cohorts, who participated in two university courses. The students were randomly assigned to three conditions (Control, Experimental 1, and Experimental 2) in which they were all tasked with generating business ideas to address sustainability issues. Results indicate that the SCAMPER prompts are effective in supporting the individual brainstorming phase, assisting participants in generating ideas with higher originality. On the other hand, sharing ideas generated individually during the group phase significantly impacts the originality of ideas generated collaboratively and also those generated during the subsequent individual phase.

4.1. Introduction

Brainstorming is a widely used technique for stimulating group creativity in various fields (Al-Samarraie & Hurmuzan, 2018), particularly in those that involve solving complex problems (Göçmen & Coşkun, 2019), such as engineering (Hsu et al., 2018), management (Doran & Ryan, 2017), and entrepreneurship (Zane & Zimbroff, 2021). This technique typically consists of two stages aligned with the divergent-convergent continuum (Al-Samarraie & Hurmuzan, 2018). The primary goal of the divergent (or idea generation) stage is to generate as many ideas as possible without immediate judgment (Ritter & Mostert, 2018). This is based on the premise that generating a larger quantity (i.e., number) of ideas increases the likelihood of producing higher-quality ones (Danes et al., 2020). As such, much research in this area has focused on developing methods to enhance idea quantity during the divergence stage of brainstorming sessions (Al-Samarraie & Hurmuzan, 2018; Maaravi et al., 2021). Among these methods, the use of hybrid (individual and group) settings for brainstorming has emerged as a prevalent topic of research in recent years (Ahn et al., 2022).

Brainstorming in hybrid settings, commonly known as "Hybrid brainstorming" (Korde & Paulus, 2017), is regarded as one of the most effective techniques for organizing brainstorming sessions (Brown & Paulus, 2002; Paulus et al., 2018). This because such setting would allow both unconstrained ideation in individual brainstorming and the stimulation of additional ideas by exposure to the ideas of others (Korde & Paulus, 2017). In this method, participants are required to alternate between individual and group idea generation throughout the brainstorming session (Brown & Paulus, 2002). This flexibility allows for various sequencing, including individual-to-group (Ritter & Mostert, 2018), group-to-individual (Baruah & Paulus, 2008), and a combination of both in the form of individual-group-individual (IGI) brainstorming (Korde & Paulus, 2017). Overall, empirical findings suggest that brainstorming in hybrid settings, regardless of the sequence of individual and group phases, yields superior outcomes compared to those in either individual or group settings, especially in terms of the total number of ideas generated (Girotra et al., 2010; Korde, 2014; Korde & Paulus, 2017; Leggett et al., 1996; Paulus et al., 2015; Paulus & Yang, 2000).

Nevertheless, while there is a positive impact on the quantity of ideas generated, research findings indicate no significant differences in the quality of ideas generated in various hybrid settings compared to those generated in individual or group settings,

measured by the degree of originality[4] (Korde, 2014; Korde & Paulus, 2017; Paulus et al., 2015). Such findings resonate with studies indicating that increased quantity does not necessarily translate to higher quality (e.g., Baruah & Paulus, 2008; Reinig & Briggs, 2008; Rietzschel, et al., 2014). Improving quality requires additional support that can effectively assist individuals in breaking free from conventional thinking (Rietzschel, 2018) and guide them toward generating higher-quality ideas (Althuizen & Reichel, 2016). The influence of such support on brainstorming outcomes is well elucidated by the dual-pathway to creativity model (DPCM) proposed by Nijstad et al. (2010). The DPCM suggests that there are two distinct but non-exclusive cognitive pathways for generating high-quality ideas: *persistence* and *flexibility*. Activating these pathways requires individuals to be mentally stimulated and engaged (Dreu et al., 2011), for which the provision of certain process constraints (or support) such as rules, task structure, and instructions plays a crucial role (Nijstad et al., 2021).

Guided by the DPCM, this study aims to identify effective support mechanisms to enhance the quality of outcomes in hybrid brainstorming sessions. To achieve this, it builds on prior empirical research aimed at identifying an optimal sequence for structuring these sessions, especially the works of Korde (2014) and Korde & Paulus (2017), and empirically examines the impact of two supports — the SCAMPER prompts and the sharing of individually generated ideas — on the quality of outcomes. Specifically, it assesses their impact on the originality of ideas generated across different phases of a hybrid brainstorming session with the IGI sequence addressing the complex issue of sustainability.

This study contributes to the literature in three significant ways. Firstly, it addresses an ongoing call for research that focuses not only on enhancing the quantity but also the quality of outcomes in brainstorming sessions (Maaravi et al., 2021; Rietzschel, 2018). Secondly, it offers an instructional design model for developing hybrid brainstorming sessions that are effective for generating high-quality ideas. Thirdly, it responds to Nijstad et al.'s (2021) call for empirical studies aimed at identifying support mechanisms that help individuals engage with either pathway when addressing real-life problems (i.e., seeking solutions to sustainability issues). According to Nijstad et al. (2021), most empirical studies exploring the DPCM primarily rely on mundane laboratory tasks. These tasks typically revolve around context-specific, open-ended questions, such as enhancing a university (e.g., Rietzschel et al., 2014) or brainstorming possible

4 The quality of ideas has two dimensions: originality and appropriateness (Nijstad et al., 2010). In studies that focus on the divergent stage of brainstorming, quality is predominantly gauged based on originality, following Guilford (1950). Appropriateness, on the other hand, is considered a criterion to evaluate the quality of ideas that could successfully pass through the convergent stage (Reinig & Briggs, 2013).

uses for a cell phone (e.g., Göçmen & Coşkun, 2019). This narrow focus potentially limits the generalizability of the findings to brainstorming sessions aimed at solving real-life problems (Paulus & Kenworthy, 2019) with a limited solution space (for more details, see Briggs & Reinig, 2010) – for which brainstorming sessions are often used in practice.

Next, we will delve into greater detail on each pathway of the DPCM. The reasons why the proposed supports might elevate the originality of outcomes will be discussed, and guidelines on how they should be implemented in a hybrid brainstorming session to achieve superior results will be outlined. Subsequently, an empirical study will be conducted to examine the impact of these supports in an educational setting, where university students are required to generate business ideas to address sustainability issues during an online hybrid brainstorming session.

4.2. Theoretical Framework

4.2.1. The DPCM: The Persistence Pathway

In research on cognition, brainstorming is considered a repeated search for ideas in associative memory (Stroebe et al., 2010). However, such a search does not always yield promising outcomes as individuals tend to generate ideas that come to mind easily and give up very fast when it becomes harder to generate ideas (Rietzschel et al., 2014). Falling into this so-called "path of least resistance" (Ward, 1994) often results in conventional (rather than original) ideas, as these ideas originate from knowledge that is highly accessible in one's memory (Stroebe et al., 2010). To stimulate more original outcomes, individuals should be encouraged to leave the least resistance path (Rietzschel et al., 2014). Based on the DPCM, one approach to achieve this is to increase individuals' persistence and perseverance when searching in their associative memory. This encourages them to follow what is referred to as the "persistence pathway", which manifests itself as a prolonged cognitive effort to generate a higher number of ideas within a few idea categories — also known as "within-category fluency" (Nijstad et al., 2002). The effectiveness of this approach is because each category contains only a limited number of conventional ideas (De Dreu et al., 2008). Therefore, deep and persistent exploration within each category could elevate the likelihood of generating more original ideas over time (Rietzschel et al., 2007).

Research findings suggest that providing individuals with more time to engage in a brainstorming task can increase the originality of the ideas generated (Baruah & Paulus, 2016), as it allows them to delve deeper into a selected number of idea categories (Stroebe et al., 2010). Additionally, empirical evidence suggests that imposing certain process constraints, such as narrowing the topic, can effectively prompt individuals

to follow the persistence pathway, resulting in more original ideas (e.g., Rietzschel et al., 2007, 2014). This is primarily because unconstrained tasks can be cognitively overwhelming, leading individuals to rely more on the path of least resistance and use heuristics (Rietzschel, 2018). To prevent this, support mechanisms are needed to encourage a deeper, more focused, and systematic exploration within a few idea categories, thereby activating the persistence pathway (Nijstad et al., 2021).

4.2.1.1. Increasing persistence: The SCAMPER prompts

SCAMPER is a well-established idea-generation technique that was first introduced by Eberle in 1972. It stimulates divergent thinking by guiding individuals through a systematic search for solutions using a set of questions (Moreno et al., 2016). To generate new outcomes, this technique encourages: (1) Substituting parts, (2) Combining elements, (3) Adapting to improve, (4) Modifying features, (5) Putting to other uses, (6) Eliminating unnecessary aspects, and (7) Rearranging or reversing components of an existing idea (Eberle, 1972). According to Rahimi and Shute (2021), the SCAMPER technique helps individuals actively generate new ideas, rather than simply waiting for these to form. However, despite empirical evidence supporting the effectiveness of this technique for increasing motivation (Altiparmak & Eryilmaz-Mustu, 2021), stimulating engagement (Rahimi & Shute, 2021), and enhancing creative imagination (Gündoğan, 2019), research findings regarding its impact on brainstorming outcomes are mixed. While some studies have shown that using the SCAMPER technique to solve a (design) problem can yield more original ideas than using brainstorming alone (Moreno et al., 2016; Rahimi & Shute, 2021), there is empirical evidence suggesting that typical brainstorming outperforms the SCAMPER technique in generating creative ideas that are both original and useful (Chulvi et al., 2012, 2013).

A possible explanation for such mixed findings could be the varied ways in which the SCAMPER technique has been implemented across studies. While some studies have applied this technique in isolation (Chulvi et al., 2012, 2013), others have used it following an initial brainstorming session on the same problem (Moreno et al., 2016; Rahimi & Shute, 2021). The latter approach seems to be more effective as the SCAMPER technique requires an initial pool of ideas to effectively stimulate new ones. Furthermore, simply providing individuals with a description of the SCAMPER principles does not necessarily guarantee their proper implementation. This point is evident in Rahimi and Shute's (2021) study, where the technique was embedded in a computer game via a popup menu to better engage students with the SCAMPER principles. Likewise, Yeo and Quek (2014) showed that the condition that utilized built-in prompts to scaffold participants by using the SCAMPER technique in a computer-based environment resulted in more original ideas than the condition where

participants were merely provided with a description note. Yeo and Quek attributed this result to increased attention to detail due to the presence of scaffolding prompts.

Last but not least, the persistence pathway requires systematic thinking, which involves blocking out distracting thoughts from one's working memory and maintaining full attention on the task at hand (Nijstad et al., 2010). Therefore, if the SCAMPER prompts aim to enhance originality through the persistence pathway, it may be more effective when utilized in the individual phase of a hybrid brainstorming session. This is because, in the group phase, there is a higher likelihood of disruptions to the train of thought due to exposure to others' ideas which can diminish the effectiveness of any supporting mechanism provided to activate the persistence pathway (Korde & Paulus, 2017).

Taking the aforementioned considerations into account, this study seeks to answer the following research question:

RQ1: What is the impact of providing SCAMPER prompts during individual brainstorming on the originality of the ideas generated, as opposed to brainstorming without any additional support?

Although theoretically the SCAMPER prompts has the potential to elevate the originality of ideas through the persistence pathway, this still needs to be verified in practice. Therefore, the current study also seeks to answer the following question:

RQ2: To what extent do SCAMPER prompts exert their effect on the originality of the generated ideas through the persistence pathway?

4.2.2. The DPCM: The Flexibility Pathway

From another theoretical perspective, original outcomes can also be achieved through "cognitive flexibility" (for more details, refer to Baas et al., 2013). This flexibility is characterized by a holistic (and not in-depth) processing of information (Förster, 2009) and an exploration of broad cognitive categories (Nijstad & Stroebe, 2006), which may lead to the formation of novel and remote associations in memory (De Dreu et al., 2008). Building on this perspective, Nijstad et al. (2010) proposed another pathway in their DPCM that can result in original ideas, known as "the flexibility pathway". The activation of such a pathway in idea-generation tasks, such as brainstorming, is manifested by the generation of ideas across a large number of idea categories (Nijstad et al., 2021). In their meta-analysis, Nijstad et al. (2010) demonstrated that an increase in exploration breadth, i.e., the number of idea categories, is associated with generating ideas of higher average originality.

However, cognitive flexibility and following the flexibility pathway do not typically occur spontaneously. Generally, individuals have a strong tendency to depend on their readily accessible knowledge, thereby limiting themselves to exploring only a few familiar idea categories (van Hooijdonk et al., 2022). This behaviour can contribute to a significant obstacle to creative idea generation during brainstorming sessions, often referred to as "the fixation effect" (Smith, 1995). From a psychological point of view, it is an inability to break free from ideas that preoccupy the mind and hold attention (Linsey et al., 2010). This may result in the generation of mostly identical ideas, which all fall within limited idea categories (George & Wiley, 2019). As a result, scholars recommend implementing support mechanisms that can assist individuals in overcoming such mental fixation (van Hooijdonk et al., 2022), thereby stimulating them to think outside (rather than inside) the box through increasing flexibility (Peterson & Pattie, 2022).

4.2.2.1. Increasing flexibility: Sharing individually generated ideas

The most important claim about the superiority of brainstorming in a group over an individual setting comes from Osborn (1957), who stated that "the average person can think twice as many ideas when working with a group as when working alone" (p. 229). This claim was based on the assumption that brainstorming in a group provokes cognitive facilitation (Paulus et al., 2001), whereby the ideas of other people trigger novel associations that would not have surfaced during individual brainstorming (Ziegler et al., 2000). This viewpoint is also supported by various theories. For example, in their search for ideas in the associative memory (SIAM) model, Nijstad and Stroebe (2006) argued that the ideas of others serve as external cues which, if attended to, could activate problem-relevant knowledge and new semantic categories in memory.

However, the above assumption has not always been supported by empirical findings. For instance, Diehl and Stroebe (1987, 1991) conducted several experiments where individuals were either exposed to ideas presented by other group members or not. Their results showed no significant differences in productivity between the two groups. In several empirical studies, scholars reported no significant difference in the number of generated ideas (Paulus et al., 2015; Ziegler et al., 2000) and their originality between the group and individual conditions (Ziegler et al., 2000). Surprisingly, Ziegler et al.'s (2000) findings showed that brainstorming in groups resulted in a smaller number of idea categories (i.e., lower flexibility). One possible explanation for such a discrepancy between theory and practice could be that during group brainstorming sessions, individuals may not pay sufficient attention to the ideas shared by other members (Dugosh & Paulus, 2005). In support of this explanation, Dugosh et al. (2000) showed that motivating participants to pay more attention to the ideas shared

by others through the use of memory instructions could help increase the number of unique ideas generated both in face-to-face and computer-supported settings. Moreover, an empirical study by Michinov et al. (2015) using a computer-mediated brainstorming task and an eye-tracking technique revealed that increased attention to a partner's ideas resulted in the generation of higher-quality ideas, as measured by their average originality. Similarly, Pi et al. (2022) showed that individuals who were characterized by high openness to experiment generated more original ideas, but only when they paid sufficient attention to their peers' ideas.

The above findings highlight the importance of implementing support mechanisms that can effectively facilitate idea-sharing processes during group brainstorming – especially mechanisms that help participants notice the ideas of others. To date, many studies have explored the role of various techniques, such as using computer-mediated brainstorming, in facilitating idea-sharing in group brainstorming and their effect on brainstorming outcomes (for an overview, see Maaravi et al., 2021). However, most of these studies have primarily focused on promoting the sharing of ideas generated "*during*" group brainstorming (Maaravi et al., 2021). More specifically, participants were asked to generate new ideas and share them with other members within a relatively short time frame, potentially leading to a limited number of ideas being shared among group members. Considering the significant role that the number of shared ideas plays in enhancing brainstorming outcomes (Paulus et al., 2013), it can be argued that such a setup may not fully harness the potential of idea-sharing in group settings.

To address this issue, and as suggested by Maarvi et al. (2021), a possible solution is to tap into the potential of hybrid settings and improve group brainstorming outcomes by facilitating the sharing of ideas that were individually generated "*before*" group work commenced. A few studies investigated the effectiveness of this solution. However, they did not find significant differences between the experimental and control conditions, both in terms of the total number of ideas generated during the group phase (Paulus et al., 2015) and their originality (Kohn et al., 2011; Paulus et al., 2015). A possible reason for such findings is that group members in the experimental conditions did not have sufficient time to review and expand the shared ideas (Kohn et al., 2011: *15 minutes* and Paulus et al., 2015: *3 minutes*). In addition, participant interactions were somewhat limited, either due to a lack of communication during the idea-sharing process (Paulus et al., 2015) or using a chatbox for such communication (Kohn et al., 2011). These limitations could potentially hinder the effectiveness of idea sharing when it comes to improving group brainstorming outcomes. To yield high-quality ideas from group brainstorming, participants need to be able to carefully process the shared ideas (Paulus et al., 2013). This involves investing time and effort

to fully understand the shared ideas and build upon them through active discussions (Maaravi et al., 2021).

This study aims to address the aforementioned shortcomings, firstly by allocating a carefully selected time frame for processing the shared ideas during the group phase in a pilot study. Secondly, instead of using a chatbox to facilitate written communication, the current study employed guided verbal communication to encourage more active discussion among participants, assisting them in better understanding the shared ideas and building upon them. This setup also makes the findings more applicable to brainstorming sessions in real-life settings such as university courses or organizations, as most brainstorming sessions in these settings occur through verbal communication. In light of the above considerations, this study seeks to answer the following research questions:

RQ3: What is the impact of sharing individually generated ideas with group members during brainstorming on the originality of the ideas generated, compared to the condition where sharing individually generated ideas is not facilitated?

RQ4: To what extent does sharing individually generated ideas during group brainstorming exert its effect on the originality of generated ideas through the flexibility pathway?

Additionally, considering that cognitive stimulation resulting from idea-sharing during the group phase can potentially carry over to the subsequent individual phase in hybrid settings (see Korde & Paulus, 2017), the current study seeks to answer the following questions as well:

RQ5: What is the impact of sharing individually generated ideas with group members during brainstorming on the originality of the ideas generated in the subsequent individual phase, compared to the condition where sharing individually generated ideas is not facilitated?

RQ6: To what extent does sharing individually generated ideas during group brainstorming exert its influence on the originality of ideas in the subsequent individual brainstorming phase through the flexibility pathway?

4.3. Method

4.3.1. Participants

In the present research study, participants were engaged in two stages: a pilot study and the main study. For the pilot study, 30 undergraduate (BSc) students were recruited through posting on the university's Intranet platform. These students voluntarily participated in the study, aiming to provide preliminary data and insights to fine-tune the designed platform and research methodology. In the main study, 94 students—comprising both undergraduate (BSc) and postgraduate (MSc) cohorts—were involved. These students were participating in two university courses specifically designed to inform them about future career possibilities and improve their entrepreneurial capabilities. Table 4-1 shows the demographic information of the main study participants.

Table 4-1. The Participants' demographic information

		Frequency	**Percentage**
Gender	Female	41	43.7 %
	Male	52	55.3 %
Educational level	Bachelor	12	12.8 %
	Master	81	86.2 %
		Mean	**Std. Error**
Age	All	24.1	2.7
	Females	24.2	3.2
	Males	24.0	2.2

4.3.2. Material

4.3.2.1. The Ideation hub

The Ideation Hub (https://ideation-hub.nl) is an online brainstorming platform that was specifically designed for this study with the intention to guide participants through a structured brainstorming process and implement the proposed supports effectively. The platform could offer clear instructions on the tasks to be completed during the individual and group phases (see Appendix 4-1), enforce time limits for each phase, and provide the necessary rules before and during each phase. Additionally, it could provide tailored support for each condition. For instance, participants in Experimental 1 and Experimental 2 conditions had the option to view their previously generated ideas and were encouraged to employ the SCAMPER principles using built-in prompts (see Figure 4-1). On the other hand, students in the Control condition did not have access to such an option.

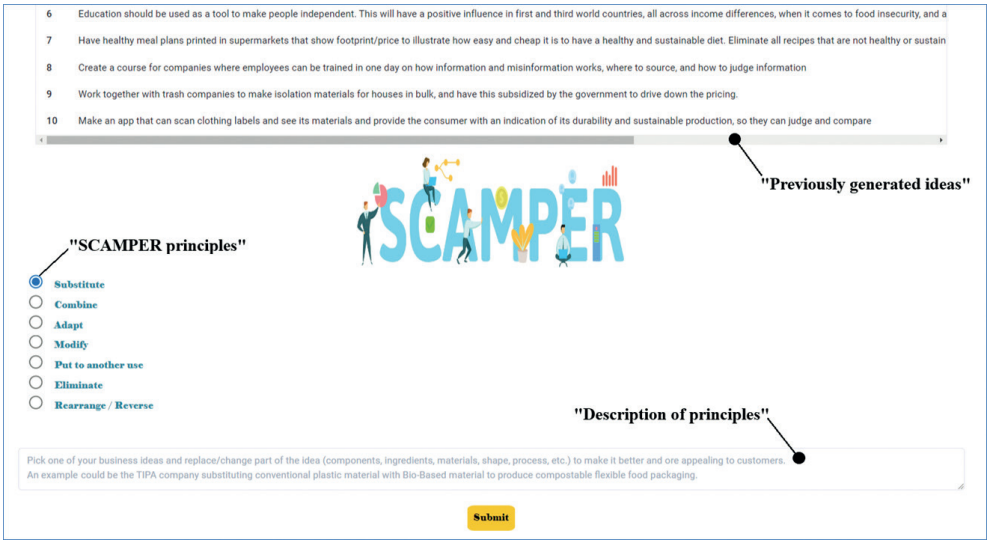


Figure 4-1. A snapshot of the platform for the condition with support for applying the SCAMPER technique

The platform could either display or hide the ideas participants generated in the first individual phase during the group phase, depending on their condition (see Figure 4-2). This feature enabled exploration of the impact of sharing individually generated ideas on the group brainstorming process and outcomes. Moreover, research findings have demonstrated that such a feature enhances individuals' engagement with shared ideas, thereby improving their productivity during group brainstorming (see Ferreira et al., 2011). Additionally, during the group phase, the platform would allow participants to submit their collaboratively generated ideas. All group members could submit ideas, and the submitted ideas became available to all members.

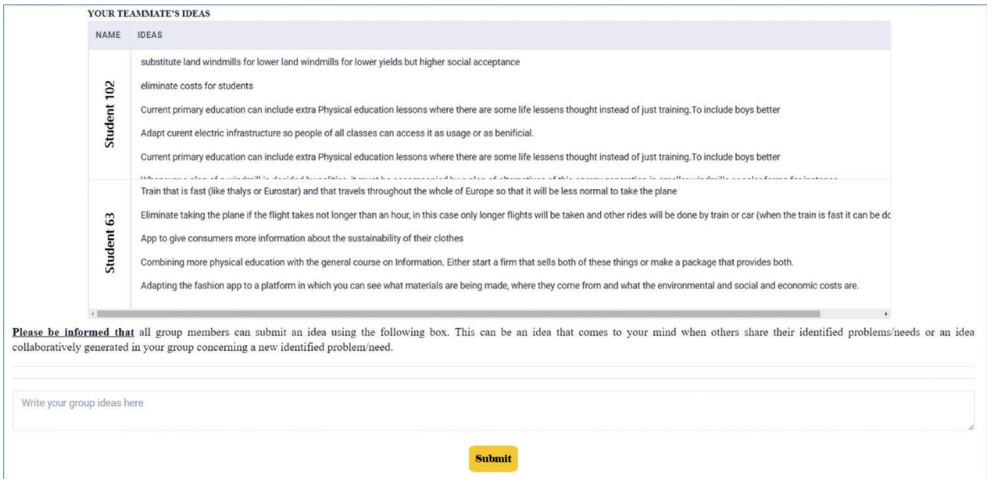


Figure 4-2. A snapshot of the platform during the collaborative phase

4.3.2.2. SCAMPER principles

The SCAMPER principles can be employed in various contexts. However, to make them more relevant to the task– as the goal was to generate business ideas to address sustainability issues – the first and third authors adapted the principles by refining the descriptions and providing real-world examples of successful businesses that have implemented these principles in practice (see Appendix 4-2). The inclusion of concrete examples was done to help participants better grasp the essence of each principle, foster greater understanding and facilitate practical application. For instance, a prime example of the 'Combining' principle in action is the development of eco-friendly electric hybrid cars, which ingeniously merge two distinct technologies - the internal combustion engine and the electric engine - to create a more sustainable and efficient transportation solution.

4.3.3. Procedure

4.3.3.1. Pilot study

A pilot study was conducted involving 30 students to assess the newly developed platform and study design. The primary objectives of this initial trial were to ascertain the clarity of the instructions and tasks during the individual and group phases and, more importantly, to determine an optimal time frame for the individual and group phases, considering the nature of the problem to be solved. Based on the feedback received from the students after they passed through all phases and the careful monitoring of their performance, the optimal durations were determined to be *15 minutes* for individual brainstorming and *30 minutes* for group brainstorming.

4.3.3.2. Main study

The study design employed in this research was a between-subjects post-test design. In total, 94 students participated in the main part of the study. Following previous studies of a similar nature (e.g., Kohn et al., 2011; Korde & Paulus, 2017), students were first randomly assigned to 31 groups, 29 of which consisted of three members each and two of which had two members. Subsequently, these groups were randomly assigned to one of three conditions: (1) Control Condition (9 triads and 1 dyad, n = 29), (2) Experimental Condition 1 (10 triads and 1 dyad, n = 32), or (3) Experimental Condition 2 (11 triads, n = 33). This two-step randomization process aimed to minimize potential confounding factors. The overall procedure followed by all participants in the various conditions is outlined in Figure 4-3.

The main study was conducted in September 2022 as part of two university courses, with prior permission from the lecturer. To maintain anonymity, each participant was randomly assigned a username and password for accessing the online platform, and

informed consent was obtained from all participants before the start of the online workshop. They were informed that their results would be used in scientific research and that they could request their data be excluded. In addition, ethical approval was received from the social sciences ethics committee of the associated university.

To run the workshop, the participants were asked to bring their own laptops. On the day of the study, they were informed about their group members and subsequently, instructed to find and sit next to them in preparation for the discussion during the group phase. To minimize distractions, participants were divided among four spacious classrooms. This arrangement ensured ample space for group members to communicate verbally during the brainstorming sessions without causing disturbances to other groups. At the beginning of the workshop, the lead author and his colleague explained all the procedures and the features of the online platform to the participants and made sure everyone knew how to log in.

Sustainable development was selected as the problem case to generate business ideas. It is defined as a form of development that "meets the needs of the present without compromising the ability of future generations to meet their own needs" (UN, 1987, p. 6). This was a deliberate choice as sustainable development is a broad and authentic topic that is familiar to many people (Baggen et al., 2017) and aligns with the recommendation to raise awareness among students about sustainable development goals in courses at the university where the study took place. At the beginning of the workshop, an explanation was provided of what is meant by sustainable development and several specific examples regarding, for example, renewable energy, climate change, and sustainable education were given. The participants were then asked to imagine they were asked to provide input for business ideas for new start-ups in the area of sustainable development. These business ideas could concern people, the 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?". The participants in all conditions were given *five minutes* to read the case and contemplate various sustainability issues in their surroundings. They could not skip any steps as the platform itself automatically progressed them to the next step after the time limit was reached.

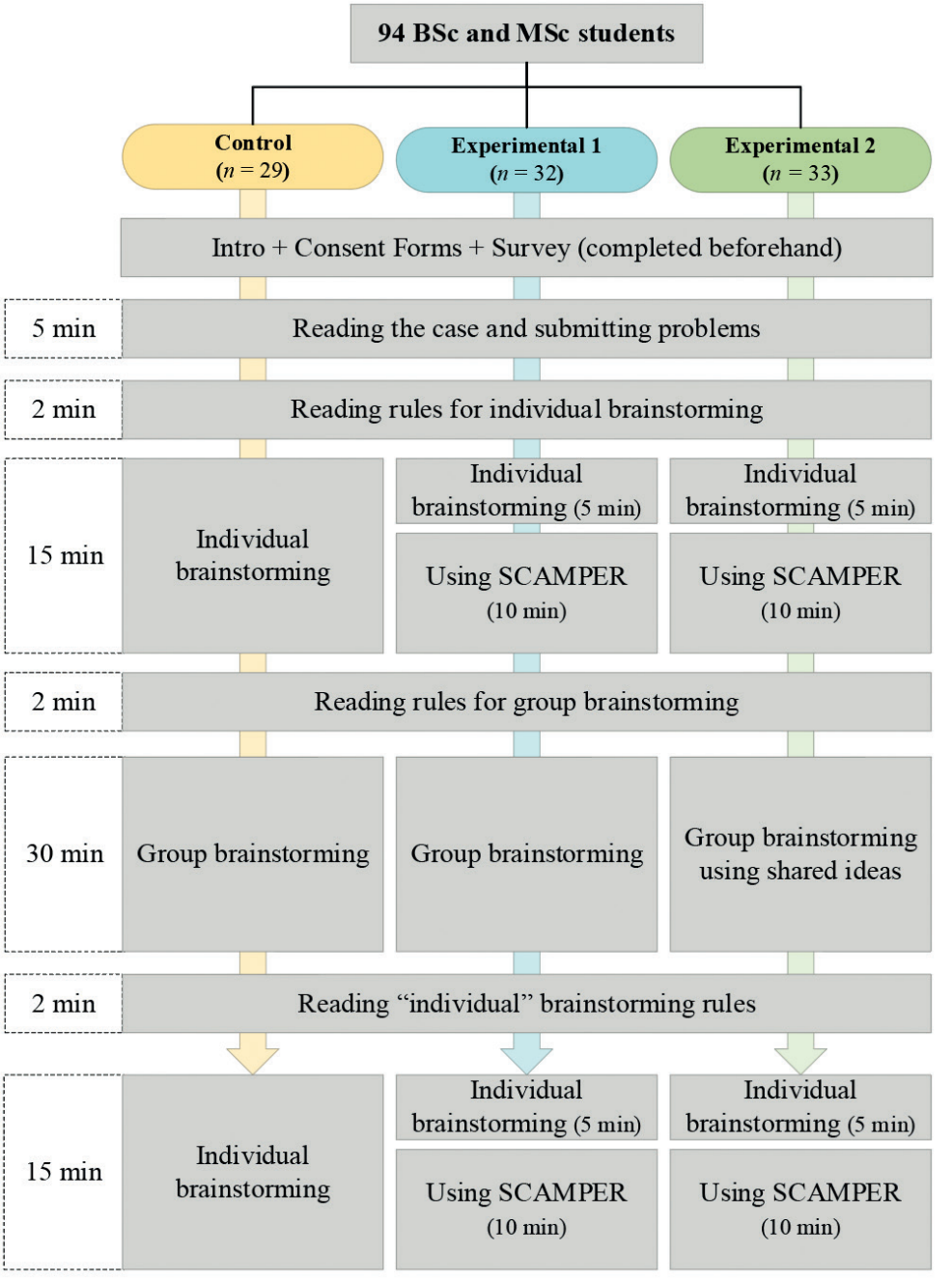


Figure 4-3. The procedure followed per condition

In all conditions, participants were required to read the same brainstorming rules for *two minutes* before the individual and group phases, adopted from (Paulus et al.,

2006). This served two purposes. Firstly, it ensured all participants became familiar with the important rules they needed to follow for fruitful brainstorming. Secondly, these steps could serve as brief breaks. Research indicates that instructing individuals to continue brainstorming after a brief break of 2-5 minutes can lead to the generation of more ideas in various settings (Paulus & Kenworthy, 2019). It should be noted that, except for the group phase, the participants were required to remain silent and focus on the tasks without any interaction with others.

Control Condition. The participants in the Control Condition followed all steps without any intervention. In the individual phase, they were asked to submit as many business ideas as they could think of to address sustainability issues. During the group phase, they were asked to collaboratively brainstorm further business ideas and submit them into the system. All participants could submit ideas during the group phase, and the submitted ideas were instantly displayed to other members. The platform did not share their individually generated ideas with their peers; however, they could verbally share these ideas themselves if they wanted to.

Experimental Condition 1. All the steps in the Experimental Condition 1 were identical to those in the Control Condition, except that both individual phases were divided into two parts. First, participants had *five minutes* to brainstorm freely and submit their ideas to the system. This time allocation was based on previous studies showing that individuals in unsupported brainstorming sessions tend to experience a rapid decline in idea generation after approximately five minutes (Baruah & Paulus, 2016). After this initial phase, the platform automatically transitioned them to another part where all their submitted ideas were visible, along with SCAMPER prompts. Participants were encouraged to select any of the SCAMPER principles to expand on their existing ideas and then generate new ones for a duration of *10 minutes*.

Experimental Condition 2. All the steps in the Experimental Condition 2 were identical to those in the Experimental Condition 1, except for the group phase. In this phase, the system shared all individually generated ideas from each member with the other members of the group. Moreover, they were explicitly instructed to read others' ideas for *five minutes* and then discuss the ones they found interesting, with the aim of expanding them into new ideas. Similar to other conditions, all participants could submit ideas during the discussion.

4.3.4. Analysis

4.3.4.1. Dependent measures

The dependent measures of students' idea generation performance were the quantity and the quality of the generated business idea. In line with previous research on idea generation (Baggen et al., 2017; Baruah & Paulus, 2008), the following criteria were employed to evaluate the quantity and quality of ideas:

(1) *Comprehensibility*: whether or not the idea can be qualified as an opportunity in terms of socially valued products or services in the context of sustainability (1 = comprehensible, 0 = incomprehensible). "Banning cars from cities to reduce air pollution is technically possible but does not constitute a product or service" (Eller et al., 2020). As such, ideas such as "wearing an extra sweater" or "turning down the heating" were scored as incomprehensible as they were more general recommendations to address sustainability-related issues than an idea for a start-up business. Incomprehensible ideas were excluded from further analysis. It is to be noted that in this study, the number of comprehensible ideas is attributed to the quantity of generated ideas.

(2) *Originality*: "the degree to which an idea is innovative" (Rietzschel et al., 2007, p. 934) which was determined using DeTienne and Chandler's (2004) 6-point scale based upon the following categories: (1) no apparent innovation or not enough information to make a determination; (2) a product or service identical to an existing product/service offered to an underserved market; (3) a new application for an existing product/service, with little/no modification or a minor change to an existing product; (4) a significant improvement to an existing product/service; (5) a combination of two or more existing products/services into one unique or new product/service; and (6) a new-to-the-world product/service, a pure invention or creation. The originality score of the individual and group phases was calculated by averaging the originality scores associated with ideas generated in that phase.

(3) *Flexibility*: the extent to which participants generated ideas in different categories. The categories were based on the examples of sustainable development in the problem case. Each idea was assigned to one category: (1) affordable and adequate food supply, (2) decent housing, (3) energy, (4) climate change, (5) education, and (6) personal health and safety. The flexibility score was calculated by counting the number of scored categories per participant.

(4) *Persistence,* i.e., the number of comprehensible ideas in one category. According to the dual pathway to creativity model (Nijstad et al., 2010), creativity can be accessed through not only flexibility but also persistence, making it crucial to incorporate both as criteria when evaluating brainstorming outcomes. Persistence for each student was quantified by dividing the number of comprehensible ideas by flexibility.

4.3.4.2. Control measures

In this study, students' educational level and attitude toward entrepreneurship were treated as covariates, due to their potential influence on (business) idea generation performance. This consideration is based on previous empirical studies that demonstrated the impact of students' educational level on their business idea-generation outcomes (e.g., Baggen et al., 2017; Oftedal et al., 2018). These findings may be attributed to the greater prior knowledge that master's students can acquire through education (also referred to as general human capital), which has been shown to play a crucial role in the identification of business ideas (Shepherd & DeTienne, 2005). In addition, scholars reported that individuals' strong feelings toward entrepreneurship could affect their capability to identify business ideas (Karimi et al., 2016b), particularly in the sustainability context (Eller et al., 2020). To evaluate students' attitudes toward entrepreneurship, we employed Liñán and Chen's (2009) survey, which comprises five items such as "Being an entrepreneur implies more advantages than disadvantages to me Responses were measured using a seven-point Likert scale, 1 representing "strongly disagree" and 7 representing "strongly agree".

4.3.4.3. Coding of ideas

First, data from the brainstorming session were screened to eliminate redundant ideas. Then, a codebook was developed with the assistance of two academic scholars in entrepreneurship to score the ideas generated by students in the individual phases. Initially, the experts each applied the preliminary version of the codebook to 10% (approximately 60) of the ideas generated by the students in the individual phases. After discussing their results, the codebook was refined and the evaluation process was repeated until the measures of inter-rater reliability reached acceptable levels: Cohen's kappa of .91 (comprehensibility), weighted kappa of .73 (originality), as well as intraclass correlation coefficients of .89 (flexibility) and .73 (originality). Subsequently, two trained master's student assistants were enlisted to evaluate the entire pool of ideas utilizing the final version of the codebook.

4.3.4.4. Unit of analysis and statistical tests

The unit of analysis, whether at the individual or group level, depended on the research question being addressed (see Table 4-2).

Table 4-2. Overview and their unit of analysis

Research questions	Unit of analysis	Data collection phase	Condition
RQ1 and RQ2	Individual	First individual phase	All conditions
RQ3 and RQ4	Group	Group phase	Experimental 1 and 2
RQ5 and RQ6	Individual	Second individual phase	Experimental 1 and 2

In line with previous studies (e.g., Korde & Paulus, 2017; Paulus et al., 2015), for the research questions in which the group level was considered as the unit of analysis, the ideas generated by each individual within a group were added together to form the group aggregate. To answer the research questions, multiple analyses of covariance (ANCOVA) were used for each facet of the brainstorming outcome (i.e., comprehensibility, originality, flexibility, and persistence) as the dependent variables, condition as the independent variable, and students' educational level and attitude toward entrepreneurship as covariates. According to Huberty and Morris (1989), multiple ANCOVAs can be selected over a MANCOVA when the research aims to examine the effects of the independent variable on each of the dependent variables separately.

To conduct the ANCOVA test for each dependent variable, first, standard checks were performed to determine whether the assumptions of homogeneity and normality were met for all data sets. It was shown that in all cases, the conditions were homogeneous, and the data were normally distributed ($p > .05$). These results were achieved after assessing the scores using the Levene and Kolmogorov–Smirnov tests. After confirming that the assumptions were met, multiple ANCOVAs were conducted for each research question to examine whether there were significant overall differences between the various conditions in terms of the dependent variables. Subsequently, post hoc pairwise comparisons were performed to identify specific differences between the groups for each dependent variable, employing Bonferroni corrections to account for multiple comparisons (Field, 2011).

Additionally, to determine whether the interventions exerted their effects on originality through the persistence or flexibility pathways as predicted in the DPCM, a regression-based mediation analysis was applied. This was in line with previous studies (e.g., Althuizen & Reichel, 2016). To this end, first, dummy variables for the type of intervention were created for each analysis. Then, Hayes's (2017) PROCESS macro v4.2 (Model 4) was implemented using SPSS 23 to explore whether, for instance, persistence could mediate the effect of the intervention on the originality of ideas generated during the first individual phase. Mediation is said to occur when zero falls outside the 95 percent confidence interval around the estimated indirect effect (Preacher & Hayes, 2008), which was generated in this study using a bootstrapping procedure with 5,000 samples. This nonparametric method is superior to Baron and

Kenny's (1986) test for mediation because it does not assume the normality of the data (Preacher & Hayes, 2008).

4.4. Result

4.4.1. RQ1 and RQ2

The results of the multiple ANCOVAs showed that the difference among conditions was not significant for the number of comprehensible ideas (p = .32) and their flexibility (p = .80) but was significant for the average originality of ideas (p < .001) and their persistence (p = .04) (see Table 4-3).

Table 4-3. Means, adjusted means, overall ANCOVAs for RQ1

Dependent V.	Condition	*n*	*M (SD)*	*Adj. M (SE)*	95% CI		*F (df1, df2)*	*p**	*η2*
					LB	UP			
Comprehensibility	Control	29	3.59 (2.78)	3.86 (.53)	2.81	4.91	1.17 (2, 89)	.32	.03
	Experimental 1	32	4.56 (2.75)	4.87 (.51)	3.85	5.89			
	Experimental 2	33	5.33 (3.06)	4.79 (.54)	3.72	5.86			
Originality	Control	29	1.96 (.49)	1.98 (.09)	1.81	2.16	10.56 (2, 89)	**<.001**	.19
	Experimental 1	32	2.39 (.45)	2.42 (.09)	2.25	2.60			
	Experimental 2	33	2.59 (.47)	2.54 (.09)	2.36	2.72			
Flexibility	Control	29	2.17 (1.10)	2.24 (.21)	1.83	2.65	.22 (2, 89)	.80	.01
	Experimental 1	32	2.09 (.99)	2.18 (.20)	1.78	2.57			
	Experimental 2	33	2.52 (1.18)	2.38 (.21)	1.96	2.80			
Persistence	Control	29	1.62 (.85)	1.67 (.17)	1.33	2.01	3.46 (2, 89)	**.04**	.07
	Experimental 1	32	2.14 (.63)	2.19 (.17)	1.86	2.51			
	Experimental 2	33	2.32 (1.16)	2.24 (.17)	1.90	2.59			

Note. *p < .05; The F tests are for the condition effect on the dependent variables.

Therefore, further analysis was conducted to locate the significant differences using pairwise comparisons with the Bonferroni correction to control for the type I error (i.e., false positives). As shown in Table 4-4, the results showed that the average originality of ideas generated in Experimental 1 (*Adjusted M* = 2.42, *SE* = .09) and 2 (*Adjusted M* = 2.54, *SE* = .09) conditions are significantly higher ($p \leq .001$) than those generated in the control condition (*Adjusted M* = 1.98, *SE* = .09). Results from other comparisons also showed a significant difference at the 10 percent level (p = .08) regarding the persistence of ideas generated in Experimental 1 (*Adjusted M* = 2.19, *SE* = .17) and 2 (*Adjusted M* = 2.24, *SE* = .17) conditions compared to those generated in the Control condition (*Adjusted M* = 1.67, *SE* = .17).

Table 4-4. Pairwise comparisons

Dependent V.	Condition (I)	Condition (J)	*MD* (I-J)	*SE*	*p**	95% CI for Difference[b]	
						LB	UB
Originality	Control	Experimental 1	-.44*	.12	.001	-.74	-.15
		Experimental 2	-.55*	.13	<.001	-.88	-.23
	Experimental 1	Control	.44*	.12	.001	.15	.74
		Experimental 2	-.11	.13	1.000	-.44	.21
Persistence	Control	Experimental 1	-.52	.23	.08	-1.08	.05
		Experimental 2	-.58	.26	.08	-1.20	.05
	Experimental 1	Control	.52	.23	.08	-.05	1.08
		Experimental 2	-.06	.25	1.000	-.67	.56

Based on estimated marginal means

*The mean difference is significant at the .05 level.

[b]Adjustment for multiple comparisons: Bonferroni. MD = Mean Difference.

Additionally, to answer RQ2 and determine whether the SCAMPER prompts in Experimental 1 and 2 conditions exerted their effects on originality through the persistence pathway as predicted in the DPCM, a regression-based mediation analysis was applied. In this regard, first, dummy variables for the type of intervention were created (i.e., no-SCAMPER vs. SCAMPER) using the control group as the baseline. Results showed that intervention was a significant predictor of persistence, b = .61, SE = .20, t = 3.00, p = .003, 95% CI [.21, 1.01] and that intervention was also a significant predictor of the average originality of ideas, b = .49, SE = .11, t = 4.38, p < .001, 95% CI [.27, .71]. However, the intervention was not a significant predictor of flexibility (b = .13, SE = .25, t = .55, p = .58, 95% CI [-.35, .62]). Moreover, the effect of both flexibility (b = .06, SE = .04, t = 1.25, p = .21, 95% CI [-.03, .15]) and persistence (b = .06, SE = .05, t = 1.07, p = .29, 95% CI [-.05, .17]) on originality was not significant. In addition, the findings indicated that the indirect effect of the intervention on the originality of ideas was not significant through flexibility (b = .00, 95% CI [-.02, .05]) or persistence pathways (b = .04, 95% CI [-.01, .11]). This indicates that the positive effect of the SCAMPER technique on the originality of ideas does not seem to be exerted through either of these pathways (see Figure 4-4).

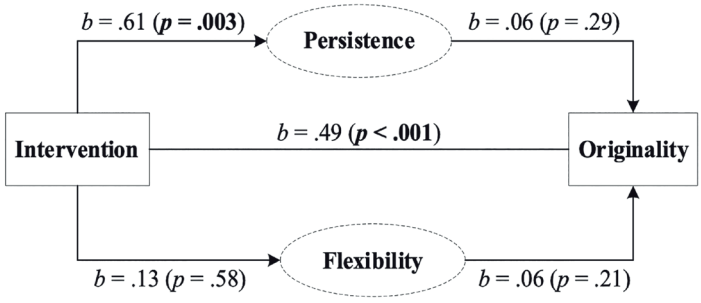


Figure 4-4. The path of intervention on originality

4.4.2. RQ3 and RQ4

The results of the multiple ANCOVAs showed that the difference among conditions was not significant for the number of comprehensible ideas (p = .26), their flexibility (p = .77) and persistence (p = .13) but was significant for the average originality of ideas (p = .02) (see Table 4-5). The average originality of ideas generated in the Experimental Condition 2 (*Adjusted M* = 2.91, *SE* = .26) was shown to be significantly higher than those generated in the Experimental Condition 1 (*Adjusted M* = 2.62, *SE* = .23). Therefore, in response to RQ3, the sharing of individually generated ideas appears to enhance the originality of ideas produced during group phase. However, in response to RQ4, the statistical analysis indicated that such an effect on the originality of ideas was not exerted through any of the pathways proposed by the DPCM.

Table 4-5. Means, adjusted means, overall ANCOVAs for RQ3

Dependent V.	Condition	*n*	*M (SD)*	*Adj. M (SE)*	95% CI		*F (df1, df2)*	*p**	*η2*
					LB	UP			
Comprehensibility	Experimental 1	11	10.18 (12.76)	11.53 (3.04)	5.17	17.88	1.38 (1, 19)	.26	.07
	Experimental 2	11	7.55 (4.74)	6.20 (3.04)	-.15	12.56			
Originality	Experimental 1	11	2.62 (.23)	2.61 (.08)	2.44	2.78	6.37 (1, 19)	**.02**	.25
	Experimental 2	11	2.91 (.26)	2.91 (.08)	2.75	3.08			
Flexibility	Experimental 1	11	2.91 (1.04)	3.11 (.35)	2.38	3.84	.09 (1, 19)	.77	.00
	Experimental 2	11	3.45 (1.21)	3.26 (.35)	2.53	3.99			
Persistence	Experimental 1	11	3.02 (2.36)	3.24 (.56)	2.07	4.42	2.45 (1, 19)	.13	.11
	Experimental 2	11	2.16 (.83)	1.93 (.56)	.76	3.11			

Note. *p < .05; The F tests are for the condition effect on the dependent variables.

4.4.3. RQ5 and RQ6

The results of the multiple ANCOVAs showed that the difference among conditions was significant for the number of comprehensible ideas (p = .007), their originality (p < .001) and flexibility (p = .02) but was not significant for ideas' persistence (p =

.36) (see Table 4-6). Overall, the ANCOVAs using comprehensibility, originality and flexibility as dependent variables showed that sharing individually generated ideas during group brainstorming has a positive impact on performance in the subsequent individual phase, as demonstrated by a significantly greater number of comprehensible ideas and their higher originality and flexibility.

Table 4-6. Means, adjusted means, overall ANCOVAs for RQ5

Dependent V.	**Condition**	***n***	***M (SD)***	***Adj. M (SE)***	**95% CI**		***F (df1, df2)***	***p****	***η2***
					LB	**UP**			
Comprehensibility	Experimental 1	32	2.94 (1.76)	2.98 (.40)	2.17	3.78	7.92 (1, 61)	**.007**	.12
	Experimental 2	33	4.70 (2.36)	4.66 (.39)	3.87	5.45			
Originality	Experimental 1	32	2.18 (.91)	2.21 (.14)	1.93	2.50	13.22 (1, 61)	**<.001**	.18
	Experimental 2	33	3.02 (.53)	2.99 (.14)	2.71	3.27			
Flexibility	Experimental 1	32	1.97 (.97)	1.94 (.20)	1.54	2.34	5.54 (1, 61)	**.02**	.08
	Experimental 2	33	2.61 (1.12)	2.64 (.20)	2.25	3.03			
Persistence	Experimental 1	32	1.58 (.81)	1.63 (.16)	1.32	1.93	.86 (1, 61)	.36	.01
	Experimental 2	33	1.88 (.79)	1.84 (.15)	1.54	2.14			

Note. *$p < .05$; The F tests are for the condition effect on the dependent variables.

In addition, to answer RQ6 and determine whether the effect of sharing individually generated ideas during the group phase of the Experimental Condition 2 on originality in the subsequent individual phase was exerted through the flexibility pathway, a regression-based mediation analysis was applied. To achieve this, dummy variables for the type of intervention were created using the Experimental Condition 1 as the baseline. Results showed that intervention was a significant predictor of flexibility, $b = .64$, $SE = .26$, $t = 2.46$, $p = .02$, 95% CI [.12, 1.16] and that intervention was also a significant predictor of the average originality of ideas, $b = .68$, $SE = .18$, $t = 3.66$, $p < .001$, 95% CI [.31, 1.04]. In addition, results indicated that flexibility is a significant predictor of average originality, $b = .28$, $SE = .09$, $t = 3.24$, $p = .001$, 95% CI [.11, .45]. Finally, the findings indicated that the indirect effect of the intervention on the originality of ideas was significant through the flexibility pathway ($b = .18$, 95% CI [.02, .39]). Given that the intervention has a significant direct effect on the average originality of ideas, and the product of all the effects is positive, this indicates that flexibility serves as a "complementary" (Zhao et al., 2010) mediator between the intervention and originality. The same mediation analysis for persistence was not significant (see Figure 4-5).

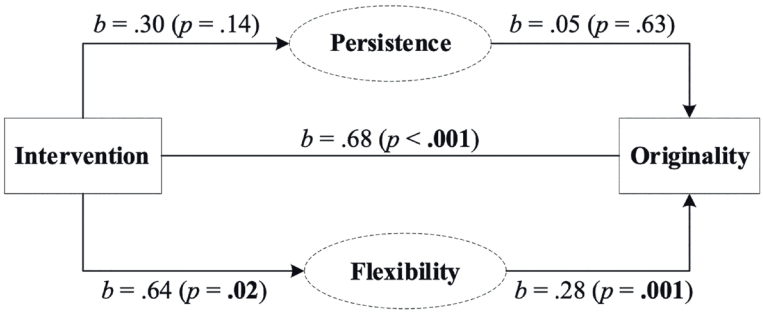


Figure 4-5. The path of intervention on originality

4.5. Discussion

The primary objective of this research was to assess the effect of two computer-mediated supports — the SCAMPER prompts and the sharing of individually generated ideas — on the quality of ideas generated in a hybrid brainstorming session using the IGI sequence. Utilizing a between-subjects post-test design and an assessment of idea quality based on the degree of originality, it was observed that the variations in the three conditions, namely Control, Experimental 1, and Experimental 2, stemmed from the implemented support mechanisms. A detailed discussion concerning each support is provided below.

4.5.1. The SCAMPER Prompts

In this study, an adapted version of the SCAMPER technique was utilized during the individual phases of a hybrid brainstorming session employing the IGI sequence. This technique was introduced as popup prompts via the online brainstorming platform developed for this study. The findings revealed that participants supported by the SCAMPER prompts during the first individual brainstorming phase (i.e., in the Experimental 1 and 2 conditions) outperformed in terms of average originality, compared to those who did not use this technique (i.e., the Control Condition). This suggests that incorporating the SCAMPER technique during individual brainstorming can positively influence the originality of outcomes when effectively scaffolded. This observation aligns with prior studies, indicating that utilizing the SCAMPER technique to improve a common product slightly increases originality compared to other methods like unsupported individual brainstorming (Gu et al., 2022). The improvement in idea originality becomes even more pronounced in studies that combined the SCAMPER techniques with brainstorming (Moreno et al., 2016; Rahimi & Shute, 2021), mirroring the approach in the present research.

The positive effect of using SCAMPER during individual brainstorming on the originality of ideas could be attributed to its potential to foster a deeper, more concentrated, and systematic exploration (Moreno et al., 2016). This in turn may activate the persistence pathway, leading to more original outcomes, as suggested by Nijstad et al. (2010) in their DPCM. The results of this study also suggested that persistence, measured by the number of ideas in each category, was slightly higher among participants who utilized the SCAMPER technique compared to those who did not. However, upon further analysis, it was discerned that persistence was not associated with the average originality of the ideas. This suggests that although there was an increase in the number of generated ideas per category for participants who used the SCAMPER technique, this increase was not the driving factor behind the heightened average originality of ideas. Furthermore, the findings showed that the positive influence of the SCAMPER technique on idea originality was not mediated by any of the pathways proposed by the DPCM. Two potential reasons might account for these observations.

First, the amount of time allocated to students to employ the technique could be an influential factor. As per Nijstad et al. (2010), the positive impact of a systematic exploration of specific idea categories on average originality is likely observed only when participants have ample time to initially generate mainly unoriginal ideas and subsequently delve into more original ones. Second, the above observations may indicate that the SCAMPER technique might affect originality through different pathways. This view aligns with Bollimbala et al. (2023), who posited that originality can be enhanced through several pathways, not just the two highlighted in DPCM. For example, according to the Theory of Literal Divergent Thinking proposed by Acar and Runco (2015), one of the 11 dichotomous pathways to originality is "synthetic versus nonsynthetic". The synthetic pathway, which resonates well with how the SCAMPER technique works, emphasizes that combining objects, words, or concepts results in mental synthesis (Finke et al., 1992). The process of mental synthesis has been proven beneficial for creativity, leading to the generation of original outcomes (Acar & Runco, 2015).

4.5.2. Sharing Individually Generated Ideas

To date, many studies have explored the use of computer technologies to enhance idea sharing during group brainstorming. However, limited attention has been paid to facilitating the sharing of "previously" generated ideas during the group phase and exploring its effect on the quality of outcomes. Tapping into the potential of hybrid brainstorming with the IGI sequence, this study sought to examine the effect of sharing ideas generated in the first individual phase on the originality of ideas generated during the group phase and the subsequent individual phase. The findings indicated

that sharing individually generated ideas could enhance the average originality of ideas generated during the group and the subsequent individual phases. Moreover, while sharing the ideas did not significantly influence the number of idea categories, i.e., flexibility, during group brainstorming, it had a significant effect on flexibility in the final individual phase. These results suggest that the mechanisms through which the intervention affected originality during the group phase and the final individual phase might differ.

During the group phase, sets of three students in each condition brainstormed for 30 minutes, aiming to collaboratively generate business ideas addressing sustainability issues. Participants in the Experimental Condition 2, however, had to additionally spend time reading, discussing, and understanding the individually generated ideas shared via the online platform, which consequently left them with less time for collaborative ideation. While this setting offered them a chance to broaden their knowledge of the given problem and its possible solutions via shared ideas (Nijstad & Stroebe, 2006), the time constraints might have limited their ability to draw inspiration from them and generate a significantly diverse range of ideas. However, as was emphasized by the provided brainstorming rules, they could potentially collaborate and combine some of the shared ideas to generate new ones. This approach could lead to the generation of more original ideas than in the Experimental Condition 1, where participants did not have access to their peers' previously generated ideas and had to rely only on the information exchanged during the group phase.

In the final individual phase, participants in both Experimental 1 and 2 conditions could benefit from a phenomenon commonly observed in hybrid settings, known as "group-to-individual (G-I) transfer of learning" (Laughlin & Barth, 1981). This concept refers to the enhancement of individual group members' specific knowledge and skills after participating in a "similar" collaborative task (Schultze et al., 2012). The G-I transfer of learning might occur because the interpersonal interactions among group members in hybrid settings could change individual resources (Brodbeck & Greitemeyer, 2000) and improve knowledge repertoires (John-Steiner & Mahn, 1996). Some studies have indicated that such transfer can occur in hybrid brainstorming sessions that include a G-I sequence, resulting in improved individual brainstorming outcomes in terms of idea quantity (Korde & Paulus, 2017) and flexibility (Brown et al., 1998; Korde & Paulus, 2017). The current research not only reinforces these findings but also provides deeper insights into how the G-I transfer of learning affects both the quantity and quality of ideas, particularly when addressing real-world problems. The results showed that participants in the Experimental Condition 2 outperformed those in the Experimental Condition 1, generating more business ideas with higher flexibility and originality.

The findings mentioned above can be associated with the fact that individuals in the Experimental Condition 2 had access to more ideas during the group phase, facilitated by the online platform. This allowed them to assimilate more knowledge by synthesizing the shared ideas and views of their peers (MA et al., 2011) and to form new associations in their knowledge structures (Nijstad & Stroebe, 2006). These new associations could be carried over into the subsequent individual phase, enabling individuals to engage in more productive brainstorming after the group work. This dynamic becomes especially pivotal when identifying business opportunities. As per entrepreneurship scholars, the OI capability is associated with particular knowledge structures (Baron, 2004; Gaglio & Katz, 2001) that can be developed over time by gaining experience in a particular domain (Baron, 2006). According to Arentz et al. (2013), enriching these knowledge structures could increase their ability to discover more business ideas. Furthermore, scholars assert that possessing rich knowledge structures can also enhance individuals' creativity, helping them develop more original business ideas (Shepherd & DeTienne, 2005) as rich knowledge in a context allows for "the sorts of associations and linkages that may have never been considered before" (Cohen & Levinthal, 1990, p. 130).

4.6. Conclusions and Implications for Practice

This study aimed to identify support mechanisms that enhance the quality of outcomes in hybrid brainstorming sessions. In doing so, it addresses an ongoing demand for empirical research on improving brainstorming quality (Maaravi et al., 2021) and a recent call to examine the DPCM empirically in authentic contexts, specifically when addressing real-life problems (Nijstad et al., 2021). To achieve these objectives, the study explored the effect of two computer-mediated support mechanisms: the SCAMPER prompts and sharing of individually generated ideas, on the originality of ideas generated during hybrid brainstorming sessions that follow the IGI sequence. Through this investigation, it also delved into the DPCM's hypotheses about the relationship between persistence and flexibility with the originality of outcomes. The SCAMPER prompts proved effective in supporting individual brainstorming sessions, assisting participants in the generation of more original ideas to address sustainability issues. On the other hand, sharing ideas generated individually facilitated via the online platform had a significant impact on the originality of ideas generated both during the group phase and the subsequent individual phase. The study offered support for the relationship between cognitive flexibility and the originality of ideas but also presented evidence that originality might be achieved through pathways other than those suggested by the DPCM.

The aforementioned findings have significant implications for practitioners aiming to organize effective brainstorming sessions, including those involved in designing EE programs. This study builds on the well-supported premise that hybrid brainstorming is one of the most effective techniques for organizing brainstorming sessions across various disciplines (Brown & Paulus, 2002; Paulus et al., 2018). This effectiveness stems from the technique allowing individuals to benefit from both the unconstrained ideation of individual brainstorming and the stimulation of additional ideas through exposure to others' ideas during group brainstorming (Korde & Paulus, 2017). However, as with all types of brainstorming, additional support mechanisms must be still provided during various phases of a hybrid brainstorming session to guide individuals toward quality outcomes.

A prime example of such mechanisms is the SCAMPER technique. This study showed that prompting participants to utilize this technique during the individual phase of a hybrid brainstorming session significantly enhances the originality of their ideas. One critical consideration when using such prompts is to introduce them after participants have had a brief individual brainstorming period, allowing them to generate a pool of ideas to which the technique can be applied (Moreno et al., 2016; Rahimi & Shute, 2021). Moreover, it is highly advisable to adapt the technique to the context in use, providing concrete examples of how to apply each SCAMPER principle. This approach enables participants to better understand how to utilize the SCAMPER technique in the given context (Gu et al., 2022). Finally, it is essential to allocate sufficient time for the effective deployment of the technique. The duration might vary based on the context and the nature of the problem at hand, be it an open-ended query or a complex real-life issue.

Another effective support mechanism is facilitating the sharing of previously generated ideas during group brainstorming. Consistent with prior studies (e.g., Dugosh et al., 2000; Michinov et al., 2015; Paulus et al., 2013; Pi et al., 2022), the current research indicated that prompting participants to read, discuss, and comprehend their peers' ideas can significantly enhance the originality of ideas generated collaboratively. This positive impact was found to be even more pronounced when participants had the chance to brainstorm individually on the same topic after the group session. This approach allows them to assimilate the insights they gained from synthesizing others' ideas, enabling them to engage in more productive brainstorming after the group work without being distracted by others.

Lastly, it is important to highlight that while the aforementioned support mechanisms can be readily applied to brainstorming sessions across various settings (e.g., face-to-

face, online, etc.), to optimize their effectiveness, it is highly recommended to leverage the advantages of online platforms, as demonstrated in the current study.

4.7. Limitations and Avenues for Future Research

The study has some limitations that open avenues for future research. First, while it offers new insights into how to design hybrid brainstorming sessions that yield higher-quality outcomes, it does not confirm that this specific design can outperform other approaches to organizing brainstorming sessions. Future empirical research is necessary to thoroughly investigate this by comparing the effects of the proposed design on both the quantity and quality of outcomes, not only with an (unsupported) hybrid brainstorming session with an IGI sequence but also with sessions that employ repeated individual or group brainstorming. Furthermore, given that individual performance can correlate with group performance in creativity tasks such as idea generation (see, for example, Dennis et al., 2013), forthcoming empirical research might adopt a more comprehensive research design to explore whether those who used the SCAMPER technique would perform also better in the subsequent group phase compared to those who did not use.

Second, despite theoretical expectations, this study did not confirm that the SCAMPER technique could enhance originality through the persistence pathway. This might be because the time allocated for students to employ the technique was insufficient. As Nijstad et al. (2010) pointed out, compared to flexibility, the correlation between persistence and originality is relatively weak, partly because this correlation greatly depends on the time participants invest to systematically explore a limited number of idea categories. Therefore, to clarify the mechanisms through which the SCAMPER technique might influence originality, and to verify Acar and Runco's (2015) proposition that originality can be realized through various pathways than only those proposed by the DPCM, future research should examine the effect of this technique on originality when participants utilise it over a longer time span. Moreover, since the effect of particular support on brainstorming outcomes might differ if it is provided in an individual or a group setting (see, for example, Ritter & Mostert, 2018), upcoming empirical research can explore whether the positive impact of the SCAMPER technique on idea originality varies when applied individually or in a group setting.

Third, while the present study provided empirical evidence, obtained under controlled conditions, suggesting that sharing previously generated ideas during the group phase can enhance the originality of outcomes in the subsequent individual phase, it remains an assumption that the G-I transfer of learning is responsible for such a

positive finding. To elucidate this, future empirical studies should explore the change in participants' knowledge of the given problem before and after group work, such as by using concept maps (see, for example, Farrokhnia et al., 2019), and determine whether this change correlates with individual performance in the subsequent phase.

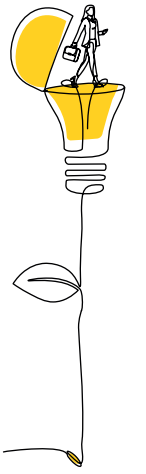
Fourth, future research could track interactions during group work to better understand how differences between conditions emerge and what elements of interaction contribute to improved outcomes in the subsequent individual phase. For instance, they could go more in-depth by identifying the collective synergetic qualities of successful groups that could help their ex-members perform better after the group work. They could investigate the quality of interactions during the group phase by utilizing Curseu et al.'s (2015) notion of group synergy. The group synergy concept captures the effectiveness of the collective induction processes in groups that exceed their best member's performance (McNeese, 2000). Curseu et al. (2015) reported that members of synergetic groups better develop their decision competencies through group interaction processes, and members of strong synergy groups obtain the highest cognitive benefits.

Fifth, in the current study, the group phase was organized in a face-to-face setting to allow for more discussion and interaction between group members compared to the common approach of communicating in online brainstorming sessions using a chatbox. However, it cannot be claimed that all groups had fruitful interactions due to various challenges associated with face-to-face group brainstorming. Future empirical research can maintain the opportunity for verbal communication among group members but leverage the potential of computer-mediated environments to effectively facilitate group interactions. This could include using computer scripts to support essential cognitive processes during group work. For instance, research findings indicate that individuals tend to focus on information or knowledge that they have in common during collaborative idea generation (Stasser, 1999; Stewart & Stasser, 1995). However, effective collaborative idea generation hinges on the process by which group members acquire meta-knowledge about each other's domain expertise (Stasser et al., 2000). They use this knowledge to pool and process unshared information related to the problem, thereby establishing what is known as a "Transactive Memory System" (TMS) (Wegner, 1987). The establishment of a TMS does not happen intrinsically during group work and can be difficult and time-consuming (Beers et al., 2005), thus has to be scaffolded during group work activities (Noroozi et al., 2013). A promising scaffolding technique for establishing a TMS in learning groups is to use scripts in computer-supported environments (Beers et al., 2005; Noroozi et al., 2013). An empirical study can explore the effect of using such scripts during computer-mediated group brainstorming on the quantity and quality of outcomes.

Sixth, as previously mentioned, the brainstorming technique typically consists of two stages aligned with the divergent-convergent continuum. The primary focus of this study was on the divergent phase of brainstorming sessions, aiming to assist individuals in generating as many original ideas as possible. Nonetheless, an optimally designed brainstorming session does not conclude at this point. An immediate evaluation should occur after the divergent phase to help individuals identify the most appropriate ideas (Boddy, 2012; Rietzschel et al., 2006). This view is also reinforced in the entrepreneurship literature related to OI. From a cognitive psychology perspective, scholars describe the OI process as a multi-step creative process (Dimov, 2007) that includes at least two underlying phases, i.e., idea generation and idea evaluation (Vogel, 2017). Thus, a strong OI capability—similar to that of expert entrepreneurs—involves not just generating numerous original ideas but also the ability to discern those with the highest appropriateness for addressing the given problem. Future research should delve into the convergent phase of brainstorming sessions, identifying approaches to support participants' evaluative decision-making process during this phase. This is what is intended to be addressed in Study 4 of the current research project, as described in the next chapter.

CHAPTER

5



Improving Business Idea Evaluation: Exploring the Effect of Describing Evaluation Criteria and Providing an Exemplar*

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Abstract

To date, many studies have demonstrated that training can enhance divergent thinking outcomes in relation to OI. However, relatively less attention has been paid to identifying support mechanisms that can enhance individuals' convergent thinking outcomes, helping them effectively select ideas with higher potential for successful business ventures in the future. To address this research gap, this study aims to investigate the effects of two techniques: (1) describing evaluation criteria and (2) presenting an exemplar, on business idea evaluation performance during the OI process. Participants (N = 80) were university students, comprising both undergraduate (BSc) and postgraduate (MSc) cohorts, who participated in a university course. They were randomly assigned to four conditions (Control, Criteria, Exemplar, and Both) in a 2x2 study design. Students in all conditions were required to rank three of their own business ideas from 1 (highest quality idea) to 3 (lowest quality idea), and their rankings were compared with those of two experts in the entrepreneurship field. Results demonstrate that providing students with a detailed description of evaluation criteria can help them better evaluate the quality of ideas. This positive effect becomes even more pronounced when exemplars, in the form of business ideas evaluated and ranked by an expert, are provided alongside the evaluation criteria.

5.1. Introduction

Entrepreneurship is viewed as an iterative decision-making process (De Winnaar & Scholtz, 2020), encompassing three inextricably linked phases, i.e., opportunity identification (OI), evaluation, and exploitation (Wood & Williams, 2014). The first phase, OI, holds particular significance as it lays the foundation for all subsequent phases. It involves identifying business ideas and transforming them into products, processes, or services that deliver value to customers, end-users, or society (Baggen et al., 2016). Recognizing this pivotal role, OI has been acknowledged as one of the key entrepreneurial capabilities (Lans et al., 2018) and has, consequently, become a central topic in entrepreneurship education (EE) programs, especially at higher education (e.g., Karimi et al., 2016a; Muñoz et al., 2020; Stagias et al., 2021; Zhu et al., 2020).

From a cognitive psychology perspective, scholars have described OI as a multi-step creative process (Dimov, 2007) that includes at least two underlying stages: idea generation and idea evaluation (Vogel, 2017). The idea generation stage entails retrieving and combining various elements of existing knowledge to create new business ideas (Canavati et al., 2021; Vogel, 2017), a process that utilizes divergent thinking skills (Gielnik et al., 2012). As with other creative tasks, the primary objective during this divergent thinking stage is to generate as many original ideas as possible (Puccio et al., 2020). However, not all generated ideas are viable entrepreneurial opportunities and have the potential to develop into successful businesses (Canavati et al., 2021). For an idea to be perceived as an entrepreneurial opportunity, it must successfully pass the idea evaluation stage (Baručić & Umihanić, 2016; Girotra et al., 2010). During this phase, individuals engage in a convergent thinking process (Berg, 2016) to select ideas with a higher chance of being a successful product or business upon realization (Eling et al., 2015; Mendoza-Abarca & Parry, 2017).

The idea evaluation process is typically carried out intuitively by expert entrepreneurs without the need for additional support (Baron, 2006). However, this cognitive process can be challenging for individuals with limited or no entrepreneurial knowledge and experience, as is the case in most EE programs (Mei & Symaco, 2020). The lack of knowledge and experience limits their ability to accurately identify and evaluate potentially valuable opportunities (Baron & Henry 2010; Ucbasaran et al. 2003). Therefore, to effectively enhance OI capability, it is essential for EE programs to extend their focus beyond simply facilitating divergent thinking and provide support to improve convergent thinking outcomes as well (McMullen & Kier, 2017). As Cropley (2006) correctly pointed out, divergent thinking not guided by effective convergent thinking risks producing “reckless novelty”.

To date, many studies have demonstrated that training can enhance divergent thinking outcomes in relation to OI by improving the number of generated ideas (DeTienne & Chandler, 2004; Promsiri et al., 2018; Shepherd & DeTienne, 2005) and their originality (Cohen et al., 2020; DeTienne & Chandler, 2004; Shepherd & DeTienne, 2005). However, relatively less attention has been paid to identifying support mechanisms that can enhance individuals' convergent thinking outcomes, helping them effectively select those with higher potential for successful business ventures in the future (Karimi et al., 2016a). To address this research gap, the current study aims to investigate the effects of techniques, namely (1) describing evaluation criteria and (2) presenting an exemplar, on business idea evaluation performance during the OI process.

This paper is organized as follows: The next section offers a detailed review of the relevant literature, establishing a theoretical framework that underpins this study. Subsequently, an empirical study using a 2x2 factorial design will be conducted in a university setting to identify the optimal approach for implementing these supports in order to enhance an individual's ability to evaluate business ideas effectively.

5.2. Theoretical Framework

Entrepreneurship and its associated processes revolve around various evaluative decision-making activities (De Winnaar & Scholtz, 2020), which can be undertaken using an intuition- and/or criteria-based approach (Pina E Cunha, 2007; Williams & Wood, 2015). The intuition-based approach allows for quick evaluations based on gut feelings, serving as a broad filter for business idea evaluation (Williams & Wood, 2015). However, this approach is highly dependent on the evaluator's expertise (Magnusson et al., 2014), and is, therefore, less fruitful for individuals with limited or no entrepreneurial knowledge and experience (Baron & Ensley, 2006). The lack of entrepreneurial knowledge and experience may cause novices to place more emphasis on general attributes such as originality, newness, or personal excitement (Baron & Ensley, 2006). Nonetheless, these attributes do not necessarily assure that the (business) idea would become useful and successful in real-world application (Levitt, 2002; Rietzschel et al., 2019).

To address the challenges novices face with intuition-based evaluation, scholars have proposed the use of criteria-based evaluation (Pryor et al., 2016; Shepherd et al., 2017). This approach encourages individuals to engage in a deeper, more deliberate, and rational evaluation process (Williams & Wood, 2015), guided by specific and well-defined evaluation criteria (Magnusson et al., 2014). These criteria serve as "standards" (Mumford et al., 2002) that determine the viability of a business idea and help

assess the uncertainties associated with its implementation (Dimov, 2007). Moreover, they provide a framework or set of measures for comparing and rating different ideas based on their quality (Dean et al., 2006).

However, scholars have asserted that evaluation criteria are context-dependent (Panadero & Jonsson, 2020) and may vary depending on the purpose and stages in which they are applied (Magnusson et al., 2014). Furthermore, evaluation criteria often involve complex tacit knowledge, posing challenges for individuals to fully grasp their underlying meaning (Hawe et al., 2021). Therefore, it is crucial to establish clear definitions of the criteria before initiating the evaluation process (Messerle et al., 2013). In this regard, Sadler (1989) proposed two approaches to defining evaluation criteria in his seminal paper: (1) describing evaluation criteria and (2) presenting an exemplar. Next, each approach will be explained in more detail.

5.2.1. Describing Evaluation Criteria

Most scholars agree that idea quality is a combination of two criteria: originality and appropriateness (also referred to as usefulness or utility) (Atakaya et al., 2022; Nijstad et al., 2010; Runco et al., 2005; Stroebe et al., 2010). Originality is defined as the extent to which an idea departs from existing paradigms and practices (Puccio & Cabra, 2012). However, this criterion alone is not a sufficient indicator of a quality idea. An idea could be highly original but fail to effectively address the problem at hand, making it inappropriate and useless (Runco & Acar, 2012). For instance, the idea of creating giant mirrors to reflect sunlight back into space to combat global warming may initially seem highly original. However, this solution does not address the underlying reasons for global warming. Moreover, the production, launch, and maintenance of such mirrors could be astronomically expensive and resource-intensive. Thus, idea quality should be seen as a trade-off between the degree of originality and the level of appropriateness in addressing the problem (McCarthy et al., 2018).

Nevertheless, research findings suggest that novices often exhibit a strong tendency to prioritize personal desirability over the essential evaluation criteria mentioned above, both in the context of entrepreneurship (Baron & Ensley, 2006) as well as in other contexts (Rietzschel et al., 2010). A potential solution to address this challenge can be prompting individuals with descriptive statements that highlight the key aspects of each criterion, specifying the specific elements and characteristics that should be present or absent and considered correct or incorrect (Sadler, 1989). To date, no study has examined the impact of such support on business idea evaluation outcomes. However, insights from related fields, such as new product development, offer valuable insights. Martinsu and Poskela's (2011) study demonstrated that the use of clearly defined evaluation criteria in the early stages of product evaluation plays a significant

role in enhancing the product's competitive and business potential. Similarly, Na et al. (2008) found that providing evaluation criteria for designs positively influences consumers' assessment of product quality. Furthermore, Eling et al. (2015) revealed that the provision of explicit evaluation criteria can substantially improve the quality and speed of evaluative decision-making processes during new product development.

5.2.2. Presenting an Exemplar

Descriptive statements can provide some clarity to evaluation criteria, but they may still contain abstract information that individuals struggle to fully comprehend (Brookhart, 2018). To overcome this challenge, scholars across various disciplines propose the use of exemplars as a means to facilitate evaluative decision-making (e.g., Bouwer et al., 2018; Carless et al., 2018; Chong, 2021; Hendry & Anderson, 2013). Exemplars are pedagogical tools that hold the potential to assist individuals in grasping implicit standards (To et al., 2022). They are defined as "key examples chosen so as to be typical of designated levels of quality or competence" (Sadler, 2005, p.192). For expert entrepreneurs, these exemplars resemble mental prototypes that have been developed and refined over time through experience (Baron & Ensley, 2006). These prototypes serve as a mental model of ideal opportunities (Williams & Wood, 2015), automatically retrieved from memory when confronted with a new idea (Scheibehenne et al., 2015), enabling expert entrepreneurs to promptly evaluate its quality by comparing the idea to the ideal opportunity (Baron, 2006).

However, novices often do not possess such well-developed mental prototypes, which is why presenting them with exemplars can enhance their tacit understanding of idea quality, making the evaluation criteria more tangible for them (Bouwer et al., 2018). Thus far, studies have demonstrated the positive impact of presenting exemplars on novices' ability to judge the quality of a scientific report (Yucel et al., 2014), understanding of task requirements (Hawe et al., 2017), confidence with marking criteria (L. Jones et al., 2017), evaluative knowledge and skill (Hawe et al., 2021), and evaluative judgment (Chong, 2021). However, to date, no studies have investigated the effect of exemplars on business idea evaluation outcomes. Additionally, there is a lack of empirical research disentangling the combined effect of both support mechanisms, i.e., describing evaluation criteria and presenting an exemplar, on the quality of evaluative decision-making outcomes (To et al., 2022).

The current study aims to address the aforementioned shortcomings in the literature regarding the two common techniques to define evaluation criteria and conduct an empirical study to answer the following research question:

- *What is the impact of describing evaluation criteria and presenting an exemplar on university students' ability to discern original business ideas with higher appropriateness within their idea pools?*

5.3. Method

5.3.1. Participants

In the present research study, 80 students—comprising both undergraduate (BSc) and postgraduate (MSc) cohorts—were involved. These students were enrolled in a variety of BSc or MSc programs related to food science and agriculture and all were participating in a university course specifically designed to inform them about future career possibilities. The students were randomly assigned to four conditions: Control (N = 20), Exemplar (N = 20), Criteria (N = 20), and Both (N = 20). However, four students (*one* from the Control condition and *three* from the Exemplar condition) were unable to finish the tasks and were subsequently removed from the study, resulting in a total of 76 participants. Informed consent was obtained from all participants before the start of the study. In particular, they were informed that their results would be used in scientific research and that they could request their data to be excluded. However, no participant made such a request. In addition, ethical approval was received from the social sciences ethics committee of the associated university.

5.3.2. Study Design

This study used a 2x2 factorial design to compare the effects of providing criteria and/or an exemplar on students' abilities to evaluate business ideas. The four conditions in this design were as follows: Control (neither criteria nor exemplar provided), Exemplar, Criteria, and Both (exemplar and criteria provided). Participants were randomly assigned to these conditions and asked to evaluate three business ideas they had previously generated. The objective was to determine which form of support—criteria, exemplars, both, or neither—most effectively assisted the participants in accurately ranking the ideas.

5.3.3. Materials

5.3.3.1. The Ideation Hub

The Ideation Hub (https://ideation-hub.nl) is an online brainstorming platform that was specifically designed for this study to guide participants through a structured idea evaluation process and implement the proposed supports effectively. The platform could offer clear instructions on the task to be completed, enforce time limits, and, more importantly, provide tailored support for each condition. For instance, participants in the Exemplar condition were provided with two ideas that had been evalu-

ated and ranked by an expert before they started ranking their own ideas. Meanwhile, participants in the Criteria condition were given an explanation of the criteria they needed to consider while ranking their ideas.

5.3.3.2. Evaluation criteria

The participants in the Criteria and Both conditions were provided with a brief explanation of the originality and appropriateness criteria, adapted by the researcher to align with the study's context. In particular, in line with previous studies in the context of entrepreneurship (e.g., Khalid & Sekiguchi, 2018; Prandelli et al., 2016), the appropriateness of business ideas was treated as a multifaceted criterion encompassing different aspects, namely, problem-solution fit and feasibility (see Table 5-1 for more details).

Table 5-1. The explanation of idea evaluation criteria

Criterion	Sub-criterion	Explanation	Source(s)
Originality	-	Originality in business ideas refers to their degree of innovation. This could range from ideas that show little to no novelty, closely resembling existing products or services, to those that represent pure invention, introducing completely new products or services to the world.	DeTienne & Chandler (2004)
Appropriateness	Problem-solution fit	The idea (i.e., a new product, service, or process) must solve the identified problems, so there must be a "match" between what the idea would produce and what the problem is.	Grégoire et al. (2010)
	Feasibility	The idea might be a great one, but if it is beyond current technologies or requires a lot of money, it will be challenging to develop the product or service and also challenging to convince the target market. The idea must therefore be functionally possible in the foreseeable future.	Grégoire et al. (2010)

5.3.3.3. Exemplar

Two business ideas were selected to be evaluated and ranked by an expert (See Table 5-2). These ideas varied in their nature and degree of impact, facilitating participants' understanding of their differences and the rationale behind their ranking. An expert in the entrepreneurship field, with extensive experience in facilitating student start-ups, ranked the ideas and provided explanations based on the evaluation criteria without directly referencing them. This approach was employed to prevent revealing the evalu-

ation criteria to the participants in the Exemplar condition. Instead, they were able to learn how to support their own rankings by reading those created and evaluated by the expert.

Table 5-2. Two business ideas evaluated and ranked by an expert

Idea 1. *A company offering an app that lets people rent cars by the hour. Users can find a car close to them, unlock it with the app, and start driving right away.* This business idea is like having a car without the need to buy one, which could be useful in big cities where owning a car can be expensive and inconvenient. This service could help decrease the number of cars in the city, which could help the environment. However, it might be difficult to manage because the company would have to take care of things like making sure the cars are in good condition, dealing with insurance, making sure the cars are safe to use, and developing a user-friendly app.
Idea 2. *A business that takes old fabrics and turns them into hand-made rugs.* This idea involves reducing waste by reusing materials that would otherwise be thrown away. This business would offer customers the opportunity to own a unique rug while also contributing positively to the environment. However, the business might face several challenges. These include sourcing enough high-quality materials, establishing a reliable network with fabric-waste suppliers, and ensuring the consistent quality of the rugs.
Ranking: Between these two, the car rental app, despite its operational complexities, holds significant potential to reshape urban mobility and has a broader impact by reducing the number of privately owned cars and associated emissions. The textile repurposing business, while unique and environmentally conscious, has a relatively lower impact and may face more hurdles in establishing its market position due to the prevalence of cheaper alternatives.

5.3.4. Procedure

The study was conducted in September 2022 in a university course at WUR, with prior permission from the course lecturer. To preserve the anonymity of the participants, each individual was randomly provided with a unique username and password to access the online platform. Participants were asked to use their personal laptops for this study. In the beginning, the lead author and his colleague explained all the procedures and the features of the online platform to the participants and made sure everyone knew how to log in.

The initial task for participants across all conditions was to generate business ideas that could address sustainability issues in an online hybrid (individual and group) brainstorming session. The ideas generated by each participant subsequently served as input for the idea evaluation task. This approach aligns with previous research, showing that individuals perform more accurately when evaluating their own ideas compared to those generated by others (van Broekhoven et al., 2022). Following the idea generation phase, participants were instructed to begin evaluating their ideas. First, they were allotted *3 minutes* to select their top three ideas from those they had generated earlier. Subsequently, depending on the condition assigned, participants received specific instructions and were prompted to rank their ideas from 1 (highest quality idea) to 3 (lowest quality idea). It is important to note that the selection of ranking as an idea evaluation method in this study was guided by its adaptability

and consistent applicability across all four conditions. In some conditions, such as Control and Exemplar, the nature of the interventions made it challenging for the participants to assign scores to ideas. However, ranking remained a viable method of idea evaluation under all conditions, thereby enabling comparability of evaluation outcomes among the different conditions. Moreover, research has indicated that when a limited number of ideas are being evaluated - as in this study - ranking proves to be as effective and accurate as scoring, which is often seen as a stricter evaluation method (Cui et al., 2019).

Participants were allotted *10 minutes* in total to read the provided information, rank their top three ideas, and submit their rankings through the online platform. The overall procedure followed by all participants in the various conditions is outlined in Figure 5-1.

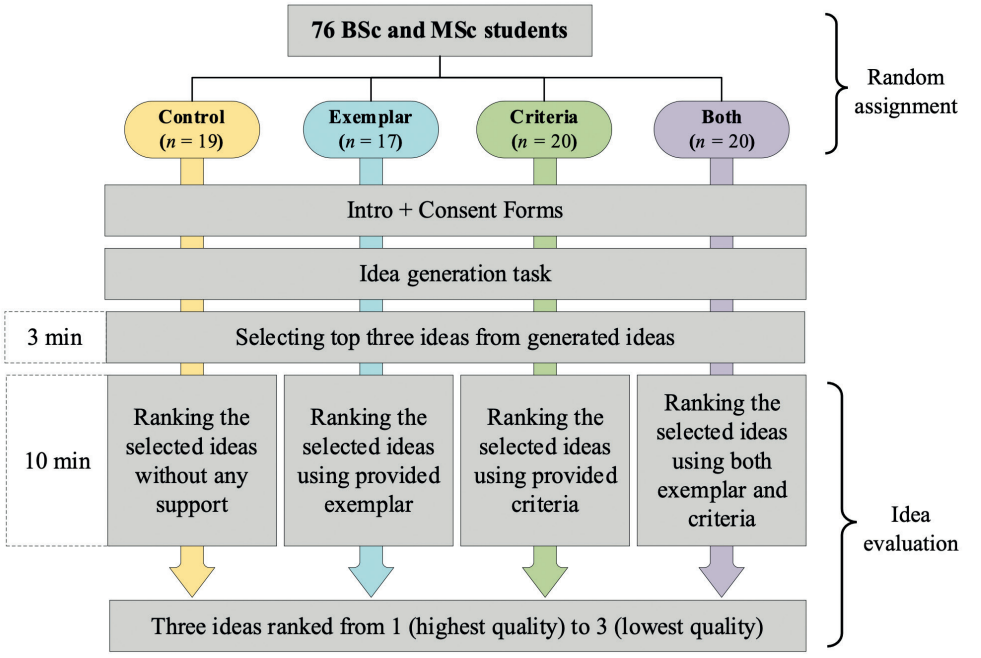

Figure 5-1. The procedure followed per condition

5.3.5. Analysis

5.3.5.1. Ranking ideas by experts

The top three ideas selected by each participant were evaluated by two experienced academic scholars in entrepreneurship, who had extensive experience in teaching entrepreneurship courses and assessing students' business ideas. First, each scholar

independently rated the ideas based on three criteria: originality, problem-solution fit, and feasibility. The originality of ideas was determined using DeTienne and Chandler's (2004) 6-point scale based upon the following categories: (1) no apparent innovation or not enough information to decide; (2) a product or service identical to an existing product/service offered to an underserved market; (3) a new application for an existing product/service, with little/no modification or a minor change to an existing product; (4) a significant improvement to an existing product/service; (5) a combination of two or more existing products/services into one unique or new product/service; and (6) a new-to-the-world product/service, a pure invention or creation. Additionally, the scale developed by Grégoire et al. (2010) was used to assess the ideas' problem-solution fit and feasibility on a five-point Likert scale. Next, the evaluations provided by the two scholars for each criterion were averaged to obtain composite scores, which were then used to rank the ideas. These rankings were subsequently utilized to investigate the impact of the provided supports in different conditions on the participants' accuracy in ranking their own ideas.

5.3.5.2. Statistical tests

In order to evaluate the accuracy of participants in ranking ideas across different conditions, their rankings were compared with expert rankings. This comparison was conducted by calculating Spearman's rho for each participant. Spearman's rho is calculated by a nonparametric test that examines the monotonic relationship between two ranked variables, in this case, the rankings of participants and experts (Akoglu, 2018). A high positive correlation indicates a strong agreement between the two sets of rankings, suggesting that participants accurately ranked their ideas in a manner consistent with the experts. On the other hand, a low or negative correlation would indicate a lack of agreement or accuracy in the rankings.

In addition, a one-way analysis of variance (ANOVA) was conducted to explore the impact of the provided support in different conditions on the correlation between participants' rankings and expert rankings. Before conducting the ANOVA, standard checks were performed to ensure that the assumptions of homogeneity and normality were met for all data sets. The results indicated that the conditions exhibited homogeneity and the data were normally distributed ($p > .05$) in all cases. Subsequently, the ANOVA test was performed to determine whether there were significant overall differences among the various conditions in terms of correlation between participants' and experts' rankings. Following the ANOVA, post hoc pairwise comparisons were conducted to identify specific significant differences between the conditions, employing Bonferroni corrections to account for multiple comparisons (Field, 2011).

5.4. Results

The Spearman's rho calculation was conducted to assess the correlation between students' and experts' rankings across various conditions. The results indicated a moderate, positive correlation in the Both condition (ρ = 0.57), followed by the Criteria condition (ρ = 0.40). However, no correlation was observed between students' and experts' rankings in the Control and Exemplar conditions (see Table 5-3).

Table 5-3. Means, adjusted means, and ANOVA results

Dependent V.	Condition	n	M (SD)	Adj. M (SE)	95% CI		*F (df1, df2)*	*p**	*η2*
					LB	UP			
Spearman's rho	Control	19	-.09 (.72)	-.09 (.17)	-.42	.25	3.25 (3, 72)	.027	.12
	Exemplar	17	.07 (.84)	.07 (.18)	-.29	.42			
	Criteria	20	.40 (.77)	.40 (.16)	.08	.73			
	Both	20	.57 (.59)	.57 (.16)	.24	.89			

Note. *p < .05

In addition, the results of the ANOVA test revealed a statistically significant difference between the conditions regarding the correlation between the participants' and experts' ranking of the ideas. Therefore, further analysis was conducted to locate the significant differences using pairwise comparisons with the Bonferroni correction to control for the type I error (i.e., false positive). As presented in Table 5-4, the results revealed that the average correlation between the rankings of participants and experts in the Both condition (*Adjusted M* = .57, *SE* = .16) was significantly higher ($p \leq .001$) compared to those in the Control condition (*Adjusted M* = -.09, *SE* = .17). Although the average correlation between the participants' and experts' rankings was relatively higher in the Criteria condition compared to the Control and Exemplar conditions, the pairwise comparisons revealed that this difference was not significant.

Table 5-4. Pairwise comparisons

Dependent V.	Condition (I)	Condition (J)	*MD* (I-J)	*SE*	*p**	95% CI for Difference[b]	
						LB	UB
Spearman's rho	Control	Exemplar	-.15	.24	1.000	-.81	.51
		Criteria	-.49	.23	.248	-1.12	.15
		Both	-.65*	.23	.040	-1.29	-.02

Based on estimated marginal means

*The mean difference is significant at the .05 level.

b Adjustment for multiple comparisons: Bonferroni. *MD* = Mean Difference.

5.5. Discussion

"Quality is something I do not know how to define but I recognise it when I see it" (Sadler, 2013, p.4). This statement encapsulates an experience many individuals relate to and mirrors the intuitive manner in which expert entrepreneurs make evaluative judgments during the entrepreneurial process. They just know a good opportunity when they see it and do not have to engage in complex processing to reach this conclusion (Baron, 2006). However, for novices, the lack of experience and knowledge makes this process both challenging and time-consuming. As a result, it is crucial to identify techniques that may facilitate novices' evaluative decision-making about the quality of work in a given context (Tai et al., 2018). Addressing this need, the current study explored the effects of two techniques, namely (1) describing evaluation criteria and (2) presenting an exemplar, on students' capability to evaluate the quality of their ideas generated during the OI process.

In alignment with previous research (Eling et al., 2015; Martinsuo & Poskela, 2011; Na et al., 2008), this study found that describing evaluation criteria could assist students in evaluating their business ideas. Specifically, the findings indicated that students in the Criteria condition outperformed those in the Control and Exemplar conditions in terms of a higher positive correlation between students' ranking and those of experts. However, students in the Criteria condition still performed less accurately in idea evaluation compared to those who received both a description of evaluation criteria and an exemplar. Additionally, the study revealed that the average correlation between students' and experts' rankings was only significantly different in the Both condition compared to the Control condition, whereas differences among other conditions were not significant. These findings imply that providing exemplars in conjunction with describing evaluation criteria is an optimal approach to support students' ability to evaluate their business ideas, corroborating previous studies in other contexts (Bacchus et al., 2020; Hendry & Anderson, 2013).

The findings regarding the superiority of providing exemplars in conjunction with describing evaluation criteria can be due to the role of exemplars in improving "internal feedback" mechanisms. When presented with evaluation criteria, individuals typically engage in self-monitoring, comparing their performance with the provided criteria (Hawe et al., 2021). Through these comparisons, they generate internal feedback about how well their work meets the expected and/or desired standards (Nicol & Macfarlane-Dick, 2006). The generation of such feedback is best facilitated when relevant exemplars are provided alongside the criteria (Hawe et al., 2021). These exemplars help individuals to more accurately grasp task requirements and differentiate quality across various levels (To et al., 2022). Supporting this, Hendry and Anderson

(2013) showed that the combination of essay exemplars and marking guides gave students a clearer understanding of the expected standards for writing a quality essay. This improved understanding has been shown to play a significant role in enhancing students' performance in assessment tasks (Bacchus et al., 2020; Colvin et al., 2016).

In addition, the superiority of the Both condition over other conditions might be attributed to the exemplars' function as "scaffolding" (Carless et al., 2018). The term "scaffolding" was first introduced by Wood et al. (1976) to describe the process by which a more knowledgeable person assists a learner in accomplishing tasks that are beyond their reach. This concept was quickly embraced by education researchers, and its application gradually extended to situations where support is offered by a more capable peer, learning material, or both (Mulder et al., 2016). In the context of evaluating ideas, when individuals have access to carefully chosen exemplars it is akin to receiving scaffolding in the form of learning material. Evaluation criteria as a supporting mechanism are often presented as explicit knowledge through descriptive statements (Bacchus et al., 2020), but comprehending some of them necessitates both explicit and tacit (implicit) knowledge (Bell et al., 2013). Tacit knowledge represents the kind of knowledge that is built up through practice over time (O'Donovan et al., 2008) and thus is "difficult to transfer verbally or in writing" (Carless & Chan, 2017). A promising approach to address this difficulty is to "illustrate dimensions of quality" (Carless et al., 2018, p. 108). Here, exemplars could be seen as supporting learning material that would scaffold individuals to better grasp the meaning behind each criterion (Chong, 2019). They may not only illuminate the core elements of an evaluation task but also demystify the thought processes of experts (Carless et al., 2018; Jones et al., 2017), thus facilitating the transfer of tacit knowledge associated with the evaluation criteria to learners (Bouwer et al., 2018; Chong, 2021).

5.6. Conclusion and Implications for Practice

This study sought to identify a technique to enhance students' evaluation of business ideas in EE courses. In doing so, it addresses an ongoing demand for empirical research on how to enhance convergent thinking in the OI process. The findings revealed that providing students with a detailed description of evaluation criteria can help them better evaluate the quality of ideas. This positive effect becomes even more pronounced when the exemplars, in the form of business ideas evaluated and ranked by an expert, are provided alongside the evaluation criteria. These findings have significant implications for practitioners aiming to organize effective EE courses in improving OI capability. They indicate that similar to divergent thinking, students' convergent thinking can be improved using appropriate techniques. One approach involves explicitly informing students about "*what*" constitutes quality in the given

context by sharing the relevant evaluation criteria and illustrating "*how*" to apply them as an expert using an exemplar.

There are two critical considerations when using such exemplars to support evaluative decision-making. First and foremost, the exemplars must distinguish between particular qualities listed as criteria and demonstrate how to determine high-quality work in which the "various qualities contribute in concert" (Sadler, 2005, p.135). In short, they should clearly illustrate the nuanced understanding of quality that experts have when making such evaluative decisions. Second, it is crucial to recognize that evaluative decision-making is contextual; what constitutes quality, and what a decision may look like, will depend on the setting in which the evaluative decision is made (Tai et al., 2018). Research has shown that novices might feel confused and overwhelmed by cognitive demands when exemplars differ from the set task (Hawe et al., 2019). Consequently, effective exemplars should closely align with and mirror the context and nature of the evaluation task. For instance, in business idea evaluations, the criteria should pertain to "business" ideas rather than concepts unrelated to the business context. Additionally, if the primary objective is to determine quality through ranking ideas, the exemplar should also include information on how an expert ranked ideas based on their quality.

5.7. Limitations and Avenues for Future Studies

The study presents some limitations that pave the way for future research. First, the findings indicate that providing evaluation criteria along with an exemplar can significantly assist students in ranking their ideas based on quality. However, such short-term outcomes offer a limited perspective on the effectiveness of EE programs and the support provided. In other words, the findings do not necessarily indicate that students developed evaluation skills beyond the aid of such support. As such, additional research is required to explore the long-term impacts of such support, determining whether students can evaluate independently. Furthermore, while students' conception of quality might be enhanced by engaging with evaluation criteria and exemplars, not all facets of quality can be conveyed through these learning activities; some aspects may still remain tacit and embodied (Hudson et al. 2017). Therefore, it is crucial to undertake studies exploring the extent to which students' conception of quality has evolved as a result of such training.

Second, the findings of the current study suggest that merely providing students with an exemplar does not enhance their performance in business idea evaluation. The exemplar could only improve their performance when it was delivered in conjunction with explicit evaluation criteria. This implies that the use of exemplars in developing

evaluative judgment necessitates a delicate balance, where students are effectively scaffolded to understand the tacit aspects of quality (Tai et al., 2017). One approach, as demonstrated in this study, is to provide students with exemplars and criteria, requiring them to interpret both independently before doing the main evaluation (e.g., Lipnevich et al., 2014). However, a recent systematic review conducted by To et al. (2022) suggests there are other, potentially more effective, scaffolding approaches. One involves the deconstruction of criteria before analyzing an exemplar (e.g., Jones et al. 2017), and another requires students to co-construct criteria with peers/teachers after exemplar analysis, inspired by social constructivist models of assessment (e.g., Ayalon & Wilkie 2020). Future studies could explore and compare the effects of various scaffolding approaches using exemplars on students' business idea evaluation performance.

Third, the primary focus of this study was on the pre-evaluation stage, where individuals received various forms of support before initiating the main evaluation. However, driven by social constructivism, scholars assert that understanding assessment processes, criteria and standards requires active student participation in structured learning activities (Rust et al., 2005). This entails students applying what they have learned to the set task and receiving feedback on their performance from a more knowledgeable other (Chong, 2019; Smyth & Carless, 2021). For instance, scholars argue that while exemplars provide "ideal" examples of quality, they do not necessarily promote learning (Jones et al., 2017). It is the subsequent dialogue, resulting from relating these examples to criteria and using them in the main task, that facilitates learning (Handley et al., 2013; Bloxham & Campbell, 2010). Such dialogue can include peer- and/or teacher feedback which illuminates the current state of students' evaluative decision-making and improves their evaluation performance by guiding them through the Zone of Proximal Development (Chong, 2019). A future study is needed to examine whether such subsequent dialogue in the forms of peer- and/or teacher feedback can improve the positive effect of the provided support on students' business idea evaluation. Moreover, additional research can seek to identify ways to facilitate effective feedback throughout the process, such as by tapping into the potential of computer-supported learning environments.

5

CHAPTER

6

Summarizing Conclusions and General Discussion

6.1. Introduction

This final chapter summarizes and integrates the results of the studies described in the preceding chapters. While the results of each study are individually discussed in Chapters 2 to 5, this chapter delves deeper by examining the main findings in the context of the existing literature, methodology, potential research directions, and practical implications. To achieve this, the initial section provides a recap of the primary findings and revisits how the presented studies have addressed the research questions posited in the introduction. Special emphasis is placed on the limitations of the studies within this research project, the contributions of this work to the scientific discourse on fostering opportunity identification (OI) capability, and recommendations for designing constructively aligned entrepreneurship education (EE) programs in higher education that effectively nurture this capability. Taking these contributions and limitations into perspective, an agenda is crafted for future research endeavors.

6.2. Overview of Main Findings

As highlighted in Chapter 2, a conceptual study was conducted to address the following question: *What are the most appropriate teaching and learning theories aligned with the opportunity discovery and creation perspectives on business opportunities?* This dissertation is built on the well-supported premise that to design a learning environment effective in fostering OI capability, it is pivotal for EE course designers and educators to consider their philosophical stance on entrepreneurial opportunities—specifically, whether they perceive these opportunities as arising from a discovery and/or creation process. Such philosophical perspectives are crucial in designing a constructively aligned EE program where the chosen teaching and learning approaches align well with the adopted philosophical perspective (Fayolle & Gailly, 2008). In light of this, an extensive review of the existing literature was conducted, focusing on various philosophical perspectives concerning entrepreneurial opportunities. The literature review facilitated the integration of the two primary perspectives with the most compatible learning theories in the field of education, based on their shared ontological and epistemological assumptions. This integration provided entrepreneurship educators and researchers with a theory-driven conceptual framework, demonstrating which learning theory better underpins and supports each perspective (see Figure 6-1).

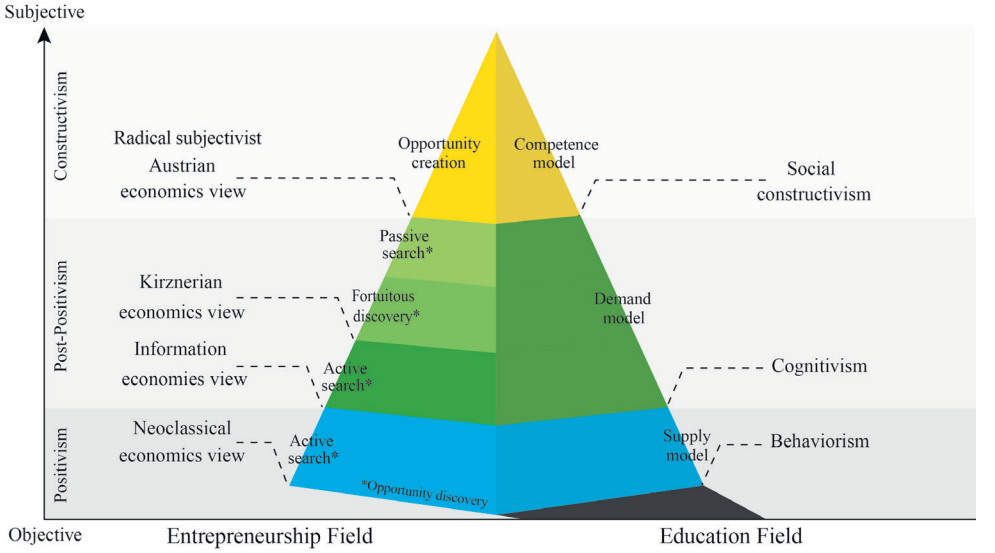

Figure 6-1. The proposed conceptual framework for bridging the entrepreneurship and education field

As shown in Figure 6-1, comparable developments are observable in both fields – from a strong focus on the object and the content (as in "Neoclassical economics view of active search' and 'behaviourism') towards a strong emphasis on the person (as in 'opportunity creation' and 'social constructivism'). As such, the process in which opportunities are identified – shaped, refined, and acted upon in the co-creation process – increasingly becomes the main point of attention, instead of the opportunity itself as a (static) outcome of the OI process.

In general, the results of the conceptual study detailed in Chapter 2 suggest that philosophical perspectives, views on opportunities, and learning theories do not exclude one another but can exist next to each other. This is consistent with the argument put forth by many scholars, positing that in a real entrepreneurial process, both active and passive search strategies (Baron, 2006), discovery and creation perspectives (Alvarez & Barney, 2010; Short et al., 2010), or causation and creation approaches (Chandler et al., 2011; Maine et al., 2015) play a role in identifying opportunities. This also applies to the teaching approaches that educators employ to foster OI capability. The behaviourist teaching approaches within an EE program could provide individuals with theoretical information and procedural knowledge about the topic at hand (Bell, 2021), forming a solid ground for higher-order social constructivist approaches (Bell & Bell, 2020). This view also aligns with Béchard and Grégoire's (2005a) hybrid teaching models for EE.

The framework outlined in Chapter 2 allows EE course designers and educators to make informed decisions regarding the teaching approaches adopted in courses aimed at fostering OI capability at the ontological level. However, in a constructively aligned learning environment, there must be also an alignment between the chosen teaching approach(es) and other essential components at the educational level. These components include learning objectives, individual and environmental characteristics, measurement approaches, and curricular content. That is why this research project shifted its focus from the ontological to the educational level, particularly in Chapter 3, to delve deeper into this topic by providing an answer to this question: *Based on the current state of the art, what factors influence and constitute the outcomes of EE programs aimed at fostering university students' OI capability?* This question was addressed by conducting a systematic review of empirical literature from the past 22 years, using Fayolle and Gailly's (2008) generic teaching model framework to consolidate findings into a single, evidence-informed framework.

The primary objective of the systematic literature review was to extract factors that influence and determine the outcomes of EE programs designed to enhance university students' OI capability. These factors were derived from the reviewed publications and categorized into five inter-related components of a constructively aligned EE course based on Fayolle and Gailly's (2008) model, leading to the proposal of an evidence-based framework for developing EE programs aimed at fostering OI capability (see Figure 6-2).

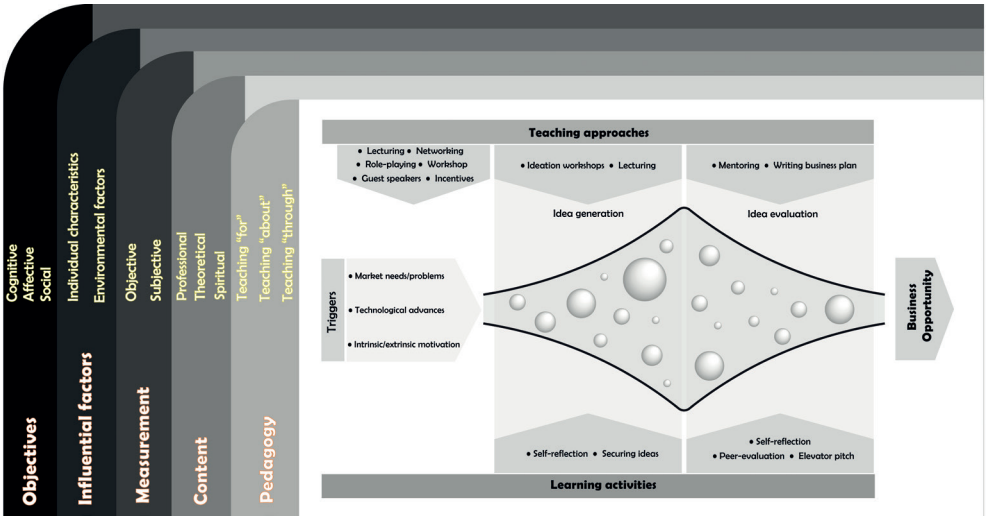

Figure 6-2. The proposed framework for developing EE programs aimed at fostering OI capability

At its core, the proposed framework suggests that improving OI capability requires viewing OI as a multi-stage process. The synthesis of empirical findings showed that OI capability is supported by an array of cognitive processes that occur in three distinct but non-exclusive stages, i.e., *triggering*, *idea generation*, and *idea evaluation*. Therefore, for the comprehensive development of OI capability, intervention strategies should be provided to help individuals successfully navigate through these three stages. These strategies have been thoroughly discussed in Chapter 3 in terms of various learning objectives tailored to support relevant cognitive processes at each stage, individual characteristics, and environmental factors that influence the achievement of these objectives, the appropriate measurement approaches, diverse content to enrich the teaching process, and appropriate teaching approaches to help individuals achieve the targeted objectives.

The results of the systematic review study indicated that, whether triggered by market pull (existing problems in the market, aligning with the Kirznerian perspective), resource push (knowledge of technological changes, aligning with the Schumpeterian perspective), and/or a strong desire to start a business, an EE course effective in improving OI capability should guide individuals toward the idea generation stage. In addition, the results indicated that enhancing creativity was the primary objective targeted at this stage in the reviewed studies, with traditional brainstorming (interactive, group ideation) being the common teaching approach to stimulate creativity. These findings served as an incentive to narrow down the focus to the "how" component under the educational level in Chapter 4, exploring how to design brainstorming sessions to effectively facilitate business OI in EE programs.

As outlined in Chapter 4, the aim of the first empirical study of this research project was to answer two key research questions: *(1) What is the impact of providing SCAMPER prompts during a hybrid brainstorming on the originality of the business ideas generated, as opposed to brainstorming without any additional support? (2) What is the impact of sharing individually generated ideas with group members during a hybrid brainstorming on the originality of the business ideas generated, compared to the condition where sharing individually generated ideas is not facilitated?.* The motivation for this study stemmed from observations that, while hybrid (individual and group) brainstorming sessions have been identified as a more effective alternative to traditional brainstorming in generating a higher quantity of ideas, they do not significantly elevate the quality of ideas compared to those generated in solely individual or group setting (Korde, 2014; Korde & Paulus, 2017; Paulus et al., 2015). Therefore, guided by Nijstad et al.'s (2010) Dual Pathway to Creativity Model (DPCM), the first empirical study sought to identify an instructional design model for organizing hybrid brainstorming sessions, resulting in ideas of higher "originality" — an essential aspect of divergent thinking

outcomes, as mentioned by Guilford (1950). To achieve this, the study tapped into the potential of computer technologies and empirically examined the impact of two computer-mediated supports — the SCAMPER prompts and the sharing of individually generated ideas — on the originality of business ideas generated during an online hybrid brainstorming session.

To answer the above research questions, a quasi-experimental study was conducted with 94 Bachelor's and Master's students who participated in two university courses. The students were randomly assigned to three conditions (Control, Experimental 1, and Experimental 2) in which they were all tasked with generating business ideas to address the real-life issue of sustainability in an online hybrid brainstorming (https://ideation-hub.nl). Unlike the laboratory settings observed in previous studies on the topic (e.g., Göçmen & Coşkun, 2019; Rietzschel et al., 2007), this study was conducted in a real educational setting as part of a university course. This approach aimed to enhance the external validity of the results, thereby making them more generalizable to similar real-world educational contexts. Moreover, the focus on generating business ideas pertinent to real-life challenges increased the relevance of the findings to the entrepreneurship field, serving as the central focus of this research project.

The results revealed that the SCAMPER prompts are effective in supporting the individual brainstorming phase, assisting participants in generating ideas with higher originality. This positive effect could be attributed to the potential of this technique to foster a deeper, more concentrated, and systematic exploration (Moreno et al., 2016). This in turn may activate the persistence pathway, leading to more original outcomes, as suggested by Nijstad et al. (2010) in their DPCM. However, further analysis indicated that the positive impact of the SCAMPER prompts on idea originality was not mediated by any of the pathways proposed by the DPCM, including the persistence pathway. Such a finding could be due to either the limited time students had to apply the technique – considering that the time participants invest in systematically exploring a limited number of idea categories is crucial when navigating through the persistence pathway (Nijstad et al., 2010) – or the possibility that SCAMPER prompts might influence originality through a pathway other than those proposed by the DPCM. This could include, for instance, "the synthetic pathway" proposed by Acar and Runco (2015) in their Theory of Literal Divergent Thinking.

Moreover, the study demonstrated that sharing individually generated ideas during the group phase has a significant impact on the originality of collaboratively generated ideas as well as those generated in the subsequent individual phase. However, the analysis of idea flexibility suggested that the mechanisms through which the intervention influenced originality during the group and final individual phases might be

different. The time constraints during group brainstorming seemed to hinder students from drawing inspiration from all shared ideas and generating ideas with significantly higher flexibility than those in the condition where no idea was shared. Nonetheless, as highlighted by the provided brainstorming rules, they could potentially collaborate and merge some of the shared ideas into new ones with greater originality. In contrast, during the final individual brainstorming, the so-called "group-to-individual transfer of learning" (Laughlin & Barth, 1981) appeared to account for the generation of ideas with high flexibility. In this subsequent phase, students had sufficient time to reflect on what they had learned during group work and to benefit from new cognitive associations formed as a result of shared ideas. This might have helped them generate ideas with higher flexibility. Further analysis showed that such increased flexibility correlated with the generation of ideas with higher originality, providing support for Nijstad et al.'s (2010) DPCM.

Chapter 4 responds to an ongoing demand for empirical research on improving brainstorming quality (Maaravi et al., 2021) and a recent call to examine the DPCM empirically in authentic contexts, specifically when addressing real-life problems (Nijstad et al., 2021). The empirical study outlined in this chapter provided new insight into how to design effective and theory-informed brainstorming sessions, superior not only in generating a high quantity of ideas but also ideas with higher originality. However, as highlighted in the framework proposed in Chapter 3, an optimally designed course to foster OI capability does not conclude at this point. As a sign of strong OI capability—similar to that of expert entrepreneurs— students should also be able to discern ideas with higher appropriateness within their idea pool. This is defined as those ideas with higher problem-solution fit and feasibility in the entrepreneurship field (Khalid & Sekiguchi, 2018; Prandelli et al., 2016). Making such evaluative judgments requires extensive entrepreneurial knowledge and experience, often lacking among university students. Therefore, further research should explore support strategies for them during the convergence phase of the OI process, where they must select only a few ideas from their idea pool with the highest potential to be a successful business in the future.

Chapter 5 addresses the following research question: *What is the impact of describing evaluation criteria and presenting an exemplar on university students' ability to discern original business ideas with higher appropriateness within their idea pools?* This research question emerges from the pressing need to identify support strategies that enhance novices' convergent thinking skills (McMullen & Kier, 2017) and assist them in the evaluation of business ideas during the OI process (Karimi et al., 2016a). To this end, inspired by findings in other contexts, the second empirical study of this research project explored the effects of two techniques, namely (1) describing evaluation criteria

and (2) presenting an exemplar, on students' business idea evaluation performance. These techniques showed promising results in supporting evaluative judgment across various tasks such as educational assessment (Jones et al., 2017), product development (Eling et al., 2015), essay writing (Hendry & Anderson, 2013), and English writing (Chong, 2019). However, to date, no study explored their impact on business idea evaluation, either individually or in combination.

From the 94 students who participated in the previous empirical study, 80 students were guided toward the business idea evaluation stage to participate in an empirical study with a 2x2 factorial design. The four conditions in this design were as follows: Control (neither criteria nor exemplar provided), Criteria, Exemplar, and Both (criteria and exemplar provided). Participants were randomly assigned to these conditions and required to rank three of their own business ideas on the same online platform from 1 (highest quality idea) to 3 (lowest quality idea). To assess their business idea evaluation performance, their rankings were compared with those of two experts in entrepreneurship. The findings revealed that providing students with a detailed description of evaluation criteria can help them better evaluate the quality of ideas. This positive effect becomes even more pronounced when the exemplars, in the form of business ideas evaluated and ranked by an expert, are provided alongside the evaluation criteria. Despite expectations, the findings indicated that merely providing students with an exemplar does not enhance their performance in business idea evaluation. This might suggest that the use of exemplars in developing evaluative judgment necessitates a delicate balance, where individuals are effectively scaffolded to understand the tacit aspects of quality (Tai et al., 2017).

6.3. Strengths, Weaknesses, and Suggestions for Future Research

This research project employed a diverse set of studies, including a conceptual study, a review study, and two empirical studies to advance the EE field concerning the development of OI capability among university students. At this point, it is pertinent to discuss the strengths and weaknesses of this dissertation, as well as directions for future research.

The conceptual study was among the few that integrated insights from both the education and entrepreneurship fields to propose a conceptual framework for the EE field. In doing so, it addressed the call from scholars for a conceptual framework for EE that is not only strongly connected with its philosophical nature (Blenker et al., 2011; B. Jones & Iredale, 2010; Pittaway & Cope, 2007), but also emerges from the synthesis of insights from both the entrepreneurship and education fields (Fayolle, 2013). Furthermore, this research undertook a rigorous approach to develop the

framework, delving deep into the philosophical roots of both fields to discern shared ontological and epistemological viewpoints. These shared viewpoints played a pivotal role in meaningfully bridging the education and entrepreneurship fields, resulting in a conceptual framework that can effectively translate relevant aspects of learning theories into optimal teaching approaches to foster OI capability.

However, there are noteworthy limitations to the conceptual study. This study did not adopt a systematic literature review method in formulating the framework but instead focused on seminal works that explored diverse philosophical viewpoints on entrepreneurial opportunities. Therefore, while it offers a valuable conceptual contribution, the proposed conceptual framework still requires verification. This can be achieved through various means: a future study can follow a systematic review approach to corroborate the framework, and/or it could undergo empirical evaluation in real-world educational contexts to verify its various assertations. The latter opens up several avenues for prospective research. One promising direction is to contrast the effectiveness of active versus passive search strategies in developing individuals' ability to identify business opportunities. In addition, another study could compare teaching approaches based on the discovery perspective with approaches based on the creation perspective. Moreover, since some scholars believe that individuals benefit from multiple perspectives during the OI process (Chetty et al., 2018), another possible research direction could be exploring the combination of both perspectives in an EE program to foster OI. The findings from such studies can offer a more comprehensive understanding of why and in what circumstances adopting a particular perspective is more fruitful for nurturing OI capability.

The review study presented in Chapter 3 built on a well-established theoretical framework developed by Fayolle and Gailly (2008) concerning the essential components of a constructively aligned EE course. This study used a thorough systematic data collection process (namely PRISMA) to provide an overview of the field and contribute to a growing body of knowledge on designing effective and constructively aligned EE courses to improve university students' OI capability. However, this study comes with several limitations that pave the way for future research. First and foremost, the framework proposed in Chapter 3 was primarily based on studies carried out in higher education settings, with a primary focus on exploring/enhancing students' OI capability. This narrow focus raises questions about the applicability of the review study's findings to different groups (such as academics, entrepreneurs, etc.) and contexts outside the university environment. While it is believed that, with certain considerations (particularly regarding influential factors), the findings of the review study may still be applicable to other groups and contexts, conducting a future review study with a broader scope can offer a more comprehensive understanding of how

EE courses should be designed to more effectively support the development of OI capability.

Second, the proposed framework in Chapter 3 was developed solely based on the synthesis of available empirical findings. While it offers a comprehensive overview of findings related to each essential educational component for designing effective EE courses, it falls short of fully demonstrating the interactive nature of these components and their interrelationships. This limitation was primarily due to the scarcity of empirical studies that examined such relationships, determining how, under which conditions, and which teaching approach is more appropriate to facilitate students' learning toward achieving an objective associated with either of the identified stages (i.e., triggering, idea generation, and idea evaluation). As a result, future empirical studies are needed to place specific emphasis on each stage and determine how various educational components should be aligned to assist students in achieving the intended outcome in that particular stage. Such empirical findings could, for instance, explore the type of curricular content (e.g., professional, theoretical, spiritual) that best supports increasing students' intrinsic motivation - a common objective in the triggering stage - when employing a particular teaching approach. The results of such empirical studies can significantly enhance the comprehensibility of the proposed framework in Chapter 3.

Third, and from a broader perspective, a similar issue arises concerning the interrelationships among the various identified stages. This also stems from the absence of empirical studies in the literature that illustrate how these three stages (i.e., triggering, idea generation, and idea evaluation) should be strategically positioned to effectively nurture OI capability. For instance, there is a need to understand how setting learning objectives in one stage impacts the selection of objectives in other stages, as well as how performance in each stage influences an individual's performance in subsequent stages. Moreover, while numerous individual characteristics and environmental factors have been identified as factors influencing students' OI outcomes in general, the mechanisms through which they affect the OI process remain unclear. This could be clarified by investigating the influence of these factors on the outcomes of each stage. For example, motivation and attitudes toward entrepreneurship might influence OI performance due to their effect on the outcomes of the triggering stage, whereas creativity and problem-solving skills might exert their influence on OI capability through their impact on idea-generation outcomes. Future empirical studies in these areas would not only help us understand the nature of these relationships, the optimal combination of conditions, the influence of one factor on another, and the stability of such influences but would also further our understanding of how EE courses can be designed more effectively to develop students' OI capability.

Both empirical studies in this research project were conducted as part of a university course (and not in a laboratory setting), utilizing rigorous research designs. These considerations significantly enhance the validity of the findings and their applicability to other similar contexts. However, these studies do have certain limitations that may affect the validity of their findings. The authentic setting of the studies presented a methodological limitation, which imposed constraints on the possibilities for experimentation. For instance, based on the framework proposed in Chapter 3, there were several individual characteristics and environmental factors that could potentially influence students' idea generation and evaluation, including prior knowledge, entrepreneurial alertness, innovative behaviour, cognitive style, and more. However, measuring all these variables could excessively burden students, potentially having a negative impact on the outcomes. Therefore, the first study only took into account a limited number of such influential factors, namely, educational level and attitude toward entrepreneurship, while the second did not control for any influential factor. Further research is therefore needed to validate the findings of these studies through a more comprehensive study design in which students' backgrounds and other characteristics are considered under more controlled conditions.

In both empirical studies in this research project, only short-term measurements were administered to assess individual performance in the idea generation and evaluation stages. This might have led to a potentially misleading enhancement in short-term individual learning performance measures, without promoting deeper processing that encourages long-term retention. It remains to be investigated to what extent the short-term results of the studies also translate into long-term learning outcomes. Furthermore, in this research project, students' OI performance was measured separately in terms of their performance in business idea generation and evaluation phases and not as one construct determining their overall improvement in OI capability and their relevant outcomes mentioned in Chapter 3, such as their perceived OI capability, their rate of employability, the number of graduate start-ups and entrepreneurial businesses, and/or their ability to cope with uncertainties. Therefore, future research is needed to assess the sustainability of training effects over time, with a particular focus on the overall enhancement of OI capability. Such research would yield even more insightful results if it focuses on higher-level impacts, such as students' societal contribution (Nabi et al., 2017) and firm founding (George et al., 2016). Here, scholars can also consider using self-perceived questionnaires for measuring other key indicators of OI capability, such as optimism and uncertainty/ambiguity tolerance (Nabi et al., 2017), especially if they view OI as associated with the entrepreneurial mindset.

The first empirical study offered new insights into designing hybrid brainstorming sessions that yield higher-quality outcomes; however, it did not confirm that this spe-

cific design could outperform other approaches to organizing brainstorming sessions. Therefore, further empirical research is necessary to thoroughly investigate this by comparing the effects of the proposed design on both the quantity and quality of outcomes with other effective ways of organizing brainstorming sessions. Moreover, the study demonstrated an enhancement in the originality of outcomes in the subsequent individual phase due to the sharing of ideas in the previous group phase. This positive effect was attributed to the G-I transfer of learning. However, this assumption still needs verification. To do this, future empirical studies should explore the changes in participants' knowledge of the given problem before and after group work, using, for instance, concept maps (refer to, for example, Farrokhnia et al., 2019), and determine whether this change correlates with individual performance in the subsequent phase.

Additionally, in the first empirical study, the outcome in the group phase was the combined result of all members' idea-generation efforts. However, group performance doesn't always mirror individual performance. This discrepancy can arise because group members might use strategies that enhance their collective output, but this doesn't necessarily translate to enhanced individual performance (Prichard et al., 2006; Weinberger & Fischer, 2006). For example, more active or knowledgeable members might complete tasks on the group's behalf; thus, less active or informed members (often termed "free riders") might not see improvements in their individual performance (Prichard et al., 2006). As such, future research is needed to monitor interactions during group tasks to better understand how differences between conditions emerge during the group phase and which interactive elements lead to better outcomes in the subsequent individual phase. In addressing these objectives, studies could substantially benefit from integrating Curseu et al.'s (2015) concept of "group synergy". This concept encapsulates the efficacy of the collective induction processes in groups that exceed their best member's performance (McNeese, 2000). Curseu et al. (2015) reported that members of synergetic groups better develop their decision competencies through group interaction processes, and members of strong synergy groups obtain the highest cognitive benefits. Building on this, future research could identify the collective synergetic qualities of successful groups that could help their ex-members perform better after the group work.

In the second empirical study, students worked individually to evaluate their own business ideas, aiming to establish a more controlled condition for comparing the effectiveness of the provided supports. However, scholars believe that human cognition is prone to sloppy thinking and errors of logic and analysis (Aviña et al., 2018), which may lead to suboptimal performance when individuals are tasked with evaluating their ideas (e.g., Faure, 2004; Putman & Paulus, 2009; Rietzschel et al., 2006). Given this, some scholars have argued that evaluating ideas is more effectively done

in teams, where diverse perspectives might enhance evaluation outcomes (Puccio & Cabra, 2012). As such, future empirical research could contrast the effectiveness of the provided supports in individual settings with those in collaborative ones to ascertain whether the setting influences the outcomes. For instance, the current study showed that describing evaluation criteria in conjunction with reading an exemplar could help individuals perform better in their idea evaluation. Other scholars have found that co-constructing criteria with peers after exemplar analysis can improve evaluative decision-making. A prospective investigation might compare the effects of these two strategies for the combined use of criteria and exemplars on idea generation outcomes. The insights derived from such inquiries would be particularly valuable in the entrepreneurship context, where the assessment of business ideas often takes place within teams (Foo et al., 2010; Healey et al., 2021).

In this PhD dissertation, several coding schemes were formulated and employed across multiple studies, each conducted by trained individuals and experts to address the proposed research questions. For instance, in the first empirical study, two trained master's student assistants were enlisted to evaluate the entire pool of ideas based on a codebook previously developed by two entrepreneurship academics. In the second empirical study, two experienced entrepreneurship educators were commissioned to evaluate the top three student ideas using three criteria outlined in the codebook. Despite the high inter-rater reliability and intra-coder test-retest reliability values of the measurements used in this thesis, the degree to which these measurements align with student achievement in real EE courses remains unclear and under-investigated. Further analysis is needed to determine how closely the results of students' idea generation and evaluation outcomes in real classes align with those obtained through the coding schemes in this dissertation.

Finally, this dissertation employed only quantitative methods to empirically explore the effects of various supports on business idea generation and evaluation as essential components of OI. However, mirroring its argument in Chapter 2 about the significance of hybrid teaching models for enhancing OI capability, future studies on this topic should move toward a middle-ground position by considering both quantitative and qualitative methods (i.e., mixed-method) in conducting their studies in the field. The mixed-method studies could offer the possibility of capturing the complex learning processes that come into play across various stages of the OI process.

6.4. Implications for Educational Practice

The viewpoint that teaching entrepreneurship is beneficial for all citizens has led to a significant increase in the number of EE programs at universities worldwide

(Yi & Duval-Couetil, 2021). Likewise, in the Netherlands, the availability of EE programs for young people has expanded in recent decades, influenced by changes in the economics education curriculum, among other factors (Boot & Kolkman, 2016). The focus of these programs, especially in higher education, has evolved from merely training future entrepreneurs and small business owners to emphasizing personal development and fostering an entrepreneurial mindset (Göksen-Olgun et al., 2022). Such a mindset enables individuals to act under uncertainty, make errors, learn from failures, and address challenges creatively as they arise (Lynch & Corbett, 2023).

To develop such an entrepreneurial mindset, EE programs at universities incorporate various objectives, among which fostering OI capability is the key one. This is because OI entails the ability to deal with uncertainty (Shepherd et al., 2007), embrace surprises (Sarasvathy et al., 2014), and come up with creative ideas that can be transformed into products, processes, or services that have value for customers, end-users, or society (Gielnik et al., 2012). To help students improve their understanding of OI and thereby develop their OI capability, EE courses typically include activities such as asking students to brainstorm in teams to find a business idea, writing a business plan for it, and pitching it in front of others for feedback. Alongside these activities, some courses also provide students with a theoretical underpinning of the OI process together with an opportunity to communicate with expert entrepreneurs to expand their insight. These practices are potentially crucial for developing OI capability. However, reflecting on my own experiences as an entrepreneurship lecturer and considering the literature on the current state of EE programs worldwide, it is remarkable that these programs often lack a well-established framework that can cohesively position these activities next to each other, hindering their ability to effectively help students develop their OI capability.

Guided by the generic teaching model for EE proposed by Fayolle and Gailly (2008), the current PhD dissertation sought to address the aforementioned shortcomings in various ways. **First**, and at the ontological level, it provided a conceptual framework that helps entrepreneurship educators and course designers determine which learning theory is more in line with their philosophical perspectives about business opportunities, thereby assisting them in making an informed decision about the teaching approaches they adopt for fostering OI capability. Examining the various layers of the proposed framework, the key message is that philosophical perspectives, views on opportunities, and learning theories do not exclude one another but can exist alongside each other. As such, for effective development of OI capability, entrepreneurship educators should not limit themselves to one teaching approach but rather carefully adopt various approaches in line with the targeted objectives.

Furthermore, the insights gained from the conceptual framework proposed in Chapter 2 offer a deeper understanding of how educators' definitions of EE can influence their views on OI, and consequently, how they structure EE programs to enhance it as a capability. The notion of narrow and wide EE seems to closely align with the dichotomy of discovery and creation perspectives. Under the narrow definition, EE programs view OI as a key entrepreneurial capability to shape students into entrepreneurs and business owners in the future. Therefore, the high emphasis would be on enriching their theoretical knowledge of OI, enhancing their "causal thinking" skills such as risk analysis and business plan development, and guiding them to systematically pass through various essential stages similar to the discovery perspective. As an EE program transitions from emphasizing individual activities to fostering collaborative efforts, from providing comprehensive information to encouraging students to utilize means at their immediate disposal at various stages, and from a systematic approach to a more flexible, enactment-oriented process of business OI, it aligns more closely with the broader definition of EE. As such, under the wide definition, one would expect EE programs with a high emphasis on knowledge co-construction during the OI process and learning "through" entrepreneurship to promote "effectual thinking". Such programs typically involve engaging in real-world experiences and addressing authentic problems, which have been shown to help students learn how to manage uncertainties, make errors, learn from failures, and address challenges creatively as they arise, thereby develop an entrepreneurial mindset (e.g., van Gelderen, 2023a, 2023b; Lindberg et al., 2017a; Zhu et al., 2020).

In the **second** effort, and at the educational level, this research project provided a comprehensive overview of the essential components of a constructively aligned EE course aimed at fostering university students' OI capability. By combining the insights from the first framework proposed in Chapter 2 with the framework developed through a systematic review of empirical studies in Chapter 3, three key implications for educational practices can be discerned. *First* and foremost, it is imperative for EE courses aimed at developing OI capability to distinguish between ideas and opportunities in their course design and also to clarify the differences between these two concepts for students. As illustrated in the framework proposed in Chapter 3, business opportunities should not be viewed as singular insights but rather as emerging from the continuous shaping and refining of business ideas (Vogel, 2017). This perspective resonates with Dimov (2007), who describes opportunity development as a "process" wherein opportunities "emerge in an iterative process of shaping and development" and where initial business ideas are "elaborated, refined, changed, or even discarded" (p. 714).

The *second* implication, which also connects well with the first one, is that an effective EE course should treat OI as a multi-stage and dynamic process, through which

students receive various forms of support to generate several ideas and refine them into a few with higher potential to become successful businesses in the future. The proposed framework in Chapter 3 explicitly underscores the key stages during the OI process: triggering, business idea generation, and business idea evaluation. The emphasis on the evaluation stage in the OI process implies that educators should not postpone facilitating evaluative judgment until the subsequent phases such as opportunity evaluation. An evaluative decision should take place early in the "new venture ideation" process to help individuals identify higher-quality business ideas (Kier & McMullen, 2018, 2020). This is a crucial step that narrows down the ideas to those of the highest quality (McMullen & Kier, 2017) and prevents any development of ideas with no potential, which in turn accelerates decision-making in the later stages (Eling et al., 2015).

The *third* implication entails offering a thorough understanding at the educational levels to develop constructively aligned EE programs that seamlessly integrate the three stages (triggering, idea generation, and idea evaluation). As such, EE programs should make choices about various educational components pertaining to each stage, guided by the philosophical perspective they adopt. For instance, during the triggering stage, some EE programs might focus on enhancing students' awareness of current needs and problems in a market. Scholars referred to this kind of trigger as "market pull" (Vogel, 2017), which is in line with the Kirznerian perspective about opportunities. Drawing on the framework proposed in Chapter 2, the most appropriate teaching approach to achieve an objective based on the Kirznerian perspective has roots in cognitivism. As such, educators could employ approaches that enable individuals' active exploration and experimentation, such as active searches in their surroundings to identify unmet problems. In addition, as highlighted in Chapter 2, one may adopt a hybrid approach to provide even richer learning experiences for students. This could involve adopting both cognitive and constructivist teaching approaches, for instance, by providing the opportunity to communicate with real customers to gain more insights into their pains and gains, and by engaging in peer discussion after an initial individual exploration. In the same stage, when guided by the creation perspective, the emphasis shifts. Instead of concentrating on existing problems or needs, the focus is, for instance, on fostering students' self-awareness regarding their own resources. The aim is to create learning opportunities that allow students to explore means-oriented questions such as "who am I?", "what do I know?", and "who do I know?", as underscored by the "effectuation theory" (Sarasvathy, 2001).

Moreover, to design a constructively aligned EE program, explicit attention should be given to aligning other essential components with the chosen teaching approach(es). For instance, if choosing brainstorming as a method to improve students' creativity,

educators should be aware that not all students would benefit equally. This technique might not be as effective for those with a high level of prior market knowledge. Such rich knowledge might channel individuals' thought processes along known paths, leading them into "mental ruts" (see Fiske & Taylor, 1991). This makes it more challenging for them to think outside the box to identify business ideas (Shepherd & DeTienne, 2005), thereby requiring additional support during brainstorming to break free from such mental ruts. In general, the framework introduced in Chapter 3 can serve as a good guide and source of inspiration for achieving such alignments between various components.

In its **third** effort, and by placing a focus on the "how" component at the educational level, the current research project aimed to shed light on how to design effective brainstorming sessions as the most common teaching approach to facilitate business OI in EE programs. Here there is two key implications for practice. *First*, and in line with the findings of the systematic review study, to craft a brainstorming session that effectively facilitate business OI, educators should place an equal emphasize on divergent (idea generation) and convergent (idea evaluation) stages. This means that while support is needed to enhance students' idea generation outcomes, additional support is required to improve their idea evaluation outcomes. Here, special attention should be paid to aligning the support mechanism with the expected outcome at each stage. According to the creativity literature, the optimal outcome of the idea generation stage is to produce as many ideas with high originality as possible (Guilford, 1950), whereas the idea evaluation stage focuses on selecting ideas that are appropriate (Reinig & Briggs, 2013). This resonates with findings in the entrepreneurship field that only business ideas that are both original (i.e., innovative) and appropriate (i.e., those with higher problem-solution fit and feasibility) can be perceived as potential business opportunities and become eligible to proceed to the other entrepreneurial phases, i.e., opportunity evaluation and exploitation (DeTinne & Chandler, 2004, Grégoire et al., 2010; Khalid & Sekiguchi, 2018; Prandelli et al., 2016).

Second, and inspired by findings in the creativity literature, the current research project provided new insights into how the divergent and convergent stages of a brainstorming session in an entrepreneurship context can be effectively supported to result in optimal outcomes. For the divergent stage, and inspired by the idea of hybrid (individual and group) brainstorming put forward by creativity scholars (e.g., Korde & Paulus, 2017), the first empirical study sought to identify an instructional design model for organizing hybrid brainstorming sessions in EE courses, superior not only in generating a high quantity of business ideas but also in producing ideas with higher originality. Guided by the Nijstad et al.'s (2010) DPMC, the study showed that providing students with two computer-mediated supports — the SCAMPER prompts

and the sharing of individually generated ideas — would help them generate business idea with higher originality. These findings suggest that merely instructing students to generate business ideas using traditional brainstorming is not suffice for them to produce ideas with higher originality. Achieving such optimal results demands theory-driven support that can guide them along specific pathways to creativity (Althuizen & Reichel, 2016; Rietzschel, 2018), such as those proposed by the DPMC. Although these supports can be offered in various settings, educators might find computer technologies especially effective for its implementation. As shown in this research project, computer-mediated environments provide various advantages for having a fruitful brainstorming session, by facilitating fruitful collaboration (Farrokhnia et al., 2019; Noroozi et al., 2012), and allowing for real-time feedback (Latifi et al., 2021) and adaptation (Noroozi et al., 2018), leading to more dynamic and enriched brainstorming experiences (DeRosa et al., 2007; Kay, 1995; Maaravi et al., 2021).

To enhance the outcomes of the convergent stage, findings from the second empirical study in this project suggest that describing evaluation criteria for students, coupled with an exemplar that demonstrates how an expert assesses business ideas, can significantly enhance their ability to evaluate ideas. Placing such an explicit emphasis on this early evaluation process offers at least two benefits for students. Firstly, it heightens their awareness that entrepreneurship involves an iterative decision-making process (De Winnaar & Scholtz, 2020). To escape ignorance and overcome doubt about the idea (Shepherd et al., 2007) individuals should be actively engaged in a iterative sense-making process, where subjective ideas are transformed into objective opportunities (Wood & McKinley, 2010). Secondly, such early support can save students considerable time and energy, leading to a more enjoyable learning experience. There are instances in EE programs where students work on business ideas only to realize partway through that the idea lacks the potential to be developed into a tangible entity, even in the form of a business plan. Including a supported evaluation stage at this point can help students move past ignorance and reduce uncertainties surrounding their ideas. Such support can range from straightforward measures, such as providing essential evaluation criteria and examples of how to apply them when assessing business ideas, to more sophisticated approaches. These could involve meticulously analyzing successful business opportunities, identifying the elements contributing to their success, forming evaluation criteria accordingly, and then applying these criteria to their own ideas. Moreover, the emergence of generative AI tools like ChatGPT offers a significant opportunity to assist students in making informed evaluative decisions during the convergent stage, while also serving as a source of inspiration during the divergent stage (see Farrokhnia et al., 2023).

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Appendix

Appendix 3-1. Criteria for the Quality Appraisal

	0	1	2	3
	No elaboration	**Some elaboration**	**Good elaboration**	**Extensive elaboration**
Criteria for qualitative studies				
Study is clear methodologically	1	4	5	1
Were all the essential parts of a qualitative study, i.e., theoretical basis (e.g., phenomenon, literature review, theoretical problem, and research question(s)), method (i.e., research context and participants, data collection method, and data analysis method), and findings (e.g., theoretical contributions and practical implications) adequately described?				
Study theoretically situated	-	3	5	3
Did the authors elaborate on the theoretical basis of their study and how their study was grounded in theory?				
Ethical process transparent	3	2	4	2
Did the authors elaborate on the ethical concerns (e.g., anonymity, confidentiality, privacy, informed consent, etc.) that should be considered in the qualitative research?				
Researcher(s') relation to participants is clear	3	2	6	-
Did the authors elaborate on how they sought to be reflexive in the interpretation of data in order to situate themselves and their stories in relation to the participants?				
Researcher(s') relation to the data is clear	1	2	7	1
Did the authors elaborate on how they put aside their stance, beliefs, and perspectives when analyzing and interpreting the data?				
Researcher(s') takes a critical stance towards own research	3	-	8	-
Did the authors critique previous related studies and practices to take a critical stance towards their own research?				
Congruence between methodology and methods used for data collection, analysis, and interpretation	1	3	7	-
Did the authors elaborate on how their adopted qualitative method used for data collection aligned with their data analysis and interpretation?				
Participants involvement in data interpretation	2	1	6	2
Did the authors elaborate on how they involve the participant in the data interpretation?				
Limitations voiced	2	4	5	-
Did the authors point up the limitations and difficulties encountered to demonstrate how reflection and reflexivity guided the emergent design and prompted changes in the study?				
Criteria for quantitative studies				

Is the source population or source area well-described?	-	4	29	3
Was the country, setting, location, population demographics etc., adequately described?				
Were interventions and comparisons well-described and appropriate?	-	12	20	4
Were interventions and comparisons described enough for the study to be replicated? Were comparisons appropriate (e.g., usual practice rather than no intervention)?				
Were outcome measures reliable?	1	3	26	6
Did the authors elaborate on how they measured the outcome? How reliable were outcome measures (e.g., inter- or intra-rater reliability scores)?				
Were outcomes relevant?	3	10	19	4
Did the authors elaborate on the relation between their measured outcomes (e.g., quantity and/or quality of identified ideas) with the intended outcome (i.e., opportunity identification competence)?				
Were the analytical methods appropriate?	2	4	27	3
Did the authors elaborate on the logic behind their used analytical methods and statistical test concerning their study design and outcomes?				
Are the study results internally valid (i.e., unbiased)?	-	8	26	2
Did the authors elaborate on how well their study minimized sources of bias (i.e., adjusting for potential confounders)? Did they report possible flaws in their study design, and how did they control them?				
Are the findings generalizable to the source population (i.e., externally valid)?	10	6	19	1
Are there sufficient details given about the study to determine if the findings are generalizable to the source population?				

Appendix 3-2. The final coding scheme

Section	Sub-section	Example codes	Definition	Example coded phrase
Study Quality (General information related to the study)	Country of study	-	The country wherein the study was conducted.	The sample for this experiment was students at a large university in Colorado, USA (Shepherd & DeTienne, 2005)
	Type of analysis	Quantitative	Studies state they use a quantitative design or analysis; and/or they use inferential statistics; and/or they use a pre- and post-test design or a control or comparison group with findings presented numerically.	We conducted a quasi-experimental design with a pre-test and a post-test with experimental and control groups (Costa et al., 2018).
		Qualitative	Studies state they use a qualitative design or analysis and/or inductive or deductive data analysis to generate codes or themes presented as frequency counts, thematic trends, or narrative descriptions.	We conducted qualitative research using the focus group methodology to investigate the entrepreneurial learning experiences of students (Kubberød & Pettersen, 2018).
		Mixed methods	Studies describing themselves as mixed-methods and/ or studies reporting both quantitative data analysis and qualitative data analysis.	Following the evaluations, we conducted a qualitative analysis of the quantitative data emerging from the opportunity assessment (Muñoz et al., 2011).
	Sample size	Number of students	The number of individuals who participated in the study and successfully finished the tasks.	The sample consisted of 113 Dutch students (Baggen, Mainert, et al., 2017).
	Gender	Male	-	The sample consisted of 86 male students (42 percent) (Karimi et al., 2016b).
		Female	-	44% of the participants were female (DeTienne & Chandler, 2007).
	Educational level	Undergraduate	An undergraduate is "a student in a university or college who has not received a first, especially a bachelor's, degree."	This study focused on undergraduate students who attended technology entrepreneurship classes (Ngah et al., 2020).
		Graduate	A graduate student is a student who's pursuing an advanced degree after having earned their undergraduate degree.	Students of a graduate program in health and nutrition enrolled in an Entrepreneurial learning Program (Ramsgaard & Østergaard, 2018).
		Post-graduate	A post-graduate student is a student who's pursuing an advanced degree after having earned their master's degree, such as Ph.D. students.	In our research, we focused on doctoral students as cases (Muñoz et al., 2020).

	Field of study	Business	The field of studies related to the business and marketing environment includes Accounting, Business, Marketing, Finance, Management, MBA, and Entreruprenruship.	The sample consists of 138 students enrolled in an MBA program at a university located in the Midwest of the USA (Kickul et al., 2010).
		Non-business	Any other field of studies that are not related to business and marketing environments.	The participants in the study were under-graduate students of agricultural sciences at a university in Iran (Karimi et al., 2016a).
	Type of course	Elective	A course that a student can choose from a number of optional subjects or courses in a curriculum.	The experimental group took the redesigned Fundamentals of Entrepreneurship course as an elective course (Karimi et al., 2016a).
		Compulsory	A course within a program that a student must pass in order to meet the regulations to be eligible to graduate.	The treatment course was a mandatory entry-level course in entrepreneurship (Lindberg et al., 2017b).
	Research focus	Fostering OI	The research focus is on how to foster higher education students' OI competence.	The purpose of this study was to improve the ability of students to generate new business opportunities when they partici-pated in a redesigned entrepreneurship course (Karimi et al., 2016a).
		Exploring OI	The research focus is on exploring the factors that affect the outcomes of higher education students' OI.	The purpose of this paper is to understand how gender affects the number and innovativeness of business opportunities identified by future entrepreneurs (González & Husted, 2011).
		Both	The focus is both on fostering and exploring OI.	We investigate how improving the entrepreneur's ability to take the user's perspective in a market enhances opportunity identification. We also show how prior market knowledge positively moderates the relationship between user perspective-taking and opportunity recognition (Prandelli et al., 2016).
Why? (Objective(s) and goal(s) of a program or course that increases the chance of OI)	Cognitive objectives (Statement that details a specific desired outcome of a course that is related to the acquisition of knowledge, rules, strategies, concepts (i.e., developing mental structures) and/or improving cognitive skills)	Creative thinking skills	An individual's ability to generate many different kinds of ideas, manipulate ideas in unusual ways and make unconventional connections in order to outline novel possibilities.	The program aimed to stimulate the students' creativity by using exercises that made them practice divergent and convergent thinking (Lindberg et al., 2017a).

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		Market knowledge	Individual's knowledge about sources of business opportunities, such as how to serve a market, customer problems and needs, technological innovations, global changes, etc.	The program aimed to enrich students' knowledge about how to serve a market and customers' problems in order to increase their business opportunity discovery rate (Arentz et al., 2013).
	Affective objectives (Statement that details a specific desired outcome of a course that is related to the change in a student's attitude, choice, feelings, etc., toward a particular behavior and/or practice)	Motivation	A drive and desire that can energize individuals to direct their behavior toward a specific action.	The program aimed to explore the effect of offering a financial reward and triggering students' extrinsic motivation on students' OI outcomes (Shepherd & DeTienne, 2005).
		Empathic concern	An emotional response of compassion and concern occasioned by witnessing other people's problems.	The program aimed to explore the effect of stimulating both students' perspectives taking and empathic concern on students' OI outcomes regarding their levels of market alignment, feasibility, and desirability (Khalid & Sekiguchi, 2018).
	Social objectives (Statement that details a specific desired outcome of a course that is related to the interaction of the individuals, groups, and/ or institutions within a society)	Co-participation	The act of participating with others in doing a task or job.	The program aimed to explore the effect of developing a community of students from different countries working on the same entrepreneurial project on their cross-cultural competencies and knowledge and their perceived ability to identify internationally viable opportunities (Musteen et al., 2018).
For whom? (The factors that affect the outcome of OI)	Cognitive factors (Learner's cognitive characteristics that affect his/ her performance and learning)	Innovative behavior	Introducing and applying new ideas, products, processes, and procedures to a person's work role, work unit, or organization.	Students' innovative behavior positively affects their OI and mediates the relationship between students' problem-solving skills and OI ability (Kim et al., 2018).
		Prior knowledge	An individual's knowledge acquired from formal education and/or work experience (i.e., general human capital) and/or his/her prior domain-related knowledge (i.e., specific human capital).	Students with higher prior knowledge of customer needs or problems (i.e., specific human capital) tended to identify more business opportunities (González & Husted, 2011).

	Affective factors (The emotional factors that influence learning)	Attitude toward entrepreneurship	The degree to which a person has a favorable or unfavorable evaluation about being an entrepreneur.	Students' attitudes toward Entrepreneurship had a positive effect on their perceived OI (Karimi et al., 2016b).
		Motivation	A drive and desire that can energize individuals to direct their behavior toward a specific action.	The results showed that students who were intrinsically motivated to study entrepre-neurship as a potential career choice per-ceived lower learning outcomes concerning the idea generation task (Hytti et al., 2010).
	Demographic factors (Factors related to learner's race/ ethnicity, gender, and language, etc.)	Education level	The category in which education leads to a qualification or degree is divided based on the requirement level (e.g., undergraduate, graduate, post-graduate).	Master students are shown to have higher intentions and perceived opportunity identification ability than bachelors (Oftedal et al., 2018).
		Gender	Female/Male	Male gender was strongly correlated with the perceived ability to recognize opportunities (Oftedal et al., 2018).
For which results? (The measurement approaches that are used for evaluating the effectiveness of a program or course in relation to OI competence development)	Evaluation criteria (Evaluation criteria are what the programs' organizers want and are able to measure as an outcome)	Quantity of ideas	The quantity of ideas is defined as the number of identified business ideas (i.e., fluency) and/or idea categories (i.e., flexibility) by each individual.	The number of opportunities was used as a proxy of the capacity that an individual had to identify opportunities (González & Husted, 2011).
		Quality of ideas	The quality of ideas is defined by the degree to which the idea is innovative, aligned with the market needs, feasible, concrete, novel, etc.	All of the students' output regarding identified opportunities was analyzed by measuring the degree of innovation and the market potential of the business idea (Nab et al., 2013).
		Self-perceived OI competence	The subjective assessment of an individual's OI competence, through survey, questionnaire, and/or interview.	A three-item scale was used to measure students' self-perceived OI competence (Baggen, Kampen, et al., 2017).
	Time of measurement (The time that the outcomes were evaluated)	During the course	Measuring the dependent variables during the course at different times.	To carry out this study, we collected data at three different time periods during the se-mester (M.-H. Chen & Agrawal, 2017).
		Shortly after	Measuring the dependent variables as soon as the course is finished.	The survey results were taken immediately after the training program (Nyamunda & van der Westhuizen, 2018).

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		0-5 years after	Measuring the dependent variables within 0-5 years after the study to measure the long-term effect of the interventions.	We conducted the interviews eight months after the internship (Kubberød & Pettersen, 2018).
What? (The contents of the entrepreneurship education program or course)	The professional dimension (The contents related to practical knowledge)	Know-what	The knowledge that individuals need to know in order to better respond to a given entrepreneurial situation, such as what one must do to create a technological company or validate an opportunity.	The "Identify" stage helped students developed proficiency in determining *what* makes business ideas valuable (Cohen et al., 2020)and is therefore frequently included in entrepreneurship education programs. In this paper, we examine a unique teaching method (IDEATE.
		Know-how	The knowledge of how to deal with a given entrepreneurial situation, to identify a potential business opportunity, to identify and mitigate the risks, etc.	The program included a workshop on idea generation techniques in order to help students know *how* to generate business ideas better (Nab et al., 2013).
	The spiritual dimension: (The contents that enable individuals to position themselves in space and time as regards the entrepreneurial phenomenon)	Know-why	The knowledge that helps individuals to understand the entrepreneurship phenomenon and its place, its purpose in society, and how it influences society and peoples' living conditions.	The teachers told success stories about entrepreneurs and invited guest entrepre-neurs as speakers who could serve as suc-cessful role models to influence their stu-dents' entrepreneurial attitudes and inten-tions (Karimi et al., 2016b).
		Know-when	The knowledge that can empower individuals to recognize the right time to proceed with an entrepreneurial idea based on their profile and abilities in that specific context.	The task of the external experts in the course was to give students feedback from a practical point of view to help them understand *the best time* to develop their projects further (Lindberg et al., 2017a).
	The theoretical dimension	Theories and scientific knowledge	The theories and scientific knowledge "about" entrepreneurship and entrepreneurial activities.	The lectures were few and delivered in a traditional format by presenting basic theories "about" entrepreneurship (Lindberg et al., 2017b).
How? (The pedagogical approaches of the entrepreneurship education program or course)	Theoretical basis (The learning theory that serves as the basis of the course or program)	Experiential learning theory	Experiential learning emphasizes learning as occurring through the transformation of experience into knowledge, allowing students to learn by "doing".	The COPSS model used for designing this course is a process-oriented pedagogical approach that resembles the *experiential learning theory* by Kolb (Lindberg et al., 2017b).

EE initiatives (Activities that can increase the number of business start-ups and contribute to their understanding of and engagement in entrepreneurial activities)	Networking with experts	Asking experienced entrepreneurs and/or experts in a specific market to join the program for giving a lecture on different related topics, giving feedback on individuals' identified business ideas, helping them develop a prototype, etc.	The student teams presented the ideas to a business panel of entrepreneurs and busi-ness advisors specializing in new venture creation (Heinonen et al., 2011).
	Creativity workshops	The workshops that include hands-on exercises for stimulating individuals' creativity and/or improving their creative thinking skills, i.e., divergent and convergent thinking skills.	The students completed a total of 12 crea-tivity exercises and activities such as the Five Whys, bugs report, problem reversal, brainstorming, elevator pitch, and ideas notebook (Karimi et al., 2016a).
	Developing business model/ plan	Asking individuals to develop a business plan for their identified ideas to learn how to write business plans, present their ideas to experts and/or participate in business plan competitions.	Students presented their developed business plans in a competition (Nab et al., 2013).
Learning activities	Self-reflection	The processes that a learner undergoes to look back on his/ her past learning experiences and what he/she did to enable learning to occur, and the exploration of connections between the knowledge that was taught and the learner's own ideas about them.	Students were required to complete a learning report at the end of the course to help them to assimilate their experiences during the course better (Muñoz et al., 2020).
	Peer-evaluation	An arrangement in which individuals evaluate the amount, level, value, worth, quality, or success of the products or outcomes of learning of peers of similar status.	Participants were asked to rate each other's business opportunities using the dimensions of the business opportunity viability prototype as criteria (Costa et al., 2018).
	Elevator pitch	Elevator pitch (also referred to as an elevator speech, elevator story, or elevator presentation) is defined as "a quick persuasive speech used to create interest in a project, a concept, or people".	Each group then presents its solution to its chosen problem through an "elevator pitch" alongside an A2-sized poster representing their ideas (DeTienne & Chandler, 2004).
Type of learning	Individual	Students individually participate in the course and accomplish the required tasks.	We assigned the treatment randomly, and each participant ran the experiment individually (Prandelli et al., 2016).

	Collaborative	Students collaborate with their peers in a group to accomplish the required tasks.	During the three-month course, the students formed teams of five or six that were each given three totally random industries for identifying business opportunities (Heinonen et al., 2011).
	Both	Both individual and collaborative learning are required to accomplish the course's tasks.	Students were given an opportunity to list several recent problems they have encountered in daily life, and then an exercise designed for each student group to help them find a solution for a specific problem by generating as many ideas as possible (DeTienne & Chandler, 2004).

Appendix 4-1. Instructions for facilitating brainstorming performance

Individual phase

In this phase, you should individually generate business ideas concerning your identified problems and/or needs using the brainstorming technique. In this regard, please first take **2 minutes** to read the following rules carefully:
(1) **Stay Focused on the Task**. Concentrate on the problem at hand and avoid engaging in irrelevant thought processes or discussions.
(2) **Do not tell stories**. We are only interested in your ideas. Do not tell stories about your experiences. Do not explain ideas. Do not expand on why you think something is good or bad. Simply state your idea and then continue with the next idea.
(3) **Keep the Brainstorming Going**. When you have no ideas during a lapse of time, restate the problem and try to think of additional ideas.
(4) **Do not Criticize**. Do not criticize any of the ideas that you generate. State any idea that you think of and do not evaluate its usefulness.
(5) **Return to Previous Categories**. When you cannot think of other ideas, go back to the categories of ideas that you have already mentioned and try to build on these previous ideas.

Group phase

In the next phase, you need to collaborate with your peers and brainstorm together to generate more business ideas in the context of sustainable development. In this regard, please take **2 minutes** to read the following rules carefully for having a fruitful group brainstorming:
(1) **Criticism is ruled out**. The adverse judgment of ideas must be withheld. No one should criticize anyone else's ideas. Say everything you think of.
(2) **Freewheeling is welcome**. The wilder the idea, the better. It is easier to tame down than to think up. Don't be afraid to say anything that comes to mind. The farther out the idea, the better. This will stimulate more and better ideas.
(3) **Quantity is wanted**. The greater the number of ideas, the more likelihood of winners. Come up with as many as you can.
(4) **Combination and improvement are sought**. You should try to suggest how the ideas of others can be joined or changed into still better ideas. Don't be afraid to combine and improve on them.
(5) **Stay focused on the task**. Concentrate on the problem at hand and avoid engaging in irrelevant thought processes or discussions. When it is necessary to interrupt a group member, say something like, "Remember that we need to stay focused on our task."
a) *Do not tell stories*. We are only interested in your ideas. Do not allow your group members to tell stories about their experiences.
b) *Do not explain ideas*. Do not allow your group members to expand on why they think something is good or bad. Let them say an idea and then interrupt them.
(6) **Keep the brainstorming going**. During a lapse of time when no one is talking, someone in the group should say something like, "Let's see what other ideas we can come up with for (restate the problem)."
(7) **Return to previous categories**. When the group members are not talking very much, go back to categories of ideas that have already been mentioned and try to build on these previous ideas. For example, say, "Does anyone have any more ideas related to (restate an idea already suggested)?"

Appendix 4-2. The adapted SCAMPER

Substitute: Pick one of your business ideas and replace/change part of the idea (components, ingredients, materials, shape, process, etc.) to make it better and more appealing to customers.
An example of a successful 'Substitution' could be the **TIPA company** substituting conventional plastic material with *Bio-Based* material to produce compostable flexible food packaging.
Combine: Pick one of your business ideas and combine it with another idea or existing product/service to extend/improve its functionality.
An example of a successful 'Combination' could be the idea of combining two different technologies (internal combustion and electric engine) to produce eco-friendly **electric hybrid** cars.
Adapt: Pick one of your business ideas and adapt it to other customers/contexts or make it more competitive.
An example of a successful 'Adaptation' could be the **Uniqlo company** which adapted their previously developed *AIRism fiber* to make a highly breathable and reusable mask during the Corona pandemic. Or the idea of **Roll-on deodorant,** which was adapted from the ballpoint pen.
Modify: Pick one of your business ideas and modify, magnify, maximize, or minimize its features (e.g., size, shape, form, color, etc.) in a way that enhances its perceived value or improves its function.
An example of successful 'Modification' could be **Soda companies** that offer you different bottle *sizes* to fit your individual or family and party needs. This way, they maximize their profit by making the same product larger or smaller, thus appealing to more customers.
Put to another use: Pick one of your business ideas and use it for another purpose.
An example of successful 'Putting to another use' could be using **VR headsets** for educational purposes such as raising awareness of environmental concerns.
Eliminate — Pick one of your business ideas and remove one of its features to attract new customers and/or improve its perceived value.
An example of a successful "Elimination" could be **Beverage companies** that offer sugar and/or preservative-free drinks, thus managing to attract a whole new sector of health-oriented consumers.
Rearrange / Reverse — Pick one of your business ideas and evolve it into something new by reordering and/or reversing its parts/processes.
An example of a successful "Rearranging" could be **Uber**, which rearranged the process by which people take a taxi, i.e., ordering instead of searching!

English Summary

Over the past few decades, there has been a significant rise in the number of Entrepreneurship Education (EE) programs at universities worldwide. At their core, these programs aim to guide students through the essential stages of entrepreneurial activity, allowing them to experience and address the uncertainties and complexities inherent in the entrepreneurial journey. In this context, fostering the OI capability, as a means to empower them to handle uncertainties and transform them into innovative solutions and value-creating avenues, has consistently emerged as a pivotal topic in EE programs at universities.

To help students improve their understanding of OI and thereby develop their OI capability, EE courses typically include activities such as asking students to brainstorm in teams to find a business idea, writing a business plan for it, and pitching it in front of others for feedback. Alongside these activities, some courses also provide students with a theoretical underpinning of the OI process together with an opportunity to communicate with expert entrepreneurs to expand their insight. These practices are potentially crucial for developing OI capability. However, reflecting on my own experiences as an entrepreneurship lecturer and considering the literature on the current state of EE programs worldwide, it is remarkable that these programs often lack a well-established framework that can cohesively position these activities next to each other, hindering their potential to effectively help students develop their OI capability.

The OI capability has a complex nature, as many factors play a role in identifying business opportunities. Improving such a complex learning outcome requires constructively aligned entrepreneurship programs wherein more explicit attention is paid to the pedagogy (i.e., the "how"), making a meaningful connection between the inputs (i.e., the learning objectives, students, and curricular content) and outputs (i.e., the learning outcomes and the impact and assessment thereof). This view has been clearly echoed by the generic teaching model for EE by Fayolle and Gailly (2008). According to this model, for developing an effective EE program, explicit attention should be given to its design at two key levels, namely, *ontological* and *educational*, and their interrelationships. At the ontological level, entrepreneurship educators must determine and be aware of their philosophical perspectives on the topic at hand. This is because such perspectives play a pivotal role in bridging entrepreneurship and education, translating essential elements of learning theories into effective teaching methods in the EE field. At the educational level, Fayolle and Gailly (2008) posited that due to the multifaceted nature of EE — encompassing diverse audiences, objectives, curricular contents, and pedagogical methods — it is imperative to design EE programs that adhere to principles of constructive alignment. Accordingly, they sug-

gest a thorough consideration of the essential educational components of any learning environment, emphasizing the need to address five essential questions in this order: (1) "*Why* (objectives, goals)?", (2) "*For whom* (targets, audiences)?", (3) "*For which results* (evaluations, assessments)?", (4) "*What* (contents, theories)?", and (5) "*How* (methods, pedagogies)?".

Guided by Fayolle and Gailly's (2008) generic teaching model for EE, the current study sought to address the shortcomings of existing EE programs aimed at fostering university students' OI at various levels using a multi-method research approach that encompassed a combination of conceptual, systematic review, and experimental studies. For its *first* objective, and at the ontological level, the study aimed to bridge the gap in the literature regarding the educational implications of the two prominent philosophical perspectives on business opportunities (i.e., discovery and creation), proposing a conceptual framework that determines the most appropriate learning theories and teaching methods to foster OI capability based on each philosophical stance. Shifting toward the educational level shaped the *second* objective of the current research project, which involved proposing an evidence-informed framework through a comprehensive overview of available empirical findings on exploring/fostering students' OI capability, categorizing them into the five essential educational components of the generic teaching model for EE. Lastly, as its *third* main objective, the project honed its focus on the "How?" components of the educational level with particular attention to brainstorming as a common teaching approach in EE programs aimed at fostering OI capability. In particular, it tapped into the potential of computer technologies to develop an online brainstorming session effective in facilitating business OI.

In chapter 1, the core concepts of this thesis are defined. In pursuing its first objective, Chapter 2 of this dissertation addresses the following question: *What are the most appropriate teaching and learning theories aligned with the opportunity discovery and creation perspectives on business opportunities?* To answer this research question, a conceptual study was conducted through an extensive review of the existing literature, focusing on various philosophical perspectives concerning entrepreneurial opportunities. The literature review facilitated the integration of the two primary perspectives with the most compatible learning theories in the field of education, based on their shared ontological and epistemological assumptions. This integration provided EE educators and researchers with a theory-driven conceptual framework, demonstrating which learning theory better underpins and supports each perspective. The framework indicated that the philosophical assumptions of the opportunity discovery perspective align most closely with behaviorism and cognitivism, while the social constructivist learning theory is better suited for EE programs grounded in the opportunity creation

perspective. In addition, the framework suggested that for developing an efficacious EE program to improve individuals' OI performance, different perspectives on the emergence of opportunities and learning should be combined and integrated into a consistent, constructively aligned EE program.

The second study, described in Chapter 3, explores the answer to the second research question of the current research project, which reads as follows: *Based on the current state of the art, what factors influence and constitute the outcomes of EE programs aimed at fostering university students' OI capability?* This research was an attempt to address its second objective, providing a comprehensive understanding of "*why*" some students can better identify business opportunities and "*how*" their OI capability can be improved. As such, using a systematic review method, 44 empirical studies (out of 945 peer-reviewed articles) on OI, dating from 2000 through 2022, were reviewed. The findings were systematically categorized by answering five essential questions raised by the adopted teaching model framework, i.e., "why?", "for whom?", "for which results?", "what?", and "how?". The findings indicate that students' prior knowledge, entrepreneurial alertness, and creativity are respectively the most influential factors in the OI process. Moreover, it has been found that developing students' OI capability requires guiding them through three distinct stages, namely, *triggering*, *idea generation*, and *idea evaluation*, within a constructively aligned learning environment. The chapter concludes by presenting several suggestions and directions for future research.

To achieve its third objective, Chapter 4 explores how to craft brainstorming sessions that effectively foster business OI. Guided by insights from the creativity field that an optimally designed brainstorming session encompasses both divergent and convergent thinking stages, the first empirical study sought to identify an instructional model to enhance the outcomes related to the divergent stage, i.e., generating a large number of ideas with high originality. To this end, it focused on improving the design of hybrid (individual and group) brainstorming sessions as a more effective alternative to traditional brainstorming in the divergent stage. In particular, it tapped into the potential of computer technologies and developed an online platform that could provide two theory-driven supports — the SCAMPER prompts and the sharing of individually generated ideas — during a hybrid brainstorming session focusing on generating business ideas to address the real-life issue of sustainability. The aim of the first empirical study was to answer two key research questions: *(1) What is the impact of providing SCAMPER prompts during a hybrid brainstorming session on the originality of the business ideas generated, compared to brainstorming without any additional support?* (*2) What is the impact of sharing individually generated ideas with group members during a hybrid brainstorming session on the originality of the business ideas generated, compared to the condition where sharing individually generated ideas is not*

facilitated? A quasi-experimental study was conducted with 94 students, comprising both undergraduate (BSc) and postgraduate (MSc) cohorts, who participated in two university courses. The students were randomly assigned to three conditions in which they were all tasked with generating business ideas to address sustainability issues. Results indicated that the SCAMPER prompts are effective in supporting the individual brainstorming phase in hybrid settings, assisting participants in generating ideas with higher originality. On the other hand, sharing ideas generated individually during the group phase significantly impacts the originality of ideas generated collaboratively and also those generated during the subsequent individual phase.

As outlined in the framework proposed in Chapter 3, and supported by findings in the creativity field, optimally designed brainstorming sessions to facilitate OI extends beyond the divergent stage and should also include a convergent thinking stage. As such, Chapter 5 of this dissertation explores strategies to elevate the outcome of the convergent stage in the business OI process. To this end, the second empirical study examined the effects of two techniques: (1) describing evaluation criteria and (2) presenting an exemplar, on students' business idea evaluation performance determined by their accuracy in discerning original ideas with higher appropriateness (i.e., higher problem-solution fit and feasibility). This study specifically sought to answer the research question: *What is the impact of describing evaluation criteria and presenting an exemplar on university students' ability to discern original business ideas with higher appropriateness within their idea pools?* From the 94 students who participated in the previous empirical study, 80 students — including both undergraduate (BSc) and postgraduate (MSc) cohorts — were guided towards the business idea evaluation stage to participate in an empirical study with a 2x2 factorial design. The four conditions in this design were as follows: Control (neither criteria nor exemplar provided), Criteria, Exemplar, and Both (criteria and exemplar provided). Students were randomly assigned to these conditions and asked to evaluate the three business ideas they had previously selected. The objective was to determine which form of support — criteria, exemplars, both, or neither — most effectively assisted the participants in accurately ranking the ideas, considering both their originality and appropriateness. Overall, the results indicated that providing students with a detailed description of evaluation criteria can help them better evaluate the quality of ideas. This positive effect becomes even more pronounced when exemplars, in the form of business ideas evaluated and ranked by an expert, are provided alongside the evaluation criteria.

Finally, Chapter 6 summarizes and combines the results of the studies and provides various avenues for future studies. In general, the results of the current research project suggest that when fostering OI capability, business opportunities should not be viewed as singular insights but rather as emerging from the continuous shaping and

refining of business ideas. This emphasizes the need to design constructively-aligned EE programs that embody this process-oriented view, guiding students through three distinct yet interconnected stages: triggering, idea generation, and idea evaluation. Such EE programs should align various educational components for each stage and also make meaningful connections among them. With a particular emphasis on support mechanisms during the business idea generation and evaluation stages, this final chapter provides an integrative view on how to design brainstorming sessions effective in fostering university students' OI capability.

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Overview of Completed Training Activities

Mohammadreza Farrokhnia
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Completed Training and Supervision Plan

Name of the learning activity	Department/Institute	Year	ECTS*
A) Project related competences			
A1 Managing a research project			
Writing research proposal	WUR	2019	6
WASS Introduction Course	WASS	2019	1
'Fostering opportunity identification capability: The role of philosophical perspectives in the selection of teaching and assessment approaches'	The 3E Conference held on 11–13th of May 2022 in Dijon, France	2022	1
'Sparking Creativity in Entrepreneurship Courses: Investigating the Effect of Hybrid Brainstorming Sessions on Business Opportunity Identification Outcomes'	The International Conference on Studies in Education and Social Sciences held on 10-12th of November 2022 in Antalya, Turkey	2022	1
'Sparking creativity in Entrepreneurship courses: The effect of using the SCAMPER technique in Brainstorming sessions'	The 3E Conference held on 10th–12th of May 2023 in Aarhus, Denmark	2023	1
A2 Integrating research in the corresponding discipline			
Systematic Approaches to Reviewing Literature	WASS	2019	4
Research Methodology: From topic to proposal	WASS	2019	4
National Spring School	ICO	2022	1
International Spring School	ICO	2021	3
B) General research related competences			
B1 Placing research in a broader scientific context			
Introductory course	ICO	2020	5
Ethics for Social Sciences Research	WGS	2019	0.5
Academic Publication and Presentation in the Social Sciences	WASS	2020	4

B2 Placing research in a societal context			
Organizing various workshops for Iranian high school teachers on how to use technology effectively in their teaching	Iran Ministry of Education	2019-2022	1
C) Career-related competences/personal development			
C1 Employing transferable skills in different domains/careers			
PhD competence assessment	WGS	2019	0.3
Project & Time Management	WGS	2022	1.5
Basic Dutch course	Wageningen in'to Languages	2019-2020	1
Member of WASS PhD council	WASS	2019-2020	1
Coordinator and lecturer of systematic review course for PhDs	ICO	2022	1
Coordinator and lecturer of ICT and Education module for PhDs	ICO	2022	1
Coordinator and lecturer of the course *Entrepreneurship and Innovation in Practice* - BMO-57306	BMO/WUR	2022	0.7
Coordinator and Lecturer of the course *New Venture Creation: From Idea to Reality* - BMO-23406	BMO/WUR	2022	0.7
Coordinator and Lecturer of the course *Entrepreneurship and Innovation in Practice* - BMO-57306	BMO/WUR	2022	0.7
Total			**40.4**

*One credit according to ECTS is on average equivalent to 28 hours of study load

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