Reviewing Entrepreneurial Competencies in Undergraduate Education With Focus on Decision-Making

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The interest of entrepreneurial competencies has increased in the academic world, yet little has been done to review how these are taught. This paper aims to review how entrepreneurial competencies interventions are delivered to undergraduate students and to shed light on the current gap between these interventions and what is proposed in entrepreneurial competencies frameworks. Therefore, decision-making and other entrepreneurial competencies delivered in undergraduate education are reviewed. A systematic literature review was conducted to detect papers reporting decision-making interventions; 15 peer-reviewed journal articles published between 2016 and 2022 are included in this review. Results indicate that, in most cases, current decision-making interventions in undergraduate education are not lined up with entrepreneurial competencies frameworks. Few papers report enhancing decision-making in students whereas the others report improving other competencies such as self-awareness. It is shown that interventions with "through" learning objectives and its teaching methods provide the greatest opportunities for undergraduates to develop decision making competence; that is the knowledge, attitudes, and skills to grapple uncertainty, ambiguity, and risk.

*Keywords: **e**ntrepreneurship, higher education, educational theory, skills, decision making*

INTRODUCTION

The main objective of entrepreneurship education (EE) is the development of competencies (Lackéus, 2015; Tittel & Terzidis, 2020) for venture creation (Bozward and Rogers-Draycott, 2017), to foster an entrepreneurial mindset (Casulli, 2022) or to prepare individuals for value creation in small or large established organizations (Walmsley, et al., 2022). Competence can be defined as "cognitive or non-cognitive abilities to support the successful execution of a task" (Weinert, 2001) or in an entrepreneurial lingo "the knowledge, skills and attitudes that affect the will and ability to perform the entrepreneurial job of new value creation" (Lackéus, pp. 12, 2015).

Some entrepreneurial competencies frameworks have been developed to help Entrepreneurship Education (EE) to translate entrepreneurial competencies into different progression models conditional to different contexts and goals. Some relevant frameworks are Bacigalupo, et al., (2016) and QAA (2018) on which, how and to whom competencies should be taught in undergraduate education. These frameworks seek

multiple outcomes in terms of developing competencies to be used in entrepreneurial journey or competencies that can directly impact students' employability (Walmsley, et al., 2022).

But how are entrepreneurial competencies being implemented to what these competencies' frameworks propose? This paper, focuses on Decision-Making (DM) to try to answer this question and to shed light on the existing gap between current interventions reported in the literature and what these frameworks propose. DM was selected because it crosses most, if not all, the entrepreneurial process (Shepherd and Williams, 2015), but also because it is crucial in the development of the entrepreneurial mindset of grappling with uncertainty and ambiguity (Casulli, 2022), it is ranked among top desirable competencies in employability (Succi & Canovi, 2020). And finally, because there is a broad literature on entrepreneurs´ DM and heuristics (Arend, et al., 2016), but a scarce literature on how DM is been taught to undergraduate entrepreneurship students, the actual learning outcomes and how these are related to entrepreneurial competencies.

A Systematic Literature Review (SLR) was conducted to answer how existing DM interventions are delivered to entrepreneurship education undergraduates. As a result, some key lessons emerge about how DM and other related competencies are delivered, which teaching methods are used what outcomes on students are measured.

Given our focus is on DM competence, two relevant competency frameworks arise for EE. Bacigalupo, et al., (2016), from now on EntreComp, and QAA (2018). EmtreComp defines three competency areas and 15 competencies. The first area contains "Ideas and opportunities" with competencies such as: Spotting opportunities, Creativity, Vision, and Valuing ideas. The second area groups "Resources" with competencies such as Self-awareness and Self-efficacy, Motivation and perseverance, Mobilizing resources, Financial and economic literacy and Mobilizing others. The third area "Into action" considers Taking the initiative, Planning, and Management, Coping with uncertainty, ambiguity, and risk (DM is inferred), Working with others, and Learning through experience.

On the other hand, QAA (2018) states DM supported by critical analysis, synthesis and judgment is one of key entrepreneurial competencies in their progression model for entrepreneurship higher education. Other concurrent competencies in this model are: Creativity and innovation; Opportunity recognition, creation and evaluation; Implementation through leadership and management, Action and Reflection; Communication and strategy; and Digital, data and media.

Interestingly, it can be argued that DM competence in these two frameworks can be group into three broad DM skill categories, from lower to upper levels of complexity and execution: Look for information and cope with uncertainty and ambiguity, Evaluate risk independently or with others and Implement decisions under uncertainty (See Table 1). EntreComp also establishes for each DM skills different levels of proficiency: levels 1 and 2 cover Foundation (relying on support from others); level 3 and 4 focus on Intermediate know-how (building independence).

TABLE 1
DM IN QAA (2018) AND ENTRECOMP

Skill Category	QAA	EntreComp				
		Skill	Proficiency Level			
	Skill		Level 1	Level 2	Level 3	Level 4
Look for information and cope with uncertainty and ambiguity	Source and retrieve relevant contextualised information	Cope with uncertainty and ambiguity	I am not afraid of making mistakes while trying new things.	I explore my own ways to achieve things.	I can discuss the role that achieve things. information plays in reducing uncertainty, ambiguity and risk.	I can actively look for, compare and contrast different sources of information that help me reduce ambiguity, uncertainty, and risks in making decisions.
Evaluate risk independently or with others	Evaluate information and formulate arguments, independently and within a team	Calculate risk	I can identify examples of risks in my surroundings.	I can describe risks related to a simple value-between creating activity in which I take part.	I can tell the difference between acceptable and unacceptable risks.	I can weigh up the risks and benefits of self employment with alternative career options, and make choices that reflect my preferences.
Implement decisions under uncertainty.	Combine analysis with synthesis, intuitive decision making, drawn from subject and evaluation of critical incidents; be resilient and flexible when faced with change or uncertainty.	Manage risk.			I can critically evaluate the risks associated with an idea that creates value, taking into account a variety of factors.	I can critically evaluate the risks related to the formal setup of a value-creating venture in the area in which I work.

In this context, a relevant question is, are we really working at EE on putting the building blocks for the development of DM competence; that is the knowledge, the attitudes and the skills to handle uncertainty, ambiguity and risk to foster their entrepreneurial capability and effectiveness? According to Casulli (2022), EE has put a lot of emphasis on creativity and venture ideation which are competencies on the early stage of the entrepreneurial process, neglecting mindsets for grappling with uncertainty and ambiguity which are crucial for later stages. McMullen and Dimov (2013) claim that there seems to be a disconnection between what is taught in the classroom and the struggle, failure, and uncertainty of most of the entrepreneurial process. Thus, there is an opportunity that EE to focus on developing competencies for opportunity

recognition and creativity as well as dealing with uncertainty, ambiguity, and risk, which can be useful in pathways such as venture creation, improving employability, and developing life/career skills (Walmsley, et al. 2022). Therefore, DM arises as a crucial competence to be fostered at EE to improve students´ knowledge, attitudes, and abilities to deal with ambiguity, uncertainty, and risk to cope with real-life environments.

The rest of the papers is as follows: section two displays the methodology of the SLR; section three reports the findings of the SLR; section four discusses findings in terms of how EE could integrate entrepreneurship competencies frameworks into practice. Finally, the last section summarizes the conclusions.

METHOD

Given our focus was on DM, a SLR was conducted to investigate how DM interventions are delivered in EE. However, during research other entrepreneurial competencies emerged as outcomes of DM interventions, and thus need to be considered in the analysis and discussion. The procedure Ummihusna and Zairul (2021) used was adopted for the review as shown in Figure 1. The SLR comprised three stages: 1) planning the review; 2) conducting the review and 3) reporting and dissemination (See Figure 1).

FIGURE 1
THE SYSTEMATIC REVIEW METHODOLOGY

1. Planning the review
- **Step 1.** Elaborate the research question of the systematic literature review
- **Step 2.** Step 2. Select keywords and databases

2. Conducting the review
- **Step 3.** Use keywords in academic databases such as Scopus, Web of Science, Google Scholar, ProQuest Emerald Insight to search journal papers between 2016 and 2022.

107 search results

- **Step 4.** Selection of papers to meet the following criteria: between 2016 and 2022, peer-reviewed journal article and English language.
- **Step 5.** Review of papers to exclude articles that do not meet the inclusion and exclusion criteria and to avoid duplication: Relevant criteria were: entrepreneurship education, teaching interventions and English language.

16 articles selected for full review

3. Reporting and dissemination
- **Step 6.** Data coding and analysis were done in the Stata 14 program. The following codes were created to structure the information: 1) Type of students, 2) Application type, 3) Learning Theory 4) Research purpose, 5) Research approach and 6) Research outcome.
- **Step 7.** Reporting the findings

Following the PICO concept (Population, Intervention, Comparison, and Outcome measures) (Aromataris and Riitano, 2014), the research question was built to provide a methodology for the review process. The research question states: how are existing DM interventions delivered to undergraduates in entrepreneurship education? The question can be decomposed using the PICO concept in the following way: *undergraduates* (population), *DM* (intervention), *entrepreneurship education* (comparison), and *delivered* (outcome). The words used for the titles, abstracts and keywords of the initial retrieved articles were then extended using similar words and placed in a logic grid table (See Table 2).

Planning the Review

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TABLE 2
LOGIC GRID WITH IDENTIFIED KEYWORDS

Population (students)	Intervention (Decision Making)	Comparison (Entrepreneurship education)	Outcome (Interventions Delivered)
– Undergraduate – Higher education – Entrepreneurship students	– Decision making – Decision making course – Case – Simulation – Gamification – Games – PBL – Blogs – Hands-on experience – Data decision-making – Competition	– Entrepreneurship – Entrepreneurship education – Entrepreneurship curriculum – Entrepreneurship study – Entrepreneurship learning – Entrepreneurship pedagogy	– Decision-making skill – Decision-making competence – Decision-making process – Decision – Ethical decision – Intuitive decision – Cognitive decision

Conducting the Review

The search for scientific papers was done mainly through Scopus, the largest abstract and citation database of peer-reviewed literature – scientific journals, books, and conference proceedings in social sciences. In this database, the search was performed by typing in the key search string built from the combination of the keywords in Table 2. As a result, the search produced the identification of 84 articles. A complementary unconstructed and unconstrained search was performed on Google Scholar, ProQuest and Emerald Insight with 23 results. As of December 2022, the search resulted in a total of 107 articles. The papers were then exported to Stata software to remove duplicate articles and exclude articles before 2016. Articles from conference proceedings, books and book chapters were omitted to ensure the quality of the literature review. Then, the title and abstract of the remaining articles were meticulously assessed to validate the selection based on a set of inclusion and exclusion criteria (See Table 3). Eventually, fifteen articles met the inclusion criteria for the final review.

TABLE 3
INCLUSION AND EXCLUSION CRITERIA

Inclusion criteria	Exclusion criteria
• Published between 2016-2022	• <2016
• Indexed journal, peer-reviewed journal article	• Non-indexed journals, review journals, conference proceedings, postgraduate dissertation, books an book chapter
• English language	• Non-English
• DM interventions in entrepreneurship Higher Education (undergraduates)	• Papers on DM interventions not link with undergraduate entrepreneurship students
• Field of knowledge: business, psychology, social sciences, decision sciences	• Other fields: medical, sports, engineering, counseling, etc.

Reporting and Dissemination

With the fifteen selected articles, the codification was done by applying the PICO concept (Aromataris and Riitano, 2014) to identify the review component and then to create relevant codes for each component (See Table 4), namely for Population 1) Type of undergraduate students; for Intervention 2) Learning objectives and 3) Teaching method; for Comparison 4) Learning theory; and finally for Outcome 5) Research design, and 6) Outcomes on students.

TABLE 4
CODES OF REVIEW ANALYSIS

PICO Concept	Review Component	Codes
P – Population	Undergraduate students	1. Type of undergraduate students
I – Intervention	DM intervention	2. Learning objectives
		3. Teaching method
C – Comparison	Entrepreneurship education	4. Learning theory
O – Outcome	Delivered	5. Research design
		6. Outcomes on students

RESULTS

Type of Undergraduate Students

In terms of type of students, although the selected papers result from a SLR focusing on DM and EE, not all selected papers explicitly state students being part of an EE program. This might be because in higher education, entrepreneurial competencies can be fostered on students in fields of study in which entrepreneurship is not embedded; although such fields do not intent to foster such entrepreneurial competencies, they might end up achieving some. Therefore, some papers selected in this review capture such a phenomenon, whereas other papers claim explicitly to collect information from students who majored in a field of study in which EE is involved.

DM interventions were delivered to undergraduate students in higher education institutions in the following fields of study: seven papers indicate higher education institutions without further detail; four papers specify business students; and the remaining papers only one paper in the fields of business and economics, economics, education, and hospitality management students, respectively. Eight papers explicitly state that interventions were part of an entrepreneurship education, an entrepreneurial skills program, or an entrepreneurship competition (See Table 5).

TABLE 5
TYPE OF STUDENTS, LEARNING OBJECTIVES AND TEACHING METHODS

Type of student	EE	Jurisdiction	Learning objective	Description of intervention	Teaching method	Papers
HEI	-	Poland	About	Mental umber Line Training Condition (MNLT) or an Arithmetic Training Active Control condition (ATAC)	Lecture and exams	Sobkowet et al. (2019)
Business	-	USA	About, For	Teaching Resource Advantage theory to frame decision making related to both strategy and tactics in marketing courses	Case study and simulation	Levin and Liu (2021)
Business	-	USA	For	Two learning activities: decisions under scenarios and group discussions regarding empathy and moral issues	Action-based	Baker (2017)
Education	-	Turkey	For	DM skill training group practices developed on the bases of the conflict theory on the decision-making styles	Action-based	Colakkadioglu and Celik (2016)
HEI	Yes	Thailand, China, Vietnam, Myanmar, India, Namibia, and USA	For	Teaching entrepreneurial finance through Financial Feasibility Canvas	Action-based	Keerativutisest and Promsiri (2021)
Economics and business	Yes	Lithuania	For	Active teaching-learning methods	Action-based	Ruškytė and Navickas (2017)
Business	Yes	Brazil	For	Searching and assessment of opportunities and risks through patents	Action research project	do Canto Cavalheiro, et al. (2020)
HEI	Yes	Oman	For	Entrepreneurship competition for students from HEIs	Competition	Abushakara et al. (2019)
HEI	-	USA	For	Strategic management capstone course that feature strategic decision-making in a simulated business strategy game	Competition	Parayitam and Papenhausen (2018)
Hospitality	-	Switzerland, USA and UK	For	Hotel simulation	Simulation	Ampountolas et al. (2019)
Business	-	Australia	For	Computer simulation	Simulation	Gibbons et al. (2021)
HEI	Yes	Indonesia	For	Simulation of provision of services or products based on industrial standards	Simulation	Kusmintari et al. (2022)
Economics	Yes	Indonesia	Through	Activities that provided them with start-up capital, intensive training, apprenticeships and supervision from the project's team-members	Action research project	Blesia et al. (2021)
HEI	Yes	Malaysia	Through	Product selling and exhibition	Hands-on experience	Johari et al. (2016)
HEI	Yes	Finland	Through	Instruction in a competitive structure; integrates experienced professionals and coaches from the industry; includes problems or ideas from industry; and builds multidisciplinary project teams.	Studio-based	Heikkinen and Stevenson (2016)

Learning Objectives and Teaching Methods

Literature has identified relevant learning objectives for EE (Ahmad, et al. 2018; Mwasalwiba, 2010). QAA (2018) has adopted such learning objectives to reach entrepreneurial effectiveness and recognizes that undergraduate entrepreneurship students should be involved in the so-called activities of learning "about", learning "for" and learning "through". "About" objectives are intended only to help students to understand, assimilate, and reflect upon existing theories. "For" objectives can help students take a more active role in making decisions in a simulated risk-free environment and "Through" objectives focus on developing entrepreneurial capabilities through activities in real-world experiential environments, allowing the student to face more uncertainty, ambiguity, and risk in their DM.

Regarding teaching methods, there is no consensus in EE (Mwasalwiba, 2010) on which methods are more suitable to achieve EE learning objectives (Ahmad, et al., 2018). However, we adopt Ahmad, et al., (2018) taxonomy of passive, active and experiential teaching methods. Passive methods are traditional instructional approaches where students are taught concepts later to be assessed through examinations. Some methods in this category are Lecture and exams, Case studies and Business plans. Active methods allow students to participate actively in the teaching-learning process, enabling their self-discovery. Active methods include, but are not limited to business/computer simulations, guest speakers, business visits, field trips and action-based. In terms of DM we would argue that this type of activities are risk-free and allow students to cope with uncertainty and ambiguity to a certain extent. Finally, experiential methods enable students to be immersed in situations closer to real life. Among experiential methods are Projects with industry, Project-based learning (PBL), Counselling/Mentoring, Practical Training and Working with entrepreneurs, Start your own business, among others.

Table 5 presents learning objectives and teaching methods. Only two papers can be classified as learning "About". Levin and Liu (2021) intervention is based on traditional lecturing and examinations whereas Sobkow et al., (2019) relied on Case study and Simulation. Eleven papers of learning "For" objectives can also be grouped according to a teaching method. Four papers use simulation (Parayitam and Papenhausen, 2018; Ampountolas, et al., 2019; Gibbons, et al., 2021; Kusmintarti, et al., 2022) to induce students to take a decision to move forward in the simulation. Action-based papers (Baker, 2017; Colakkadioglu and Celik, 2016; Keerativutisest and Promsiri, 2021; Ruškytė and Navickas. 2017) describe DM interventions as a sequence of activities where the facilitator share knowledge in a contextual setting and students are asked to perform tasks that includes discussion and reflections. Abushakra, et al., (2019) reports the use of an entrepreneurship competition to enhance soft skills and Canto Cavalheiro, et al., (2020) use an Action research project to foster students to search and to assess opportunities and risks through patents.

There are three papers of learning "through" with different teaching methods: Blesia, et al., (2021) use Action Research Project; Johari et al., (2016) with Hands-on experience and Heikkinen and Stevenson (2016) with Studio based. These papers expose students to real-life activities such as obtaining start-up capital; selling and building multidisciplinary teams; and receiving feedback from industry experts, among other things. Those activities allow the student to manage risk and ambiguity in an open environment and closer to real-life scenarios.

Learning Theory

There are several learning theories. We can mention behaviorism, direct instruction, cognitivism, social learning theory, constructivism, connectivism, learning by doing and self-regulated learning. Although each has its characteristics, boundaries between one and the other are complex to establish.

Kolb defines experiential learning as "the process whereby knowledge is created through the transformation of experience" (Kolb, 1984, p.41). In other words, it results from living the experience, transforming it and making it yours (Kolb's experiential learning model). Entire learning process can be understood as the learner going back and forth through four stages: concrete experience, observations and reflections, abstract conceptualization, and active experimentation (McCarthy, 2010).

Experiential learning is increasingly used in higher education because employers identified it as a higher impact practice, in other words, experiential learning contributes to develop complex order skills such as

critical thinking or problem-solving (Berner, 2015, May 15) and self-reflection. EE has embraced the adoption of experiential learning as a learning model.

However, there are various ways of interpreting how to operationalize the model. In a study conducted by Mensah et. al. (2022), identify three ways to operationalize experiential learning in EE: through the senses, cognitive action and involvement in real life activities. There isn't a single school of thought on its application, it's even possible to locate authors who favor, for example, a combination of these operationalization ways (Mensah et. al., 2022; Neck and Greene, 2011).

In this line of thought, only one article applies non-experiential teaching methods (lecturing), the majority apply various experiential teaching techniques, and most focus on cognitive action and real-life activities (See Table 5).

Outcomes Measures

This part of the paper presents the results according to the PICO concept related to *intervention delivered* (outcome) regarding research design and outcomes on students' competencies.

Research Design

All reviewed papers, except one, were experimental studies where students were exposed to a teaching method (case, simulation, etc.,) through some intervention and subsequent data collection instruments were applied (See Table 6). Although one study was non-experimental, it is included in this review because it was based on past experiential learning, and it improves our understanding of DM interventions through a literature comparison. Among the fifteen studies, five were quantitative, six were qualitative and four were mixed approaches. In the quantitative approach (33%), three studies applied a post-intervention questionnaire, whereas the other two applied both pre-intervention and post-intervention questionnaires. The qualitative approach was the dominant method and represented 40% of all studies: insider action research, textual records of students´ work, semi-structured interviews, and observation. The non-experimental paper was done by Heikkinen and Stevenson (2016) using a comparison based on a literature review. Mixed methods papers combine quantitative and qualitative research in the following way: pre-intervention and post-intervention questionnaires, interviews, observation and open-ended questionnaires and Textual records of students´ work.

TABLE 6
RESEARCH DESIGN

	Research Design	Authors	No. of articles
Quantitative	Experimental 1) Pre-intervention and Post-intervention questionnaires Experimental 1) Post-intervention questionnaire	Abushakara et al. (2019) Ampountolas et al. (2019) Baker (2017) Ruškytė and Navickas (2017)	5
Qualitative	Experimental 1) Insider action research 2) Textual records of student's work 3) Semi-structured interview Non-experimental 1) Comparison based on a literature review	Do Canto Cavalheiro et al. (2020) Gibbons et al. (2021) Kusmintarti et al. (2022) Levin and Liu (2021) Johari et al. (2016) Heikkinen and Stevenson (2016)	6
Mixed Method	Experimental 1) Pre-intervention and Post-intervention questionnaires 2) Interviews 3) Observation Experimental 1) Pre-intervention and Post-intervention questionnaires 2) Interviews Experimental 1) Pre-intervention and Post-intervention questionnaire 2) Open-ended questionnaire Experimental 1) Post-intervention questionnaire 2) Textual records of students' work	Blesia et al. (2021) Colakkadioglu and Celik (2016) Keerativutisest and Papenhausen (2018) Parayitam and Papenhausen (2018)	4

Research Outcomes on Student Competencies

The analysis of research outcomes points out that students subject to teaching interventions experienced effects in terms of entrepreneurial competencies (See Table 7). To undertake this analysis, we followed EntreComp as a reference framework for entrepreneurial competencies and tried to classify interventions accordingly. Therefore, in fact papers can be classified as developing DM as well as other entrepreneurial competencies. For example, Sobkow et al. (2019) report that participants developed a more exact symbolic-number mapping, a basic numeracy competence related to DM.

TABLE 7
COMPETENCIES AND RESEARCH OUTCOMES ON STUDENTS

Competencies	Outcomes on students	Papers
0. Numeracy	Participants developed a more exact symbolic-number mapping	Sobkow et al. (2019)
1.5 Ethical and sustainable thinking	Prompts a more deliberate, thoughtful ethical DM process Development of ethical principles of communication and collaboration	Baker (2017) Ruškytė and Navickas (2017)
2.1 Self-awareness and self-efficacy	Improvement of confidence Increase of self-esteem Strong identification with roles; emotional excitement foster learning	Abushakra et al. (2019), Ampountolas et al (2019); Blesia et al. (2021); Ruškytė and Navickas (2017) Colakkadiouglu and Celik (2016) Gibbons et al. (2021)
2.4 Financial and economic literacy	Raise the awareness on the financial aspects of business Achieved financing, marketing and sales skills	Keerativutisest and Promsiri (2021) Kusmintarti et al. (2022)
3.1 Taking the initiative	Creation of real solutions and prototypes Simulation of provision of services or products based on industrial standards	Heikkenen and Stevenson (2016) Kusmintarti et al. (2022) Johari et al. (2016)
3.3.1 Cope with uncertainty and ambiguity	Increased on positive coping style scores Cope with an emergency situation	Colakkadiouglu and Celik (2016) Abushakra et al. (2019)
3.3.2 Calculate risk	Explored and applied relevant techniques, behaviors and strategies for managing a hotel Assessment of opportunities and risks through patents Evaluation on interdependence of decisions Learning of resource allocation to improve competitive positioning	Ampountolas et al (2019) do Canto Cavalheiro et al. (2020) Gibbons et al. (2021) Levin and Liu (2021)
3.4 Working with others	Builds multidisciplinary project teams Cooperative conflict management is positively related to agreement-seeking behavior	Heikkenen and Stevenson (2016) Parayitam and Papenhausen (2019)

The outcomes on students' competencies covered the three competencies areas of EntreComp: 1. Ideas and opportunities, 2. Resources and 3. Into Action. Particularly, two papers, Baker (2017) and Ruškytė and Navickas (2017), clearly stated on improving Ethical processes and principles; six papers, Abushakra, et al., (2019), Ampountolas, et al., (2019); Blesia, et al., (2021); Ruškytė and Navickas (2017), Colakkadioglu and Celik (2016), Gibbons et al., (2021) described enhancement of Self-awareness and self-efficacy; two papers, Keerativutisest and Promsiri (2021) and Kusmintarti, et al., (2022) claimed improvement of Financial and economic literacy; three papers, Heikkinen and Stevenson (2016), Kusmintarti, et al., (2022), Johari et al., (2016), can be alleged to Taking the initiative. and finally, two papers (Heikkinen and Stevenson (2016) and Parayitam and Papenhausen (2018)) showed improvement on Working with others.

Papers fostering DM competence are Abushakra, et al., (2019) and Colakkadioglu and Celik (2016) who reported students Coping with uncertainty and ambiguity; and Levin and Liu, (2021), do Canto Cavalheiro, et al., (2020), Ampountolas, et al., (2019) and Gibbons et al. (2021) who worked with enhancing Risk calculation.

DISCUSSION

Geographical Dispersion of Studies Across the World

Although the United States was the most frequent country in the studies included in this literature review with 3 studies, there is an interesting dispersion of countries where DM interventions were delivered. The second country is surprisingly Indonesia with 2 studies. The rest of the countries have only one study: Australia, Brazil, Finland, Lithuania, Malaysia, Oman, Poland, Switzerland, and Turkey. Only 2 studies were conducted with a mix of local and international students: Ampountolas, et al. (2019) with students from Switzerland, the United States, and the United Kingdom, and Keerativutisest and Promsiri (2021) with students from Thailand, China, Vietnam, Myanmar, India, Namibia, and the United States. This dispersion of countries reflects a global interest towards understanding DM interventions.

DM Definition

There is a lack of consensus about what DM means regarding competence development. Some papers understand DM as financial choices regarding financial performance, expected values, return on investment and risk assessment (Baker, 2017; Sobkow et al., 2019; Levin and Liu, 2021; Keerativutisest and Promsiri, 2021). Although financial jargon and financial skills are necessary for DM development, this definition is more in line with Financial and economic literacy competence than with DM competence (Coping with uncertainty, ambiguity, and risk). Other papers comprehend DM as management of day-to-day operations, product production, time to market decisions (Ampountolas, et al., 2019; do Canto Cavalheiro, et al., 2020); concepts related to Planning and management competence. One paper explicitly set DM in the context of ethical issues which is clearly more in line with Ethical and sustainable competence (Gibbons et al., 2021). Only few papers understand DM in line with DM EntreComp definition; particularly with Coping with uncertainty and ambiguity (Colakkadioglu and Celik, 2016; Abushakra, et al., 2019) and with calculation of risk (Ampountolas et al., 2019; do Canto Cavalheiro, et al., 2020; Gibbons et al., 2021 and Levin and Liu, 2021).

Learning Goals, Teaching Methods and Uncertainty, Ambiguity, and Risk

Gibb (2008) points out competencies should help individuals to create, cope and enjoy change involving higher levels of uncertainty and complexity; therefore, there should be a progression of learning goals from "For" to "Through" for undergraduate students to experience higher levels of uncertainty and ambiguity. Casulli (2022) claims that EE has put great emphasis on competencies such as creativity and ideation neglecting grappling with uncertainty and ambiguity which are crucial competences in later stages in the entrepreneurial process.

Therefore, in current EE practice, students are not usually exposed to a certain degree of risky environments to develop their DM skills. For example, two papers in the review are learning "About" papers which offer minimum exposure to uncertainty and ambiguity with teaching methods such as lecturing. Eleven papers are learning "For" papers with Simulation and Action-based as the most common teaching methods to expose students to an environment of uncertainty and ambiguity, but without any risk. Finally, three learning "through" papers exhibited DM interventions with a higher degree of uncertainty, ambiguity and risk due to students receiving start-up capital, exhibiting and selling products and trying to solve industry problems while receiving professional coaching.

Goals and Outcomes of Learning

We see an indirect relationship between DM intervention goals and accountability of student skill performance; as learning objectives increase from lower to upper levels of entrepreneurial effectiveness ("About"; "For" and "Through"), there is an increasing difficulty in assessing the validity of student skill performance due to some paper's measures being the students' perception or project milestones. More appropriate skill measures are performance evaluations.

In "About" learning goals, it can be relatively easy to assess skill performance with hard data such as numeracy tests (Sobkow et al. (2019) or financial evaluations (Levin and Liu, 2021) due to knowledge

acquisition being the main issue. Most "For" learning goals papers report perceptions on skill development (Colakkadioglu and Celik, 2016; Baker, 2017; Ampountolas, et al., 2019 and others), whereas some papers inform student advancement on project or simulation milestones (do Canto Cavalheiro, et al., 2020; Gibbons et al., 2021; Parayitam and Papenhausen, 2018). Finally, "Through" learning goals are the most difficult to assess skill performance given the DM interventions involve various parties whose net impact is difficult to measure. These papers use testimonials as students' perception on skill development (Johari et al., 2016) or project or simulation milestones (Heikkinen and Stevenson, 2016; Blesia, et al., 2021), but none of them assess students' skill performance. This pattern reflects entrepreneurship research's challenge to build generalized and verifiable knowledge and develop robust theories.

Competencies Outcomes on Students

Although papers in this review have DM and EE in common and most explicitly state DM as their core subject, there is a heterogeneity of outcomes´ competencies that students achieved based on the EntreComp framework (see Table 7). First of all, there is a basic competence such as numerary, which is out of the scope of EntreComp. Then, there are two papers on Ethical and Sustainable thinking, six papers on Self-awareness and self-efficacy, two papers on Financial and economic literacy; three papers on Taking the initiative and two papers on Working with others. There are only six papers in which outcomes can be classified according to EntreComp DM skills: two related to Cope with uncertainty and ambiguity and four regarding Calculate risk. Colakkadioglu and Celik (2016) claim that students increase their positive coping style scores with their intervention, whereas in Abushakra, et al., (2019) students can cope with an emergency situation. Ampountolas, et al., (2019) hold that students explored and applied relevant techniques, behaviors and strategies for managing a hotel. The other three papers allege that students improve their assessment of risk and opportunities (do Canto Cavalheiro, et al., 2020), their evaluation of interdependence of decisions (Gibbons et al., (2021) and learning resource allocation (Levin and Liu, 2021).

CONCLUSION

This paper reviews published papers on how DM interventions are delivered in EE by identifying learning theories, teaching methods and competencies outcomes on students, among other issues. Although this review is far from complete, a systematic process offers valuable input towards understanding the most common ways DM and other entrepreneurial competencies are taught.

In the first part, methodological steps were taken such as elaborating the research question and adopting the PICO concept as a reference to perform the review. The research question is how are existing DM interventions delivered to undergraduates in entrepreneurship education? With this question, a SLR was conducted mainly through Scopus. 84 papers were identified plus 23 in a complementary search. All the results were exported to Stata software to remove those that do not meet the search criteria. Finally, 15 papers were selected by applying inclusion and exclusion criteria.

The application of the PICO concept led us to use its four components as follows: *undergraduates* (population), *DM* (intervention), *entrepreneurship education* (comparison), and *delivered* (outcome). With these references, six categories were created: 1) Type of students, 2) Learning objectives, 3) Teaching method, 4) Learning theory, 5) Research design and 6) Outcomes on students.

In the first category, Type of students, it was found that most DM interventions target business students. In the second and third categories, most papers focus on "For" learning objectives and most common teaching methods within this objective are action-based and simulation. However, just a few papers report "Through" learning objectives where students are exposed to DM interventions that foster grappling uncertainty, ambiguity, and risk. Teaching methods such as Hans-on experience, Studio-based and Action-research allow students to be involved, to certain extent, in risky environments and real-life situations like what they will experience later in life.

In the fourth category, Learning theory, almost all papers apply an experiential approach, which is common practice in EE. In the fifth category, Research design, it offers an interesting insight in terms of the type of research approach: qualitative (40%), quantitative (33%) and mixed methods (26%) approaches. We

claim that as papers target higher learning goals, multiple effects happen in the learning process, making these effects less tractable for a quantitative approach. This pattern is aligned with the challenge of entrepreneurship research to balance context-specificity (Van Burg et al., 2020) and generalization.

Finally, in competencies outcomes on students, there is a heterogeneity in terms of the development and the level of proficiency of competencies if we consider EntreComp framework. There are six papers on DM competence, six papers on Self-awareness and self-efficacy, three papers on Taking the initiative; two papers on Ethical and Sustainable thinking, two papers on Financial and economic literacy and two papers on Working with others. This pattern might be because there is not a common definition of DM for competence development. Therefore, even though some papers claim the improvement of DM competence on students, there is no verifiable evidence that students achieved a level of proficiency, or the evidence points out to a competence different from DM.

As a future line of research, it highlights the need to understand each competence individually and not only as a group, to measure each of them and how each contributes to developing other competencies. This could help educators to understand when to develop each competence, how to intervene and how to measure the outcome.

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