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**Active Methods in Entrepreneurship  
Education: A Competency-Based  
Approach to Investigate Their Theoretical  
Foundations and Effectiveness**

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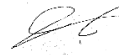
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**Declaration:**

Hereby I declare that this doctoral thesis, my original investigation and achievement, submitted for the doctoral degree at Tallinn University of Technology has not been submitted for doctoral or equivalent academic degree.

Basel Hammoda



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**Aktiivsed meetodid ettevõtlusõppes:  
pädevuspõhine lähenemine nende  
teoreetiliste aluste ja tõhususe uurimiseks**

BASEL HAMMODA





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## List of publications

1. Hammoda, B. (2023). Extracurricular Activities for Entrepreneurial Learning: A Typology Based on Learning Theories. *Entrepreneurship Education and Pedagogy*, 0(0).
2. Hammoda, B. (2024b). The impact of educational technologies on entrepreneurial competencies: A systematic review of empirical evidence. *Knowledge Management & E-Learning*, 16(2), 309-333.
3. Hammoda, B. & Winkler, C. (2024) Active methods in Entrepreneurship Education: A case study with engineering students. *European Journal of Engineering Education*.
4. Hammoda, B. & Foli, S. (2024). A digital competence framework for learners (DCFL): A conceptual framework for digital literacy. *Knowledge Management & E-Learning*, 16(3).
5. Hammoda, B. (2024a). ChatGPT for founding teams: An entrepreneurial pedagogical innovation. *International Journal of Technology in Education (IJTE)*, 7(1), 154-173.
6. Hammoda, B. (2024d). Academic Startup Clinic: Applying effectuation and experiential principles to educate and support academic entrepreneurs. In Hepworth-Sawyer, R.; Marrington, M., Hall, J. & Beaumont, E. (Eds.), *Contemporary Enterprise and Entrepreneurship in Context*. Routledge. (Forthcoming).

### Other publications related to the thesis:

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2. Hammoda, B. (2024c). Digital Technology in Entrepreneurship Education: An Overview of the Status Quo. In Durst, S. & Pevkur, A. (Eds.), *Digital Transformation for Entrepreneurship. Digital Transformation: Accelerating Organizational Intelligence* (71-93). World Scientific Publishing Company.

## **Author's contribution to the publications**

1. Hammoda, B. (2023). Single author: Problematization, literature review, data collection and analysis, discussion and paper write up.
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4. Hammoda, B. & Foli, S. (2024). Lead author: Problematization, literature review, data collection and analysis, discussion and paper write up.
5. Hammoda, B. (2024a). Single author: Problematization, literature review, data collection and analysis, discussion and paper write up.
6. Hammoda, B. (2024d). Single author: Problematization, literature review, discussion and paper write up.

### **Other publications related to the thesis:**

1. Winkler, C., Hammoda, B., Noyes, E., & Van Gelderen, M. (2023). Second author: Problematization, literature review, discussion and paper write up.
2. Hammoda, B. (2024c). Single author: Problematization, literature review, discussion and paper write up.



## Introduction

My interest in pursuing this PhD stems mainly from my entrepreneurial activities. As a startup mentor, a previous MBA student in entrepreneurship, and an entrepreneur, I could see discrepancies between the causal approaches followed to educate future entrepreneurs in academic institutions and the dynamism of real-life entrepreneurship. Hence, I realized that the adoption of more active methods is required at higher education institutions (HEIs), to equip entrepreneurial students with the required practical knowledge, skills, and attitudes to survive the realities of the professional environment. Similarly, companies are increasingly emphasizing the need for entrepreneurial and market ready graduates. Something that the traditional theory-laden pedagogies in management and entrepreneurship cannot fulfil adequately. When the time was right, I moved to Estonia to do my PhD at Tallinn University of Technology (Taltech). Tallinn is known to have a dynamic and flourishing startup ecosystem, and a prevailing entrepreneurial culture. Moreover, Taltech promotes the development of entrepreneurial skills among its students regardless of their study discipline and hosts a well-reputed team of entrepreneurship education researchers and lecturers.

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Entrepreneurship is largely understood as an economic activity that includes an element of novelty (Acs & Audretsch, 1990; Audretsch, 2012; Schumpeter, 1942). It can take different shapes and forms including new venture creation (Bhave, 1994; Neck et al., 2004), new value creation (Amit & Zott, 2001; Bruyat & Julien, 2001; Fayolle, 2007), cultivate sustainability conscious graduates (Mets et al., 2021), and innovation (Acs & Audretsch, 2005; Zhao, 2005). Teaching entrepreneurship has grown rapidly in the last two decades in higher educational institutions (HEIs) across all regions (Varblane & Mets, 2010) and disciplines (Mawson et al., 2023), with universities making significant investments in entrepreneurship courses and programs (Antonelli et al., 2024; Fayolle, 2018; Mawson et al., 2023; Nabi et al., 2017). It has even witnessed increasing propagation outside HEIs in schools, community organizations, and corporates (Fayolle, 2018; Mawson et al., 2023; Nabi et al., 2017). This propagation could be attributed to the role of entrepreneurship and entrepreneurial behavior in driving economic growth, innovation, and sustainable development goals (Acs, 2008; Carree & Thurik, 2010; Díaz-García et al., 2015, Rashid, 2019), with entrepreneurship education (EE) shown as an important contributor to the development of entrepreneurial characteristics and startup survival (Cosenz & Noto, 2018; Nabi et al., 2017). This development, however, has resulted in diversification and lack of consensus on the definitional terms, foundational principles, and approaches to teach entrepreneurship (Decker-Lange et al., 2021; Gibb, 2002; Kuratko & Morris, 2018). It comes as no surprise then that entrepreneurship education (EE) is defined broadly as “any pedagogical program or process of education for entrepreneurial attitudes and skills” (Fayolle et al. 2006, p. 702), which is the seminal definition followed through. Fayolle’s definition indeed embodies the diversity of the methods used to teach entrepreneurship, which are investigated and represented in the thesis, including classroom-based ones, extracurricular activities, and digital educational technologies. Additionally, it signals that the main purpose of EE as in developing learners’ skills and attitudes, rather than a positivist orientation that aims for venture creation.

The approaches followed at HEIs to teach entrepreneurship can be largely categorized as either traditional or modern/ active/ innovative (Lackéus, 2015; Mwasalwiba, 2010). Traditional pedagogies, that were prevalent previously in HEIs, tend to teach students “about” entrepreneurship (Lackéus, 2015), with common topics discussed including its definitions, geo-demographics, socio-economic impacts, firm lifecycle, etc. These usually rely on lectures and theory-oriented case studies (Decker-Lange et al., 2021) and exhibit a mechanistic knowledge imparting attitude following the behavioral and cognitive models of learning (Higgins et al., 2013). Throughout the years, this approach was challenged for lacking demonstrable impact on students’ interest in entrepreneurship and developing practical knowledge and skills (Hägg & Kurczewska, 2021; Robinson et al., 2016). They are however being gradually replaced with more active approaches that promote practical and self-driven learning attitudes (Günzel-Jensen & Robinson, 2017; Hase & Kenyon, 2000, 2007; Robinson et al., 2016; Neck & Corbett, 2018).

Active methods promote a learning-by-doing approach, that aims at developing entrepreneurial competencies (ECs) (Mwasalwiba, 2010; Neck & Corbett, 2018), which are the set of knowledge, skills, and behaviors exhibited by an entrepreneurial individual (Bacigalupo et al., 2016). These methods are expected to answer to the perceived inadequacies of traditional educational models towards the development of practical entrepreneurial skills that could support entrepreneurial students navigating real-life business and professional settings (From, 2017; Kozlinska et al., 2023; Ilomäki et al., 2016). Examples of active methods can include curricular activities such as groupwork and presentations, extracurricular activities such as student clubs (Pittaway et al., 2015) and venture creation programs (Pocek et al., 2021), and methods that are based on digital technologies such as serious games (Grivokostopoulou et al., 2019).

The introduction of active methods thus contributes and aligns with a competency-based approach in EE (Kozlinska et al., 2023; Morris et al. 2013), which has received more attention from scholars, educators, and policymakers in recent years (Neergaard et al., 2021; QAA, 2018). A competency-based approach promotes the development of a broader skill set among student entrepreneurs that connects to behavioral and affective outcomes and can be deployed in a variety of career options (Glackin & Phelan, 2020; Morris et al., 2013; Nabi et al., 2017; QAA, 2018). Hence, a competency-based approach helps extend the value of EE beyond the prevalent socio-economic driven approaches that were traditionally used to guide entrepreneurship teaching in HEIs, and the assessment of its outcomes such as startup rates, intentions, or amount of funding raised (Bacigalupo et al., 2016; Glackin & Phelan, 2020; Kozlinska et al., 2020; Nabi et al., 2017).

The **problem statement** for this thesis relates to the condition that the accelerated propagation of active methods in EE at HEIs has probably eclipsed the understanding of entrepreneurship educators of the learning theories that underpin these methods (Fayolle, 2018; Kakouris et al., 2023; Neck & Corbett, 2018). Learning theories establish how individuals develop their mental schemas that shape their knowledge, behaviors, and attitudes (Bereiter, 1990), which are of particular importance in guiding the learning of an action-oriented field like entrepreneurship (Neck & Greene, 2011). This situation is thus impeding the ability of EE educators at HEIs to integrate those active methods in their pedagogies effectively and knowledgeably, hindering the development of students’ entrepreneurial competencies (ECs) (Bozward & Rogers-Draycott, 2020; Cope & Watts, 2000; Deakins & Freel, 1998; Lackéus, 2020; Neck & Corbett, 2018). This theoretical frailty extends to our assessment of EE outcomes as in the developed ECs (Antonelli et al., 2024; Mets et al., 2017). We lack an established reference framework (Bird, 2019),

which impedes our ability to assess the competency-based outcomes of active methods in EE (Preedy et al., 2020). Hence, grounding active methods in established and broadly validated theories will allow us to incorporate them more insightfully in EE and more conclusively assess their outcomes (Kakouris et al., 2023; Pittaway et al., 2015). In simple terms, we need to look back to move forward.

In terms of the **research gaps**, the applied pedagogies and methods in EE lack sufficient theoretical grounding, with scarce connections to established learning or entrepreneurship theories (Arranz et al., 2017; Beaumont et al., 2022; Fayolle, 2018; Kakouris et al., 2023; Preedy et al., 2020; Preedy & Jones, 2015). A main reason behind this insufficiency stems from entrepreneurship educators being either entrepreneurship researchers or have some professional entrepreneurial / management experience (Neck & Corbett, 2018). Hence, lacking a sufficient background in education and educational sciences has confined our approaches to conducting EE research and teaching it to “what we already know”, following a more practice driven approach (Kakouris et al., 2023; Kyro, 2015). Fayolle (2013) commented on this as well critiquing EE practice for being poorly theoretically and philosophical founded. In addition, there is an apparent divergence in interpreting and implementing “known” learning theories among entrepreneurship researchers and educators (Kyro, 2015). The criticality of addressing this theoretical fragility arises from what Neck and Corbett (2018) posited, and I agree with their argument, that “Applying classic education theories and frameworks to EE to further advance the question of how entrepreneurship can or should be taught will help faculty and students equally”. (p.35).

Moreover, most available studies rely on a limited set of theories such as the theory of planned behavior (Ajzen, 1991) or experiential learning (Kolb, 1984), without much attention to other conjectures or efforts to connect them with the more widely established learning and entrepreneurship theories (Kakouris et al., 2023; Jones et al., 2015; Morris et al., 2017; Pittaway et al., 2011; 2015). Additionally, despite the recognition of competency-based approaches, there is a divergence in assessment methods that renders the generalizability of any one method debatable (Bird, 2019), with limited investigation of their application (Nabi et al., 2017; Neergaard et al., 2021). Thus, a more theoretically established framework is required to better assess active methods outcomes. Consequently, we are lacking sufficient and conclusive empirical insights on active methods impact on EE competency-based outcomes, and the intricacies of their application (Chen et al., 2021; Duval-Couetil et al., 2016; Hagvall Svensson, 2023; Higgins et al., 2013; Koropogui et al., 2023; Pittaway et al., 2015; Preedy et al., 2020).

This thesis thus **aims** to investigate the theoretical foundations of different active methods, as well as advance our understanding their outcomes, more specifically competency-based outcomes when applied in EE at HEIs. Through the publications in this thesis, I aimed at addressing the following research questions:

- RQ1: What are the theoretical foundations of active methods in EE, deployed to improve its competency-based outcomes?
- RQ2: How can a competency-based approach be operationalized for assessing the outcomes of active methods in EE, as a reliable theoretical framework?
- RQ3: How do active methods contribute to competency-based outcomes in EE?























































Hammoda (2024a) applied ChatGPT for a founding team exercise and reported on it in a pedagogical innovation. The learning activity involved 20 students, who were surveyed afterwards for their perceived ease of use, usefulness, and convenience of using ChatGPT for entrepreneurial learning. They were also provided with space to provide additional comments on their experiences. The students' feedback was complemented by educator (author's) observations. A brief survey was sent out directly after the seminar to avoid recall bias (Schmidt et al., 2023). It requested that the students evaluate their experience using ChatGPT for receiving guidance on founding team composition, through three questions and an open feedback comment box. In total, 17 out of the 20 students responded to the survey (85%). The quantitative responses were imported to Microsoft Excel and analyzed descriptively for the mean and standard deviation to understand the general agreement/ disagreement in student responses and the variance in students' views, with regards to the survey questions (Stockemer et al., 2019). Responses to the open-ended questions as to the educator's observations were utilized to adjutant the findings (McKim, 2017).

Hammoda and Winkler (2024) conducted a case study within the context of an entrepreneurship course, designed with guidance from Mäkimurto-Koivumaa and Belt (2016) framework which leveraged active learning principles. The course was delivered to students from technology and engineering backgrounds. The paper investigated the intricacies of applying several active methods of EE, and their perceived challenges and opportunities, following an exploratory case study approach (Yin, 1994) as it allows answering questions of "how" and "why" (Leonard-Barton, 1990). We relied on interviews with the 18 students, the educator (one of the authors) observations, and input from a workshop with 8 EE experts. We followed Yin (1994) and Miles and Huberman (1994) suggested guidelines to data analysis. The data collected from the different sources was refined and reduced. Then categorized and recombined to expose it for analysis, using the active methods as a unit of analysis. This was performed in an inductive and iterative process (Strauss & Corbin, 1998), to satisfy the purpose of the study, deduce conclusions, and validate them in relation to extant literature (Eisenhardt, 1989).

Finally, Hammoda (2024d) conceptualized a model for academic entrepreneurship education and support. I relied on experiential learning (Kolb, 1984; Kolb & Kolb, 2005) and effectual principles (Sarasvathy, 2001) as predominantly active learning conduits that are widely used in a teaching "through" entrepreneurship approach. The conceptual logic is usually welcomed in scholarly areas that lack enough theorizing and/ or existing theoretical frameworks fail to address the research question.

### 3. Summary of findings

In this part, I present a summary of the findings from the different publications included in the thesis, organized according to the research questions. For the detailed findings of each publication and discussion of specific findings, please refer to the respective paper.

#### 3.1. RQ1: What are the theoretical foundations of active methods in EE, deployed to improve its competency-based outcomes?

The theoretical grounding of active methods in EE was part of four of the publications included in the thesis: Hammoda (2023) on ECAs, Hammoda and Winkler (2024) on active methods in STEM EE, Hammoda (2024a) on generative AI in EE, and Hammoda (2024d) applying effectuation and experiential learning for academic EE.

Across the thesis publications, the author aimed mainly to extricate and further establish the theoretical origins and associations of different active methods. These were found and hypothesized to be grounded in different learning and entrepreneurship theories, that provide them with a theoretical frame to understand their effectiveness towards developing entrepreneurial competencies, as to the opportunities and contingencies of their effective application. Extracurricular active methods were connected to five different learning theories and perspectives; experiential, social, situated, existential, and cognitive. Active methods applied in a classroom environment were grounded in active learning views of Piaget, Vygotsky, and Dewey. Moreover, generative AI application for EE and uptake by entrepreneurship students was posited to be better aligned with a heutagogical and effectual logic. Similarly, educating academics on entrepreneurship was conceptualized to follow effectuation and experiential learning principles to better match the needs of academic entrepreneurs. However, it was found that the theoretical affixation of active methods is rather situational. The theoretical relationship of active methods is dependent on the purpose and the context of their application, with several of them exhibiting a modular relationship to the different learning theories.

I highlight here the main findings from these publications. In Hammoda (2023), the paper identified 34 ECAs following in-depth interviews with 22 ecosystem experts, that can help develop entrepreneurial students' competencies. These were mapped against cognitive, experiential, social, situated, and existential theories of learning, as in figure (5). Cognitive ECAs included for example workshops, courses, books, industry news, reports, and documentaries. These can develop financial knowledge and self-confidence, while giving the students creative ideas and the ability to identify opportunities. Experiential ECAs were either virtual, as in simulations and virtual companies, or authentic which included side hustle and launching a crowdfunding campaign. Essentially, these experiential environments can allow students to practice the different aspects of running a business including planning, marketing, supply chain management, taxation, investment, and payrolls. Additionally, students tend to learn how to deal with uncertainty and risk, preparing them for the dynamic startup world.

Social ECAs included mentoring, students' organizations, exchange programs, and online groups and forums. Mentors can provide access to valuable resources and experiences, that could be otherwise unattainable. Additionally, they can provide more specific advice based on the mentor's background like legal or marketing advice. Social ECAs were recommended to help finding team members and co-founders. They also develop teamworking and public speaking skills, and planning and management skills if

they get involved in organizing them. Situated ECAs recommended by the experts can last for either a short period such as hackathons and startup competitions or longer durations as in accelerators and internships. Through these situated learning experiences, students get to develop presentations, business, and financial models in iterations and in teams. They also act as creativity beds as students are expected to come up with an innovative solution to societal and/ or environmental problems. Moreover, these situations act as communities of practice where they get to learn about different entrepreneurial practices from their peers, mentors, advisors, and entrepreneurs. Existential activities were deemed essential as they form a core part of transforming new knowledge and experiences into updated mental models and behaviors. They also allow students to learn more about themselves and their surrounding environment. Hence, developing better awareness and self-efficacy, while igniting their creativity and opportunity identification skills. Several existential activities were recommended by the experts including opportunity walk, reflective practices, engaging in artistic activities, and undertaking self-assessment tests. However, it is worth noting that the proposed theoretical alignment is rather flexible and depends on the context and the purpose of applying an ECA.

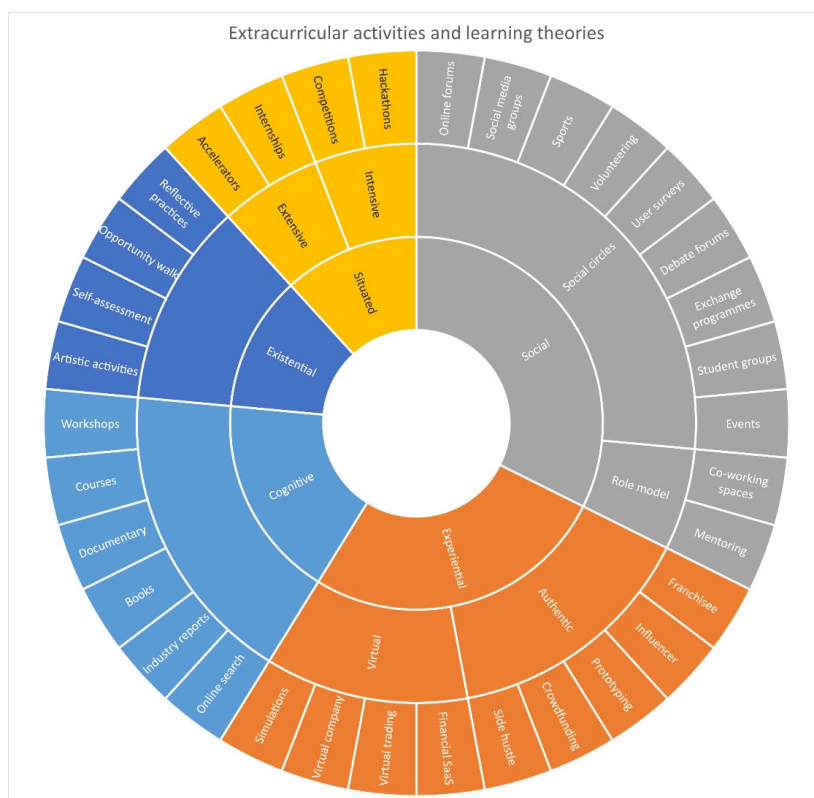


Figure (5): A Typology of Extracurricular activities in entrepreneurship education  
Source: Hammada (2023)

Hammoda and Winkler (2024) studied the application several active methods to teach entrepreneurship to students from engineering and technology backgrounds. They reported on the benefits they bring towards developing students ECs, the potential challenges, and the intricacies of applying them in a classroom environment, using views of the students, educator, and EE experts. In general, introducing active teaching methods was well appreciated and students found active approaches to be very important in learning entrepreneurship, as an unknown topic to them, which provided them with sufficient theoretical knowledge while allowing them to practice it simultaneously. Across the active methods implemented, pitching and presenting and mentoring sessions were the most valued by the students. Regular pitching spurred their motivation and helped them become more creative and self-confident. It also improved their communication skills and taught them better planning and management, through putting theoretical knowledge to application. Mentoring allowed them to receive feedback and ask questions in a criticism free environment. They were also able to acquire knowledge and guidance that is tailored to their individual needs. Students reported that groupwork is an essential skill in modern workplaces. However, to maximize its benefits they would like to work with different people to learn from more diverse experiences and working styles. Guest speakers were well appreciated for allowing them to learn from real-life experiences and explore possible entrepreneurial and career paths. Something that would take years to develop otherwise. Online search or 'Googling' as coined by EE experts was seen as an indispensable skill to gain insights into markets, companies, and competitors. However, students should learn how to perform it effectively, i.e., where to go to find what type of information. Using multimedia and social media improved message communication and clarity, especially for complex theoretical constructs. It also improved the likeness of the course and allowed them to gain more comprehensive view on the social and ethical aspects of running a business.

Moreover, in Hammoda (2024a), generative AI (ChatGPT) was applied in an entrepreneurial pedagogical innovation as the new advanced technology with promising educational applications (Farrokhnia et al., 2023), especially in the field of entrepreneurship (Winkler et al., 2023). Generative AI is conceptualized as a heutagogical learning tool that embodies the effectual decision making of entrepreneurial students and entrepreneurs. It was applied for a founding team activity that aimed at providing students with insights on the different compositions of entrepreneurial teams and how to organize them based on to the type of business they are starting. ChatGPT provided them individualized and contextually relevant, in an evolving and conversational manner. Students perceived it as extremely useful in supporting them in understanding the varying compositions of founding teams pertinent to the type of business and developing an insightful comprehension of the recommended constellations, and relatively easy to use for venture ideation and creation activities. Moreover, they got to comprehend and experiment with the practicalities of team building, financial and equity arrangements, and business modelling. They also found it to be rather convenient for entrepreneurial learning in comparison to the habitual lectures and classroom-based methods.

Hammoda (2024d), designed a conceptual model for academic EE based on effectuation and experiential learning principles. Both are increasingly used in "through" approaches to teach entrepreneurship. Moreover, effectuation and experiential learning are particularly relevant in the context of academic EE as academic entrepreneurs

typically face resource and time constraints (Alexander et al., 2015), and lack exposure to entrepreneurial role models (Miller et al., 2018), and need to improve their practical skills (ibid).

### **3.2. RQ2: How can a competency-based approach be operationalized for assessing the outcomes of active methods in EE, as a reliable theoretical framework?**

A competency-based approach was followed in the thesis and manifested to varying degrees across the thesis publications. More specifically, it was used for identifying the outcomes of active methods in EE and for developing a competency-based framework for digital competence among learners.

A competency-based approach was at the heart of assessing the impact and outcomes of applying active methods in EE. I relied on EntreComp framework, as a validated and applied framework in research on entrepreneurial competencies, to assess the outcomes of applying educational and digital technologies in EE. The learning outcomes were hence mapped to the corresponding entrepreneurial competencies as listed on the EntreComp. This approach helped understand and develop a standardized competency-based approach for assessing the outcomes of several types of educational and digital technologies, including simulations, AI, MOOCs, virtual reality, online communities, and computer-assisted technologies. Moreover, experts reporting on the possibilities of the extracurricular activities in Hammada (2023), were guided by the EntreComp framework in their reporting on the benefits of 34 different types of ECAs, as a tool to align their replies with a competency-based approach to EE. Similarly, a competency-based approach was applied for reporting on the benefits of the eight active methods applied in a classroom environment, leveraging the individual entrepreneurial competencies on the EntreComp in Hammada and Winkler (2024). Additionally, I built on widely adopted digital competence frameworks such as Digital Competence Framework for Citizens (DigComp 2.0) by Vuorikari et al. (2016) and the UNESCO's 2018 global framework; Digital Literacy Global Framework (DLGF) by Law et al. (2018), to conceptualize a Digital Competence Framework for Learners (DCFL) that is updated to become inclusive of learners' skills required to utilize mobile and cloud technologies and to career-related digital platforms.

I hence present the findings from relevant publications in more details. Hammada (2024b) investigation of the impact of using ET to teach entrepreneurship on the learning outcomes, relied the EntreComp framework to analyze and report on the findings. The paper systematically reviewed 26 articles spanning different types of ET and translated the reported learning outcomes in each into the corresponding ECs. These are displayed in figure (6). The review showed that in general, research on ET in EE is at a nascent stage which started gaining momentum a few years ago only. It also lacks sufficient theoretical grounding, if any, and methodological rigorousness.

The Digital Competence Framework for Learners (DCFL) developed through an integrative review in Hammada and Foli (2024), builds on preceding widely adopted digital competence frameworks such as Digital Competence Framework for Citizens (DigComp 2.0) by Vuorikari et al. (2016) and the UNESCO's 2018 global framework; Digital Literacy Global Framework (DLGF) by Law et al. (2018). It proposes a tailored digital competence framework for learners that addresses some of the missing aspects in previous ones, although it maintained all the fundamental competence areas outlined in



the DLGF (Law et al., 2018). Within the “Devices and software operations” competence area, four competencies have been adjusted. These include physical operations of PCs and laptops, software operations in PCs and laptops, physical operations of mobile devices, and software operations in mobile devices. Unlike the DLGF, which covers digital devices in general (Law et al., 2018), our framework focuses exclusively on PCs, laptops, and mobile devices. Additionally, employability competencies were separately highlighted in DLGF in comparison to DigComp 2.0 through the addition of a separate competence area; “Career-related competencies” (Law et al., 2018). We find this competence area very important to the end goal of digital literacy capacity building programs among learners, i.e., improving their entrepreneurial capacities, job market readiness, and employability potential (Ancarani & Di Mauro, 2018; Gallardo-Echenique et al., 2015; Khan et al., 2022). As an extension of this competence area, we introduced two additional individual competencies. The first aspect is “Creating and editing career-related profiles,” which focuses on understanding the components of a curriculum vitae (CV) and effectively presenting skills, knowledge, and experience in a professional and concise manner, including in online environments and professional communities (Florenthal, 2015; Van Dijck, 2013). The second aspect is “Browsing, searching, filtering, and evaluating career opportunities,” which highlights the ability to identify and utilize career-related portals that advertise jobs and projects specific to a particular field.

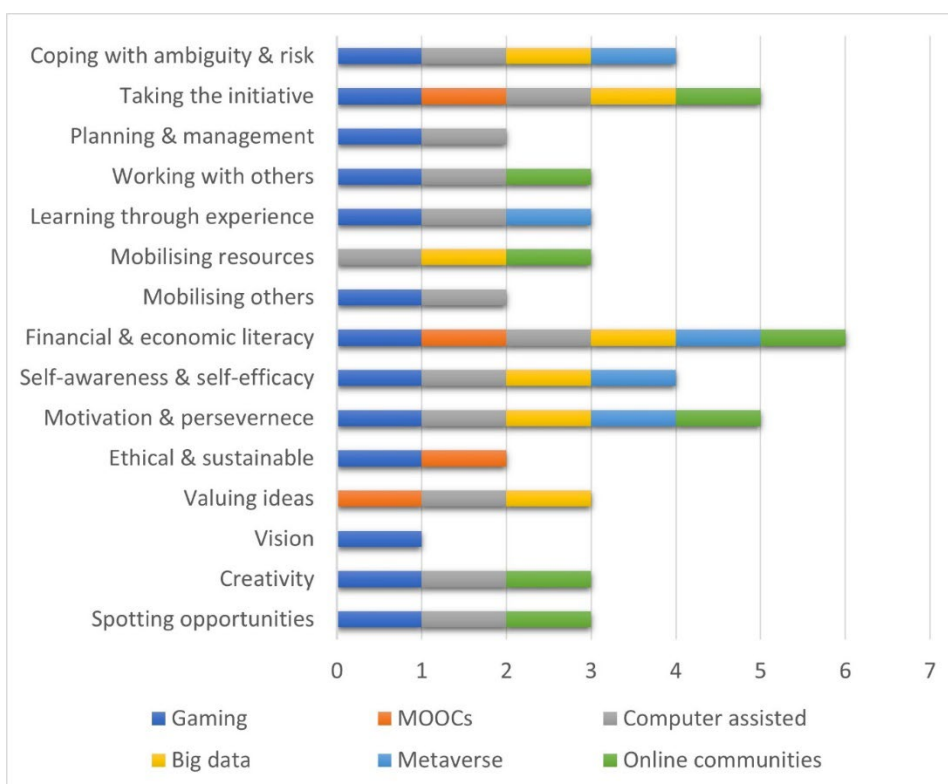


Figure (6): Digital technology contribution to the development of ECs  
Source: Hammada (2024b)

### **3.3. RQ3: How do active methods contribute to competency-based outcomes in EE?**

The thesis explored the contributions of active methods applied in EE towards developing competency-based outcomes, i.e., entrepreneurial competencies, relying chiefly on the EntreComp a reference framework.

Different types of educational and digital technologies were found to impact ECs development differently as in figure 6 (Hammoda, 2024b). Most notably, business simulations and serious games were found to have the most profound impact on developing a broad range of ECs. While MOOCs and online learning environments did not demonstrate significant impact on the development of ECs.

Extracurricular activities were posited by ecosystem experts as beneficial towards the development of students' ECs. While I identified and reported on 34 different ECAs in Hammoda (2023) (see figure 5), mentoring was the most recommended ECA. It was regarded especially beneficial towards the development of a broad range of competencies, including financial literacy, self-awareness and efficacy, and business management. Additionally, ECAs of experiential nature were highlighted by experts as conduits towards the development of practical ECs by learning from experience, identifying opportunities, dealing with uncertainty, and working with others. Existential ECAs such as opportunity walk, self-assessments, and reflective exercises, were especially posited to improve entrepreneurship student's self-efficacy and spotting opportunities. Social and situated ECAs were recommended for developing management and leadership capabilities, getting specific experience to students entrepreneurial interests, and building networks and communication skills. While cognitive ECAs were still deemed essential for acquiring needed financial and economic knowledge and learn from entrepreneurial stories.

In Hammoda and Winkler (2024), several classroom-based active methods were found to help develop students' ECs. These included presentations, guest speakers, mentoring, multimedia and social media, group work, case studies, reflective essays, and online search. The findings provide holistic insights into the nature and intricacies of applying active methods in a classroom environment. The findings provide holistic insights into the nature and intricacies of applying active methods in a classroom environment. Generally, students found active approaches essential in learning entrepreneurship as an unknown topic, providing sufficient theoretical knowledge while allowing them to practice it simultaneously. Presentations were the most valued as it improved their motivation and confidence, taught them better planning, and translating theory to practical applications. Mentoring improved their self-efficacy and improving their management skills more effectively. Guest speakers allowed them to learn from others' experiences, and better spot opportunities. Case studies helped develop their critical thinking and problem-solving skills, their creativity, and build their financial and planning capabilities. Working in groups simulated real-life professional environments and taught them team working, negotiation, and leadership skills. Reflective essays increased their self-awareness and efficacy, and improved their critical thinking and appraisal abilities. Online search and the use of multimedia and social media was seen as a natural occurrence, given the high dependence of modern enterprises on these tools and platforms. Learning to use them effectively improved knowledge acquisition and comprehension about entrepreneurial concepts and examples, and allowed them to better research the market, identify and value opportunities, and become more creative.

## 4. Contributions

In this part, I highlight the main contributions from the articles featured in the thesis. I grouped them into two main contribution areas that corresponds to our research questions, and two subareas emerging from them. These are displayed on figure (7) and are inclusive of the theoretical and practical contributions of the thesis. However, for a more nuanced account of the contributions of each publication, please refer to the respective article.

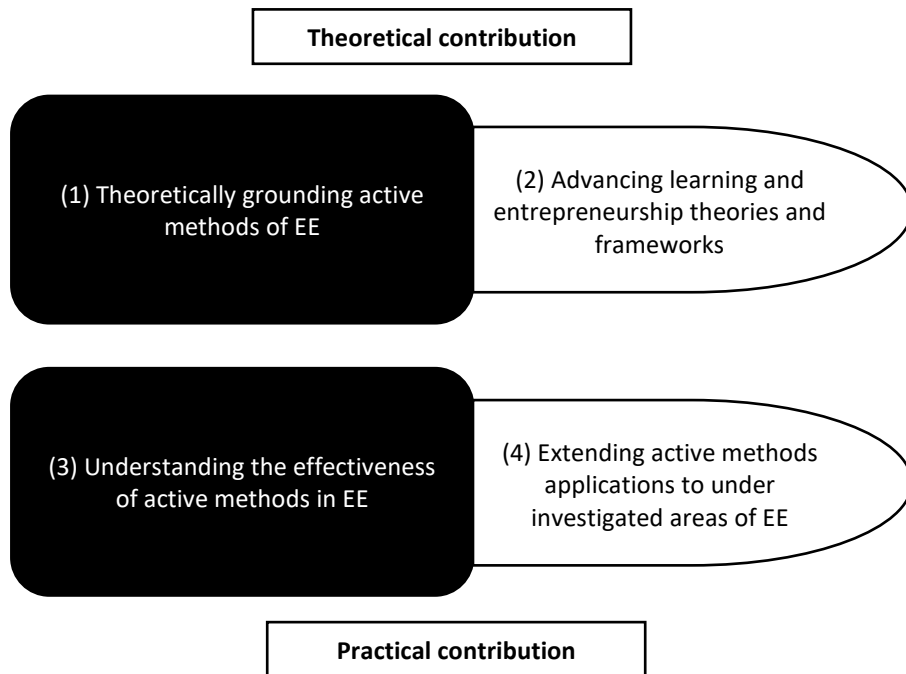


Figure (7): Thesis contributions  
Source: Created by the author

### 4.1. Theoretically grounding active methods of entrepreneurship education

The main contribution of this thesis is in further grounding active methods used in EE in their theoretical foundations. In the profound literature reviews conducted on EE, it became more evident that the development of entrepreneurship pedagogies has in most cases insufficiently grounded them in educational theories and constructs (Fayolle, 2018; Kyrö, 2015). This frailty has been frequently criticized by scholars within and outside the field (Bécharde & Grégoire, 2005; Fayolle, 2013; Kyrö, 2015; Preedy et al., 2020; Rideout & Gray, 2013). In recent years, it became more ‘felt’ as a pressing issue with the diffusion of ‘for’ and ‘through’ pedagogical thinking and methods among entrepreneurship educators (Fayolle, 2018; Lackéus, 2020; Winkler et al., 2015). This was evident in the review on ET in EE (Hammoda, 2024b) as a significant number of the reviewed articles lacked sufficient theoretical and methodological rigorousness. Building

the theoretical foundations of active methods used in EE, based on the different learning models and theories will help us as educators and researchers in understanding what works and why, hence support us in developing better pedagogies (Farrokhnia et al., 2023; Hammoda, 2023; Nabi et al., 2017; Robinson et al., 2016).

Throughout the papers that comprise this thesis, the author focused on theoretically grounding the different active methods that were investigated for teaching entrepreneurship. For example, while ECAs are often explained through an experiential learning lens (Padilla-Angulo, 2019; Preedy et al., 2020), the paper on ECAs for EE (Hammoda, 2023) expanded the discussion on their theoretical interconnectedness to additional constructs, including social, situated, cognitive, and existential learning. The paper provides a basic understanding of the theoretical underpinnings of different ECAs for EE, as one of the few papers that focuses on this as its primary contribution (see also Pittaway et al., 2011; Pocek et al., 2021; Politis et al., 2019). The study also opens the door for theory-based evaluations (Birckmayer & Weiss, 2000) to study the effectiveness of EE approaches and programs, by comparing the expected patterns of learning deduced from theories, against the nature and outcomes of the different ECAs. Theory-based approaches could prove beneficial in assessing the outcomes of an elusive and multidisciplinary educational field, such as entrepreneurship (Duval-Couetil, 2013; Pittaway & Edwards, 2012), and provide an alternative route to the prevailing economic measures (Nabi et al., 2017) and the growing competency based (Morris et al., 2013) evaluations.

Moreover, the conjoint nature of learning theories when applied for EE was exhibited across the discussed ECAs and demonstrates the versatility and richness of EE approaches in comparison to extant literature. The dominance of one theoretical construct over others is thus situational and relies on the intended learning outcomes and the micro activities the learner participates in within a specific learning activity. Additionally, in the active learning in STEM EE paper (Hammoda & Winkler, 2024), we employed the principles of active learning theories based on the perspectives of John Dewey (1974), David Kolb (1984), Jean Piaget (1995) and Lev Vygotsky (1987) in designing and delivering several active methods during an entrepreneurship course. The academic EE publication (Hammoda, 2024d) applied effectuation theory (Sarasvathy, 2001) and experiential learning (Kolb, 1984; Kolb & Kolb, 2005) to the field of academic entrepreneurship education. It provided a new theoretical platform, grounded in effectuation and experiential learning, for educating and supporting academic entrepreneurs.

More recently, the rise of generative AI and its applications has provided more questions than answers to the academic community. Researchers, for example, are yet to identify relevant theoretical foundations that can be applied to analyze and implement generative AI in research and teaching (Farrokhnia et al., 2023; Winkler et al., 2023). The pedagogical innovation included in this thesis (Hammoda, 2024a) positions generative AI as a heutagogical (Hase & Kenyon, 2000, 2007) and effectual (Sarasvathy, 2001) tool and thus contributes to the heutagogical remodeling of EE, one that has learners at its center and promotes their independence (Neck & Corbett, 2018). Moreover, the pedagogical innovation serves as an exemplar for applying advanced technology for transformative learning purposes (Mezirow, 2003). Additionally, the pedagogical innovation builds on the effectual logic of Sarasvathy (2001) and adds to it by applying it within the context of entrepreneurship students, in contrast to the original conceptualization of effectuation among expert entrepreneurs. It extends the

argument for applying effectuation as the main logic for generative artificial intelligence applications for entrepreneurial training and support (Lupp, 2023).

Moreover, across the articles in the thesis, and in general as a researcher in EE, I tend to follow a competency-based approach (Morris et al., 2013). This coincides with the broader definition of EE as a developmental endeavor that aims to equip students with specific business knowledge and a variety of skills and attributes that can support them in different career paths (Nabi et al., 2017). As a theoretical reference point for data analysis and interpretation, I followed a competency-based approach relying upon the European Union Entrepreneurship Competence Framework, known as EntreComp (Bacigalupo et al., 2016). EntreComp is the most widely adopted framework for entrepreneurial competencies in research and teaching entrepreneurship and offers a flexible model that can be adapted to the different contexts and applications (LópezNúñez et al., 2022; Morselli & Gorenc, 2022). Hence, employing it in research provides a valid theoretical grounding for analyzing and assessing the outcomes of EE. EntreComp was applied as a reference framework to translate the learning outcomes resultant from applying ET in EE into entrepreneurial competencies (Hammoda, 2024b). It was also applied to understand the usefulness of ECAs deduced from ecosystem experts' interviews towards the development of ECs (Hammoda, 2023). More broadly, it was utilized in principle to investigate the benefits and opportunities of the implementation of different active methods in a STEM EE course (Hammoda & Winkler, 2024).

## **4.2. Advancing learning and entrepreneurship theories and frameworks**

An additional theoretical contribution demonstrated throughout the thesis publications is in advancing and extending the applications of several theories and frameworks within an entrepreneurial learning context, conceptually and empirically. Hence, improving their validity and better establishing their connection to active methods and the scholarly field of EE.

Hammoda (2024b) review on ET in EE, establishes a basic tool that maps the competencies developed by each potential technology when applied in EE. An area that Morris et al. (2013) highlighted, as lacking a standardized tool. Given the divergence in competency-based assessment methods, notwithstanding that the reliability and generalizability of any competency-based method is debatable (Bird, 2019), our approach provides a path that can guide scholars on implementing a more reliable measure. It does so by extending the applications of our reference tool; EntreComp framework (Bacigalupo et al., 2016) into a new pedagogical delivery method, i.e., educational technologies.

The DCFL paper (Hammoda & Foli, 2024) proposes a framework for digital competence among learners by drawing inspiration from DigComp 2.1, an evolved version of DigComp 2.0 (Carretero et al., 2017), and the Digital Literacy Global Framework (DLGF) (Law et al., 2018). This framework is among the few that discusses digital competence within a learner context, as the first to utilize inputs from both DigComp 2.0 (Vuorikari et al., 2016) and UNESCO's Digital Literacy Global Framework (DLGF) (Law et al., 2018), builds on them, and thus extends their remit to the specific learner's context. It adds a comprehensive and updated model that caters for the changes induced by COVID-19 (Zhao et al., 2021), to the short list of digital competence frameworks targeted at learners (Pettersson, 2018).

The academic EE publication (Hammoda, 2024d) extends effectuation principles to an educational context and proposes a conceptual application of experiential learning in a new field, i.e., academic entrepreneurship. Originally, effectuation was developed based on experienced entrepreneurs accounts and hence, it requires adaptation and investigation of its potential applications in other fields (Chandler et al., 2011; Engel et al., 2014), including education (Günzel-Jensen & Robinson, 2017; Li et al., 2022). It also revives the research on EE as a process (Leitch & Harrison, 1999). Similarly, Hammoda (2024a) application of ChatGPT for EE illuminates the potential for effectual and heutagogical approaches in supporting students morphing into active entrepreneurs (Krueger, 2007). Both publications (Hammoda, 2024a, d) provide a much-needed empirical illustration of effectuation principles affixation to education practices (Günzel-Jensen & Robinson, 2017), thus extending our limited understanding of effectuation process applications (Engel et al., 2014). Moreover, I build connections between effectuation and heutagogy (Hammoda, 2024a) and experiential learning (Hammoda, 2024d), in response to Perry et al. (2012) call for building relationships between effectuation and established paradigms.

Additionally, the reflective elements of the proposed models in both papers align with their premise as a core component of the learning process by extracting new meanings and remodeling cognitive maps of learners (Hase & Kenyon, 2000, 2007; Jones et al., 2019; Kolb & Kolb, 2005). Regarding the Hammoda (2024a), more specifically, ElTarabishy (2023) advocates the use of ChatGPT in what he labelled as “The Socratic Method” to engage students in reflective conversations on the recommendations provided by ChatGPT. Hence, it is important for educators and students undertaking a similar learning activity to reflect deeply on the results provided by generative AI applications, in relation to their convictions and realistic entrepreneurial models (Hammoda, 2024a).

### **4.3. Understanding the effectiveness of active methods in entrepreneurship education**

The articles featured in the thesis, provide several practical insights. These are mainly geared towards supporting educators, HEIs and organizations invested in educating and training entrepreneurs in understanding the usefulness of active methods in EE (Koropogui et al., 2023) and integrating them in their entrepreneurship courses and programs more effectively, for improved outcomes.

The ECAs illustrated in Hammoda (2023) can provide enhanced opportunities for ‘learning by doing.’ Thus, updating the entrepreneurial students’ knowledge, skills, and mindset through new experiences (Duval-Couetil et al., 2016; Pittaway et al., 2011). By leveraging the findings of this study and given the complementary nature of ECAs to curricular EE (Lilischkis et al., 2015), educators at HEIs can signpost their students to participate in different activities based on their competencies’ profile to improve their attainment of ECs and complement curricular activities. This can further promote a student-centered approach to learning (Hase & Kenyon, 2000; Jones et al., 2019), which enhances entrepreneurial students’ engagement and drive better outcomes (Robinson et al., 2016). For example, students with limited financial literacy, can benefit from blending cognitive (workshops and course) and experiential (simulations and games) approaches that were recommended by the ecosystem experts, to improve their financial knowledge and practical skills. Moreover, to those students having communication problems and/ or

lower self-confidence, several ECAs such as mentoring and participating in events and student groups, which are predominantly social in nature, can prove remedial. To cover for the experience gap among students, experts recommended activities such as interning, entrepreneurial projects, and community work. Moreover, to resolve the problem of idea-driven entrepreneurship, where students focus on the idea rather than the user and market needs, experts suggested that students engage in customer discovery, reflective practices, discuss ideas openly with others, and prototype their solutions to better identify real societal needs and build meaningful solutions.

The investigation of several active methods in a classroom environment in Hammuda and Winkler (2024) provides valuable insights to entrepreneurship educators on their usefulness, nature, potential and limitations when applied in a classroom environment. The applied active methods helped develop students' broader skill sets, improved their entrepreneurial orientation, and widened their career prospects. (Hagvall Svensson, 2023; Zappe et al., 2023). They enhanced students' entrepreneurial competencies by engaging them in educational activities that resemble real-life settings (Neck & Corbett, 2018). Pitching, for example, helped develop several ECs including management, communication, financial literacy, and self-confidence. Hence, educators might want to repurpose the customary pitch at the end of an entrepreneurship course to repetitive, active learning experiences. Mentoring sessions can be utilized to provide constructive and individualized guidance to students, thus improving their specific weaknesses and self-efficacy. In terms of guest speaking and case studies, while proven impactful in developing students' competencies, it is crucial that educators recognize the potential negative impact of promoting famous, successful entrepreneurial exemplars on their students' morale and self-efficacy. This undesirable impact is what Wraae and Nybye (2024) referred to as the "dark side of entrepreneurship education". Additional and more elaborate insights on several active methods effective utilization is provided in the publication.

Leveraging the mapping of ET to EC in Hammuda (2024b), entrepreneurship educators and program designers can utilize it to integrate technologies more insightfully in their pedagogies, alongside other teaching methods and tools. Hence, achieving better outcomes and improving students' learning experiences. Moreover, they can use it as a basic tool for assessing the effectiveness of applying ET in EE, following a competence-based approach. The appropriateness and usefulness of different ETs are elaborated upon in the findings section and in the respective paper. Moreover, the mapping exercise can be replicated and adapted to assess the outcomes of other methods and tools used in EE and other business and management disciplines. The results of this study can as well support educators and administrators' efforts in building the business case for adopting ET in entrepreneurship and business education, knowing that some of the main barriers to do so is the lack of awareness of their possible applications and potential benefits (Cooper, 2007; Hammuda, 2024c; Secundo et al., 2020b).

The digital competence framework for learners (DCFL) proposed in Hammuda and Foli (2024) can be used as a guide to policymakers and regulators in areas of education, employment, and industry. It can contribute to defining policies and standards for learners' digital competence assessment and development, whether through the educational institute or by themselves (Caena & Redecker, 2019), as it has become evident that user buy-in and engagement are essential for the success of digital skills programs (Conrads et al., 2017). From an economic development perspective, having digitally skilled graduates is becoming a critical success factor in today's technology

reliant businesses and organizations (Ancarani & Di Mauro, 2018; Janssen et al., 2013; Ratten, 2023). Educational institutions have recently started recognizing this urgent need and are prioritizing the development of the digital skills among their students in order to graduate digitally capable manpower (Bond et al., 2018; Ratten, 2023). Thus, this framework supports and contributes towards digital competence development initiatives at education institutions and within life-long learning environments, which can enhance the innovation and entrepreneurial abilities (Caena & Redecker, 2019) of societies' future workforce and entrepreneurs.

Additionally, the effectuation-based model for academic EE proposed in Hammada (2024d) offers an alternative approach to traditional methods at HEIs for educating and supporting nascent and to-be academic entrepreneurs. It answers better to their specific needs, challenges, and situational factors than formal entrepreneurship courses (Günzel-Jensen & Robinson, 2017; Politis, 2005). The model allows for personalized learning, mindset development, and self-awareness, which are critical aspects of entrepreneurial learning (Rae, 2000). Thus, it caters for a broader range of EE outcomes, from competencies development to social capital enrichment, and venture creation.

Moreover, the generative AI (ChatGPT) activity depicted in (Hammada, 2024a) provided insightful guidance on the potential of applying it for EE effectively. Hence, it can help entrepreneurship educators designing effective learning activities for their students. However, I urge educators and leaders across the entrepreneurship ecosystem to improve their digital and AI literacy in order to apply advanced technologies adequately within their classrooms and varying learning spaces (ElBanna & Armstrong, 2023; Kasneci et al., 2023), and guide their students and trainees on using it appropriately.

#### **4.4. Extending active methods applications to under investigated areas of entrepreneurship education**

The publications outlined in the thesis leaned towards investigating active methods in a rather under investigated areas and groups of EE. These have significant value in establishing active methods in EE and EE itself as a distinguishable scholarly subfield and connecting them to broader and more diverse applications and other subfields of entrepreneurship research. Hammada and Winkler (2024) investigated the application of active methods in STEM EE, an under researched area that deserves further exploration given the changes in the market requirements. Graduating engineers are expected to exhibit ECs and orientation to drive innovation through their entrepreneurial ideas and assume leadership roles (Hagvall Svensson, 2023; Winkler et al., 2015; Zappe et al., 2023). Moreover, the pedagogical innovation (Hammada, 2024a) is among the first to report on an empirical application of generative AI (ChatGPT), as an active learning method within the entrepreneurship education field, which is currently lagging other educational and management research disciplines in investigating the applications of advanced technology like generative AI (Winkler et al., 2023a). The entrepreneurship education and support model proposed in Hammada (2024d), extends our understanding of active methods applications, that leverages effectuation (Sarasvathy, 2001) and experiential (Kolb, 1984) principles in a 'through' EE approach (Fayoole & Gailly, 2008) to academic entrepreneurship which is receiving increasing attention recently (Skute, 2019).



Additionally, The ECAs paper (Hammoda, 2023) relied upon entrepreneurship ecosystem experts' views, supporting their incorporation in the EE process as an important step to improving its outcomes (Isenberg, 2010; Kuratko, 2005; Lilischkis et al., 2015). This is especially relevant as existing ECAs studies, as to the wider EE literature, tend to focus on HEIs actors' views only (Bischoff et al., 2018; Rae et al., 2012; Lilschkis et al., 2015). Finally, the review of ET impact on EC (Hammoda, 2024b) contributes to the limited validated knowledge at the nexus of technology, education, and competence development within an entrepreneurship context. So far, there have been limited empirical investigations of the learning outcomes and competencies developed through ET when applied in EE, and even more scarce reviews on their effectiveness (Lin & Sekiguchi, 2020; Ratten & Jones, 2021).

## **5. Limitations and future research**

### **5.1. Limitations of the thesis**

The thesis, as to the individual publications included in it, are not without their limitations. In the following paragraphs, I highlight the main general limitations across the thesis organized against the research questions. For limitations pertinent to each publication, please refer to it.

#### **5.1.1. RQ1: What are the theoretical foundations of active methods in EE, deployed to improve its competency-based outcomes?**

While the thesis aimed to theoretically ground the different active methods of EE investigated throughout its publications. However, it is important to realize that distinctiveness is not absolute and there is inherent flexibility and overlap among implemented theories. Thus, the appropriation of learning and entrepreneurship theories to an active method relies on the intended purpose of using it and the context of its implementation.

#### **5.1.2. RQ2: How can a competency-based approach be operationalized for assessing the outcomes of active methods in EE, as a reliable theoretical framework?**

The thesis relied on a competency-based approach to EE (Morris et al., 2013), leveraging EntreComp framework (Bacigalupo et al., 2016) for entrepreneurial competencies evaluation. However, it is worth noting that the EntreComp framework has its inherent limitations, as a basic and a modular framework that is aimed to be adjusted and built upon according to the purpose of its application. Moreover, as proposed in Hammoda (2024b), there are some rearrangements of the competencies that are due in the framework itself. Additionally, as noted by Bird (2019) there is a lack of agreement on a standard competency-based framework which contributes to the debate on the effectiveness of similar models. Additionally, Hammoda and Foli (2024) developed a digital competence framework specifically for learners, through an integrative review process. However, as to other competency-based frameworks it requires further validation and adaptation to the specific context of its application.

#### **5.1.3. RQ3: How do active methods contribute to competency-based outcomes in EE?**

Several publications in the thesis aimed at investigating the usefulness of the different active methods when applied in EE. However, there are limitations regarding the sample sizes and the qualitative approaches followed across them. This limitation is attributed to the main purpose of the thesis and type of data sources available to the author to conduct research within doctoral studies duration. Hence, in the future, further validation using quantitative and experimental designs is advised. Moreover, additional active methods could be elicited and thus investigated, and the interpretation of their usefulness might differ through the examination of broader and/ or more diverse contexts and participants.

## 5.2. Future research

Similar to the thesis contributions, I highlight here briefly the main future directions of research that can build on the collective work of the thesis. For specific recommendations on future research directions of each study, please refer to the publications.

- 1) In general, I call for further research that aim at better understanding the nuances and usefulness of applying active methods and digital technologies in EE. Most of the scholarly work so far is of a rather exploratory nature, which is required in a nascent field. However, as early studies yielded valuable results, scholars might want to adopt a confirmatory approach, through employing experimental and quantitative methods, for example, to validate and expand upon the findings of the studies included in this thesis. For example, researchers might want to adopt the mapping of ETs versus ECs in Hammoda (2024b) and conduct empirical studies on the impact of different ETs used in EE. Additionally, while Hammoda (2023) aimed to include a diverse set of entrepreneurship ecosystem experts, these selected were based on three groups only from the external EE stakeholders' categories of Bischoff et al. (2018). Researchers might want to build upon the study and incorporate larger numbers of members from other groups in their sample through quantitative methods, to expose more diverse opinions.

Additionally, the thesis uncovered certain issues when applying active methods that requires further attention from both scholars and educators and adopting a balanced approach when incorporating them. For example, the continued promotion of pitching while useful to develop students' competencies, should be applied as a learning activity rather than having a competition-focus. Moreover, guest speakers, media, and case studies should deviate from the prevalent "hero" entrepreneurial exemplars and become more representative of everyday entrepreneurship realities. Moreover, while digital technology showed promising results in teaching entrepreneurship, it also highlighted some challenges related to teachers' and institutions readiness, and students' motivation. Similarly, it is worth noting that active methods should be complemented with knowledge-intensive lectures to build students' knowledge repository. This could be included either early in the course (See Creed et al. (2002) and Täks et al. (2014, 2016) or at later stages (Mäkimurto-Koivumaa & Belt (2016).

- 2) Additionally, I advocate for continuing the scholarly efforts connecting the innovative methods we use in EE to the established learning and entrepreneurship theories. One approach is to examine the application of additional constructs that I posit to provide value in EE, such as design science, design thinking, embeddedness, stakeholders' theory, and systems thinking. Additionally, while the studies included in the thesis represented a step forward, it also highlighted that the relationship between active methods and their theoretical underpinnings is nonlinear. It is rather transversal and modular, depending on the purpose from applying the active methods and the context of their application. Thus, more inclusive scholarly discussions can prove helpful to further establish the theoretical grounding of these methods, potentially

through the implementation of Delphi method among EE scholars (van Gelderen et al., 2021) or integrative reviews of existing literature (Torraco, 2005).

- 3) Moreover, I encourage EE researchers to direct their attention to underrepresented areas of EE, such as teaching directed to non-business disciplines, EE occurring in informal settings, and corporate entrepreneurship training. STEM EE, which is investigated in this thesis in Hammada and Winkler (2024) is still in early stages, despite the propagated promotion of entrepreneurship courses and incubators to STEM students (Hagvall Svensson, 2023). Additionally, while work on academic entrepreneurship is gathering momentum, there is still a lack of clarity on role definition and the integrative possibilities of the different stakeholders in the entrepreneurship education ecosystem, as to the effectiveness of EE methods that can be implemented (Li et al., 2022; Rippa et al., 2022).
- 4) Building on the thesis publications, the data collected, and the feedback received during the multiple review processes. I identified a few research projects to build upon it. One extension to my work is empirically validating the digital competence framework for learners. Some preparatory work is already underway with an educational organization to plan for it. The other builds on the data collected for the extracurricular activities by investigating the integrative possibilities of entrepreneurship ecosystem actors for improved efficiency and effectiveness, which needs to be complemented by the views of HEIs educators and researchers. A third one came up during the review process of Hammada and Winkler (2024), which is to investigate multidisciplinary approaches to EE. This primarily has been discussed to be conducted using a mixed method approach with a university providing interdisciplinary EE.
- 5) Finally, I advocate for better connecting EE research with other related entrepreneurship domains such as entrepreneurial identity, entrepreneurial passion, intention-action gap, marginalized entrepreneurship, and ecosystems. These could provide EE scholars and educators with valuable insights from different perspectives on the axiological premises of EE, and improve its academic legitimacy, in addition to the theoretical grounding discourse.

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A special dedication to my little boy. May you grow in a world that knows no hatred and always be surrounded by love and kindness. Your Pappa.

## **Abstract**

### **Active methods in entrepreneurship education: A competency-based approach to investigate their theoretical foundations and effectiveness**

Entrepreneurship education has grown in popularity in recent years and became a competitive arena for business schools. However, because of the practical nature of entrepreneurship, there have been increasing calls to investigate and adopt more active methods to teach entrepreneurship to students. Traditionally, university level education relied on behavioristic methods to address the knowledge deposition requirements of masses of students. These have shown however to have limited impact on developing practical entrepreneurial skills. Hence, an increasing amount of research has tried to investigate more active and experiential methods, that can complement traditional methods and fill this gap. Yet, research on the intricacies and outcomes of these methods necessitates in-depth exploration of their intricacies and usefulness. Additionally, as a relatively new field of inquiry, active approaches to entrepreneurship education lack sufficient theoretical grounding and connection to the widely adopted learning and entrepreneurship theories. The author, through this thesis, embarked on a journey to investigate the intricacies and usefulness of different active methods: curricular, extracurricular, and digital technology reliant. It furthers the theoretical grounding of different active methods and extends our understanding of their applications to underrepresented areas of entrepreneurship education research.

## Lühikokkuvõte

### **Aktiivsed meetodid ettevõtlusõppes: Pädevuspõhine lähenemine nende teoreetiliste aluste ja tõhususe uurimiseks**

Ettevõtlushariduse populaarsus on viimastel aastatel kasvanud ja sellest on saanud ärikoolide konkurentsiala. Ettevõtluse praktilise olemuse tõttu on aga üha rohkem kutsutud uurima ja kasutusele võtma aktiivsemaid meetodeid ettevõtluse õpetamiseks õpilastele. Traditsiooniliselt tugines ülikoolitaseme haridus bihevioristlikele meetoditele, et täita õpilaste masside teadmiste kogumise nõudeid. Siiski on nende mõju praktiliste ettevõtlusoskuste arendamisele piiratud. Seetõttu on üha rohkem uurimusi püüdnud uurida aktiivsemaid ja kogemuslikumaid meetodeid, mis võivad traditsioonilisi meetodeid täiendada ja seda lünka täita. Kuid nende meetodite keerukuse ja tulemuste uurimine nõuab nende keerukuse ja kasulikkuse põhjalikku uurimist. Lisaks puudub ettevõtlushariduse aktiivsel lähenemisel suhteliselt uue uurimisvaldkonnana piisav teoreetiline alus ja seos laialt levinud õppimis- ja ettevõtlusteooriaga. Selle lõputöö kaudu asus autor teekonnale, et uurida erinevate aktiivmeetodite keerukust ja kasulikkust: õppekava, õppekavavälised ja digitehnoloogiast sõltuvad. See edendab erinevate aktiivmeetodite teoreetilist põhjapanemist ja laiendab meie arusaama nende rakendustest ettevõtlushariduse uurimise alaesindatud valdkondadele.

## Appendix

### Publication I

Hammoda, B. (2023). Extracurricular activities for entrepreneurial learning: A typology based on learning theories. *Entrepreneurship Education and Pedagogy*, 0(0). <https://doi.org/10.1177/25151274231218212>

**Publication II**

Hammoda, B. (2024). The impact of educational technologies on entrepreneurial competencies: A systematic review of empirical evidence. *Knowledge Management & E-Learning*, 16(2), 309–333. <https://doi.org/10.34105/j.kmel.2024.16.015>

**Publication III**

Hammoda, B. & Winkler, C. (2024) Active methods in Entrepreneurship Education: A case study with engineering students. *European Journal of Engineering Education*.  
<https://doi.org/10.1080/03043797.2024.2384893>

**Publication IV**

Hammoda, B., & Foli, S. (2024). A digital competence framework for learners (DCFL): A conceptual framework for digital literacy. *Knowledge Management & E-Learning*, 16(3).



**Publication V**

Hammoda, B. (2024). ChatGPT for founding teams: An entrepreneurial pedagogical innovation. *International Journal of Technology in Education (IJTE)*, 7(1), 154–173.  
<https://doi.org/10.46328/ijte.530>

**Publication VI**

Hammoda, B. (2024). Academic Startup Clinic: Applying effectuation and experiential principles to educate and support academic entrepreneurs. In Hepworth-Sawyer, R., Marrington, M., Hall, J. & Beaumont, E. (Eds.), *Contemporary Enterprise and Entrepreneurship in Context*. Routledge.

# Curriculum vitae

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## Education

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