Beyond the Buzz: Which Entrepreneurial Competencies Endure? A 12-Month Tracking of Cognitive vs. Affective Skills

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Abstract

This work-in-progress paper investigates the impact of Challenge-Based Learning (CBL) on the development and retention of entrepreneurial competencies among management university students. The study focuses on a master's management course on sustainability and social entrepreneurship at the University of Trento, aiming to develop business ideas with social impact that solve societal problems offered by the so-called challenge providers. Adopting a longitudinal case study methodology, data were collected through the two-course editions. For both editions, the EntreComp framework has been used at two stages: pre-course and post-course. Results show significant short-term improvements across all 15 entrepreneurial competencies after the course. Notable progression is observed, particularly in areas related to creativity, vision, valuing ideas, and mobilizing resources. However, others, including self-awareness, self-efficacy, motivation, and working with others and learning through experience, underline a low progression. These findings suggest that CBL effectively fosters entrepreneurial skills in the short term, especially for vision, creativity, and valuing opportunities. The study also provides practical recommendations for educators to enhance CBL design, including the development of soft skills, the selection of appropriate challenges, and strategies for post-course engagement. Limitations and further research directions are depicted at the end of the paper.

Keywords: Challenge-based learning; entrepreneurial competences; competences retention; comparative analysis; case study.

1. Introduction

Over the last three decades, higher education institutions (HEIs) have been increasingly encouraged to become more entrepreneurial, supporting innovation hubs (Katz, 2003; Kuratko, 2005; Britchenko et al., 2019; Ashton & Comunian, 2019; Youtie & Shapira, 2008), entrepreneurship centers (Menzies, 2009), and academic spin-offs (Guerrero et al., 2016). As they transition away from the traditional "ivory tower" model (Etzkowitz, 1983), universities are now key actors in regional innovation ecosystems, operating within the frameworks of the triple and quadruple helix (Gianiodis et al., 2016; Ratten, 2014; Urbano & Guerrero, 2013; Zhang et al., 2016). In this transformation, entrepreneurial universities actively promote student and graduate entrepreneurship by offering cultures, practices, and environments conducive to opportunity recognition and value creation (Mascarenhas et al., 2017). Among the many initiatives fostered by entrepreneurial universities are curricular and extracurricular entrepreneurship programs, hackathons, start-up labs, and seasonal schools dedicated to entrepreneurship (Von Graevenitz, 2010; Scroccaro & Rossi, 2022; Passarelli & Bongiorno, 2025). A particularly impactful format gaining traction worldwide is Challenge-Based Learning (CBL) (Nichols & Cator, 2008; Nichols et al., 2016; Pérez-Sánchez et al., 2020, 2023; Vignoli et al., 2021). CBL is a constructivist and experiential learning methodology that engages students with real-life challenges provided by public or private organizations seeking innovative solutions (the so-called challenge providers). Students work in interdisciplinary teams to co-develop novel outcomes, including services, products, and processes. This paper aims to address two main gaps in the literature: (i) a lack of longitudinal studies on the retention of entrepreneurial competences post-CBL experience; (ii) the absence of standardized tools to measure entrepreneurial competence acquisition and retention in CBL contexts. Concerning the first gap, impact measurement suffers from contradictory findings due to an over-reliance on short-term and subjective indicators, stressing the need for long-term follow-up (Pittaway & Cope, 2007; Nabi et al., 2017). When it comes to the second gap, literature argues that a lack of a theoretical framework for systematic development and measurement validation of entrepreneurial competencies persists, which hampers the ability to track and compare learning outcomes (Seikkula-Leino & Salomaa, 2021; Bolzani & Luppi, 2021).

To assess the development and retention of entrepreneurial competences, the study adopts the EntreComp framework (Bacigalupo et al., 2020), which defines 15 entrepreneurial skills across three macro-areas: ideas and opportunities, resources, and action. This framework offers a developmental and competency-based approach, aligned with the CBL pedagogy (Ratiu et al., 2023). Unlike other tools, like the Entrepreneurial Intention Questionnaire (Linan & Chen, 2009; Vankov et al., 2022) or the General Enterprising Tendency test (Caird, 1991), EntreComp measures concrete, observable competencies developed through active learning. This working-progress paper presents a case study based on two editions of the Social Entrepreneurship and Sustainability course, embedded in the master's program in management at the University of Trento (Italy). Accordingly, the research is guided by two questions. RQ1: What entrepreneurial skills do students acquire through a CBL and hands-on course? RQ2: Which skills persist in the short term, and which tend to diminish?

2. Literature background:

In the following section, a literature background is provided to frame the research questions and the methodology.

2.1 CBL as a Pedagogical Innovation

CBL embodies a shift in didactics, emphasizing active, student-centered, and self-directed learning (Knowles, 1975; Scroccaro & Rossi, 2022; Norrman et al., 2022). Teachers act not as instructors but as facilitators and mentors, participating in the learning journey alongside students (Eldebo et al., 2022). This method reinforces both educational outcomes and societal impact by bridging the gap between HEIs and challenge providers (companies, associations, public institutions, etc.), in line with the principles of the knowledge triangle and the quadruple helix (Vilalta-Perdomo et al., 2022; Sukacke et al., 2022; Leijon et al., 2022; Perna et al., 2023; Garcia-Zambrano et al., 2024). CBL promotes open innovation strategies (Chesbrough & Di Minin, 2014) by involving students in processes of questioning, exploration, and co-creation with external partners. These partnerships not only enrich student learning but also stimulate innovation within participating organizations, making CBL a two-way bridge between education and real-world impact.

2.2 CBL and Entrepreneurial Competence Development

CBL has been shown to foster entrepreneurial mindsets and skills through experiential and problem-based learning (Ktoridou & Eteokleous, 2012; Portuguez & Gomez, 2021; Hölzner & Halberstadt, 2022; Norrman et al., 2022). It helps students build competencies such as creativity, teamwork, initiative, and resource mobilization (Perez et al., 2020; 2023; Rincon et al., 2023). According to Fayolle (2007), entrepreneurial skills include knowledge, behaviors, and attitudes that allow individuals to identify opportunities, manage resources, and deal with uncertainty. Despite its rising popularity, research on the measurable impacts of CBL on entrepreneurial competence remains limited (Johnson et al., 2009; Martinez & Crusat, 2020; Palma-Mendoza et al., 2019; Vignoli et al., 2021; Colombelli et al., 2022). Most existing studies rely on pre/post-test designs and overlook the long-term retention of entrepreneurial competences (Dewettinck & van Ameijde, 2011; Silveyra-Leon et al., 2023).

3. The Sustainability and Social Entrepreneurship course:

The course is a core component of the master's program in Management at the Department of Economics and Management, University of Trento. This 48-hour, 8 ECTS course adopts a challenge-based and hands-on learning approach, focusing on hybrid and sustainable business models. Students are tasked with developing project ideas and social business models in response to real-life challenges proposed by local stakeholders—such as organizations, cooperatives, and associations—operating in the Trentino area. The course aims to foster innovative and sustainable solutions through direct student engagement with these actors. The course is structured into three main phases: problem validation, idea generation, and solution validation. During the problem validation phase, student teams interact with the challenge providers to gain an in-depth understanding of the issues at stake. They conduct field research, interviews, and desk research, applying analytical tools such as the fishbone diagram, iceberg model, and the five whys method. This phase also involves envisioning future scenarios, analyzing trends, and performing market assessments using SWOT, PESTEL, stakeholder mapping, and competitor analysis. In the idea generation phase, teams engage in structured brainstorming sessions to produce and refine multiple solutions, fostering creativity and identifying potentially disruptive approaches. These ideas are then presented to the challenge providers, who offer feedback and assist in selecting the most promising solution for further development. In the solution validation phase, students iteratively prototype and validate their proposed solutions through continued field

engagement and interviews. They build personas through the empathy map and job-to-be-done tool. Each team develops a Social Business Model Canvas and a business plan, culminating in a final pitch presentation to an audience of faculty members, investors, and entrepreneurs.

Two editions of the Sustainability and Social Entrepreneurship course are considered in this paper. In the following section, differences and similarities in terms of students, challenges, challenge providers, contexts, and programs are underlined between the two considered editions.

3.1 2023/2024 edition

In the 2023/2024 edition, the class was composed of 18 students, including two non-attending participants. Students were organized into four heterogeneous teams, while the two non-attending students formed an independent team. Team formation was based on criteria including gender balance, personality test results, and students' preferences regarding the challenge themes, to replicate the diversity and unpredictability typical of real-world work environments. To provide meaningful challenges, faculty selected five real-world problems from local social organizations, addressing key themes such as urban regeneration, social inclusion, rural depopulation, sustainable tourism, and local food systems. The selection process lasted approximately two months and involved interviewing representatives from over ten different organizations. The final five were chosen based on the societal relevance and urgency of their challenges, their motivation to engage with students, and their operational capacity (in terms of staff, time, and resources). The selected challenge providers represented a variety of organizational forms, including cooperatives, work integration social enterprises (WISEs), start-ups, foundations, and non-profit organizations. These five challenges were fully defined before the start of the course.

3.2 2024/2025 edition

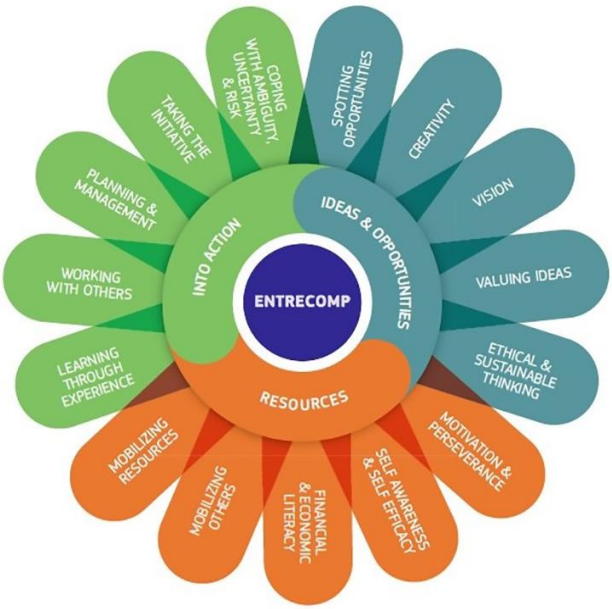
In the 2024/2025 edition, the class was composed of 23 students, including five non-attending participants. Students were organized into five heterogeneous teams. Non-attending students were put together in a single team. Also, for that edition, team formation was based on criteria including gender balance, personality test results, and students' preferences regarding the challenge themes, to replicate the diversity and unpredictability typical of real-world work environments. This time, the faculty did not select real-world problems from different challenge providers. Instead, a specific territorial context was chosen, and together with local stakeholders, four main challenges were identified. Therefore, Val di Fassa, a Trentino valley in the Dolomites in Trentino, northern Italy, was selected. And, the faculty together with the local stakeholders, such as APT Val di Fassa (the Val di Fassa tourist agency), FASSA Coop (the cooperative market chain of the valley), Fassa Village (a local hotels chain), and other stakeholders, co-selected four main issues of the valley: (i) the lack of houses and accommodations for residents, seasonal workers, and tourists; (ii) an unsustainable mobility and the lack of a coordinated public transport network; (iii) the lack of services for residents in terms of healthcare, mail delivery, shopping delivery, childcare, elderly care; (iv) the lack of managerial competences (see Table 2). The first two issues are correlated with the morphology of the area and with the overtourism in two seasons: winter and summer. The second two issues are more related to the cultural and social context.

4. Methodology:

To evaluate both the acquisition and retention of entrepreneurial competencies in the two-course editions, this study adopts a case study methodology (Yin, 2017). This approach is particularly well-suited for exploring the complexities inherent in innovation management research and for generating in-depth insights into emerging phenomena through quantitative data (Siggelkow, 2007). Data were collected from 41 students using a questionnaire based on the EntreComp framework at two different time points: a pre-test at the start of the intervention (February 2024 and February 2025) and a post-test at its conclusion (June 2024 and June 2025).

The EntreComp framework is widely recognized across Europe and offers a holistic, competence-based approach—distinct from trait- or knowledge-based assessments, making it particularly adaptable to interdisciplinary applications and challenge-based learning (CBL). A potential limitation, however, is the need to contextualize the framework for specific learning environments. The questionnaire evaluates 15 entrepreneurial competences (Figure 1) organized into three core domains (Bacigalupo et al., 2020): (i) Ideas and Opportunities (Spotting opportunities, Creativity, Vision, Valuing ideas, Ethical and sustainable thinking); (ii) Resources (Self-awareness and self-efficacy, Motivation and perseverance, Mobilizing resources, Financial and economic literacy, Mobilizing others), and (iii) Into Action (Taking the initiative, Planning and management, Coping with ambiguity, Working with others, Learning through experience).

Figure 1. The EntreComp flower (Bacigalupo et Al, 2020)



The survey consists of 45 closed-ended items—three per competence—measured on a 10-point Likert scale (1 = lowest, 10 = highest). For each participant, individual competence scores were calculated by averaging the responses to the three corresponding items. These averaged scores were treated as continuous variables and analyzed using comparative statistical methods. To examine changes over time across pre-test and post-test, the Wilcoxon signed-rank test was employed. This non-parametric method is particularly appropriate for Likert-scale data, which often violates assumptions required for parametric tests (Norman, 2010), thereby ensuring methodological rigor and robust longitudinal

evaluation.

Four primary risks were identified in the use of the EntreComp-based self-assessment. The first one is the Self-report bias: participants may unintentionally inflate their responses due to overconfidence or social desirability (Paulhus, 1984; Podsakoff et al., 2003). The second one is the Common Method Variance (CMV): the use of a single instrument to collect all data may artificially increase correlations among variables (Podsakoff et al., 2003). The third one is the multidimensional complexity: measuring 15 competences may introduce multicollinearity, especially if the instrument's factor structure is not validated. And the fourth one is the fatigue bias: the length of the questionnaire (45 items) could lead to respondent fatigue, particularly in the post-test phase, compromising response quality (Diamantopoulos & Siguaw, 2006; Lavrakas, 2008).

To address these challenges, five main strategies were implemented. The first one is the Pre-test/post-test design: by employing a repeated-measures design, changes in competencies are assessed within individuals over time. This reduces the influence of individual differences and minimizes the effect of self-report inflation. The second one is the non-parametric statistical analysis: the Wilcoxon signed-rank test was chosen to account for the ordinal nature of Likert data and the potential for non-normal distributions due to small sample sizes or skew. This enhances statistical reliability and reduces the risk of Type I and Type II errors. The third one is the item- and dimension-level descriptive analysis: to identify items with extreme variance or low internal consistency, descriptive statistics and reliability checks were conducted. Items showing weak performance were earmarked for refinement in future iterations. The fourth one is the clear instructions and anonymity: participants were assured of the confidentiality and research-only purpose of their responses, helping to minimize social desirability bias and encourage honest self-evaluation. And finally, the fifth one is the consistency in administration: All waves of the survey were conducted under comparable conditions in terms of platform, timing, and facilitation. This consistency reduced the risk of procedural bias due to contextual variability.

5. Results:

The results indicate substantial short-term improvements across all entrepreneurial competencies following the intervention, aligning with previous research (e.g., Bolzani & Luppi, 2021; Colombelli et al., 2022). A comparative analysis of the pre- and post-intervention EntreComp questionnaire reveals that students generally enhanced their entrepreneurial competencies.

As shown in Table 1, the percentage of participants rating themselves at 7 or higher (indicating a high competence level) increased across all dimensions from the pre-test to the post-test. Significant improvements were observed in competencies such as coming up with innovative ideas, assessing various ways in which your ideas can develop successfully (related to creativity and vision competencies). Participants also reported progress in identifying opportunities for innovative value creation within their field of expertise and selecting the most valuable opportunity when faced with multiple options (spotting opportunities competence). Notable gains were recorded in assessing the social and ecological impact of their ideas (Ethical and sustainable thinking competence) and in anticipating which new developments will be of importance within your field (valuing ideas competence).

Table 1. Pre- and Post-EntreComp results

EntreComp	Items for each competence	Pre (% ≥7) (n=41)	Post (% ≥7) (n=41)	Var %
Spotting opportunities	1. Identify opportunities for innovative value creation within your field of expertise	53.66	94.44	36.59
	2. Anticipate which opportunities will be of high value	56.10	77.78	24.39
	3. Select the most valuable opportunity when faced with multiple options	63.41	94.44	31.71
Creativity	4. Come up with innovative ideas	43.90	72.22	41.46
	5. Come up with new and different solutions	67.50	77.78	20.30
	6. Find new ways of solving problems	65.85	88.89	26.83
Ethical and sustainable thinking	7. Assess the social and ecological impact of your ideas	63.41	100.00	34.15
	8. Apply sustainability values (social and ecological) to your practice	65.85	100.00	29.27
	9. Assess what is seen as "good sustainable practice" in your field of expertise	65.85	88.89	26.83
Valuing ideas	10. Identify the novel value in new ideas within your field of expertise	58.54	77.78	26.83
	11. Assess which needs and requirements are necessary to solve the most important challenges within your field	58.54	83.33	29.27
	12. Anticipate which new developments will be of importance in your field	48.78	77.78	39.02
Vision	13. Assess various ways in which your ideas can develop successfully	46.34	83.33	41.46
	14. Imagine novel connections and relationships that will be important for the development of your ideas	60.98	94.44	34.15
	15. Anticipate what you need to do to reach the goals you set	70.73	88.89	24.39
Self-awareness and self-efficacy	16. Achieve goals that you set for yourself	95.12	100.00	4.88
	17. Perform tasks that you are unfamiliar with	73.17	88.89	17.07
	18. Succeed in endeavours that you set your mind to	85.37	94.44	7.32
Motivation and perseverance	19. Finish tasks that you have started, even if you are tired of them	87.80	100.00	9.70
	20. Continue to work on tasks despite setbacks and failures	82.93	94.44	14.51
	21. Immediately start working on tasks, even if they are challenging	75.61	83.33	14.63
Mobilising resources	22. Actively network to increase your number and quality of your contacts	63.41	100.00	31.71
	23. Find the right people to assist you with various tasks	75.61	83.33	9.76
	24. Contact people you do not know when you need something	60.98	94.44	34.15
Financial and economic literacy	25. Estimate a budget for a new project	56.10	77.78	24.39
	26. Control costs in projects	58.54	88.89	24.39
	27. Read and interpret financial statements	73.17	77.78	4.88
Mobilising others	28. Make people enthusiastic about your ideas	75.61	88.89	19.51
	29. Convey your ideas in an enthusiastic manner	82.93	88.89	12.07
	30. Convince others to engage in your activities	70.73	88.89	24.39
Taking the initiative	31. Be the one who takes the initiative	70.73	83.33	19.51
	32. Make difficult decisions	65.85	88.89	29.27
	33. Quickly assess complex situations	60.98	83.33	31.71
Planning and management	34. Create a project plan	65.85	88.89	19.51
	35. Organise and structure tasks in a project	75.61	83.33	17.07

	36. Set project goals	*80.49*	*88.89*	*14.63*
Coping with ambiguity, uncertainty, and risk	*37. Deal with uncertainty when implementing new activities*	*63.41*	*94.44*	*29.27*
	38. Work under stress and pressure	*73.17*	*88.89*	*21.95*
	39. Deal with sudden changes and surprises	*75.00*	*94.44*	*17.68*
Working with others	*40. Work with many different people*	*85.37*	*100.00*	*14.63*
	41. Actively participate in teamwork	*95.12*	*100.00*	*4.88*
	42. Promote your ideas and opinions when working in a group	*85.37*	*88.89*	*9.76*
Learning through experience	*43. Look for new opportunities to develop new knowledge and skills*	*73.17*	*88.89*	*21.95*
	44. Learn from challenging tasks	*90.24*	*94.44*	*7.32*
	45. Select challenging work tasks that you can learn a lot from	*73.17*	*100.00*	*19.51*

Furthermore, students demonstrated active networking to increase their number and quality of their contacts and contacting people they do not know when they need something (both related to the "mobilising resources" competence), as well as quickly assessing complex situations (taking the initiative competence).

Participants reported less progress in achieving goals that they set for themselves, succeeding in endeavours that they set their mind to, and finishing tasks that they have started, even if they are tired of them (related to self-awareness, self-efficacy, and motivation competences) since they evaluated themselves very highly in both pre- and post-test. Moreover, they evaluated low progression in reading and interpreting financial statements. Working with others and learning through experiences are competencies that were marked with low progression since they evaluated themselves highly in both test times.

Table 2 synthesises the Wilcoxon signed-rank test results comparing students' entrepreneurial competencies at two measurement points: before the intervention (Pre) and immediately after the course (Post). Statistical significance was evaluated using a threshold of $p < .05$. All competencies improved significantly immediately following the intervention (Pre-Post comparison), with the strongest effects observed for Creativity (+1.42 points; $p < .000$), Mobilising resources (+1.31 points; $p < .000$), Vision (+1.26 points; $p < .000$), and Valuing ideas (+1.23 points; $p < .000$). Remarkably, the EntreComp area that has been positively progressing is the Ideas and Opportunities one. On the contrary, the weakest effects can be observed for Self-awareness and self-efficacy (+0.39 points; $p = .013$), Motivation and perseverance (+0.57 points; $p = .006$), Learning through Experience (+0.81 points; $p < .000$), and Working with others (+0.92 points; $p < .000$). These items were evaluated highly in the Pre-test. This is the reason why students do not perceive a strong progression between before and after the Course.

Taken together, these findings highlight two crucial insights: competencies related to creativity, vision, and valuing ideas (Ideas and Opportunities area), and Mobilising resources (Resources area) maintain remarkable improvements over the long term, while competencies related to personal resilience, mobilization of resources, and coping strategies (Resources and Into Action areas), such as Self-awareness and Self-efficacy, Motivation and

Perseverance, Working with others, Learning through Experience appear less stable, indicating that sustained reinforcement or ongoing support might be needed to ensure their retention.

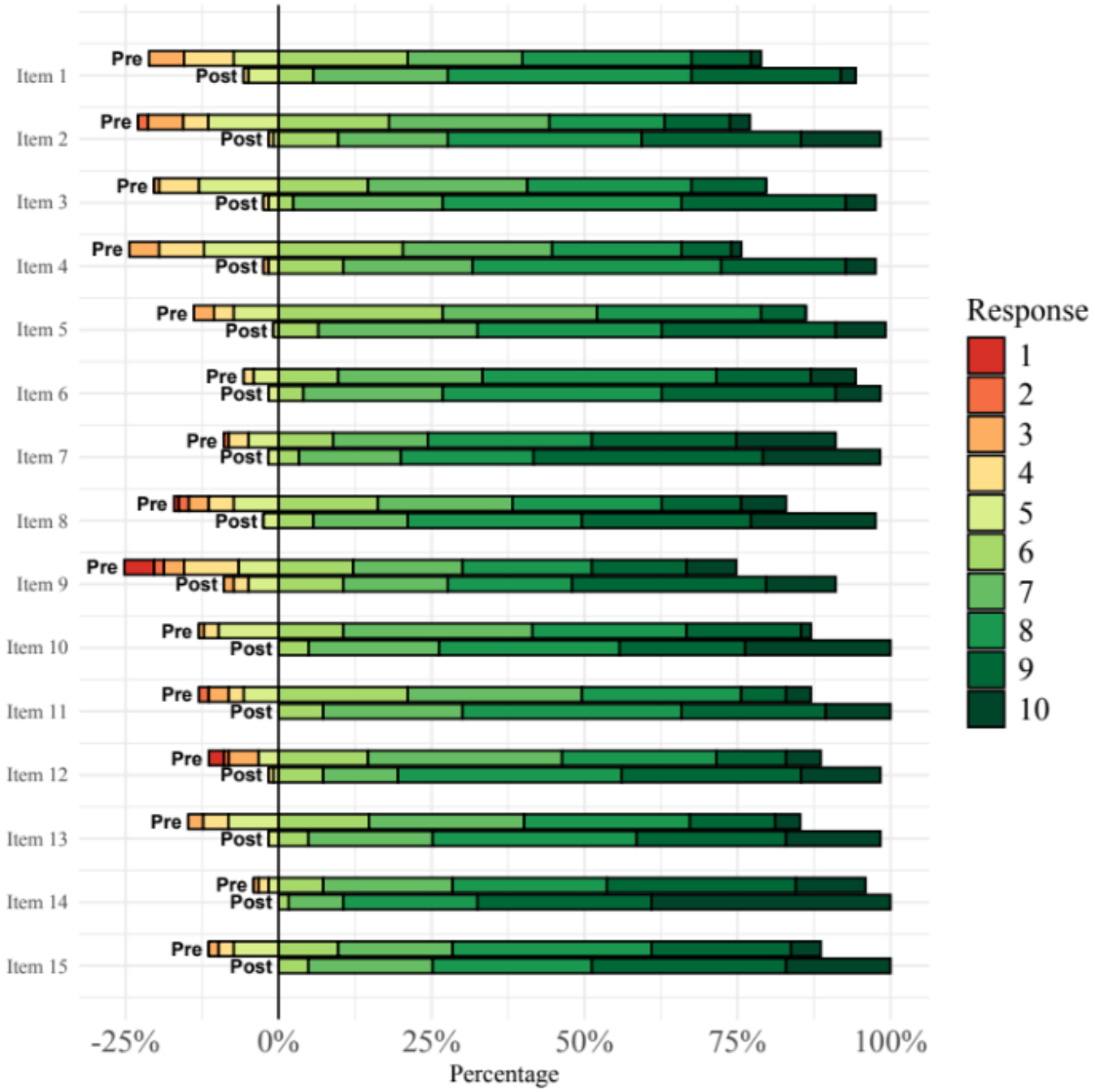
Competences related mainly to the first Ideas and Opportunities area have a higher long-term retention rate, probably because they are often more cognitive, tangible, or directly applied, while the competences related to Into Action areas are more context-dependent on the course (Laker & Powell, 2011). These latter are practiced intensely within the team and towards the challenge goal. Once the team disbands and the project ends, the specific context (the team dynamic, the challenge pressure) that was enforcing the practice of these skills disappears. Students have to develop in a short timeframe and require sustained self-reflection, repeated high-stakes failure/recovery cycles, and deliberate practice outside of the core business task. A single course, even a longitudinal one, may not be sufficient to rewire a student's default coping or self-management mechanisms fundamentally.

Table 2. Averages' differences between pre- and post-treatment

Areas - EntreComp	Items - EntreComp	Delta (Pre-Post)	V (Pre-Post)	P-Value (Pre-Post)
Ideas and Opportunities	*Item 1. Spotting opportunities*	*1.09*	*88.50*	*0.0001222513*
	Item 2. Creativity	*1.42*	*41.50*	*0.00000295205*
	Item 3. Ethical and sustainable thinking	*1.11*	*107.50*	*0.0001369455*
	Item 4. Valuing ideas	*1.23*	*41.50*	*0.000004604662*
	Item 5. Vision	*1.26*	*52.00*	*0.000003897713*
Resources	*Item 6. Self-awareness and self-efficacy*	*0.39*	*188.00*	*0.01360994*
	Item 7. Motivation and perseverance	*0.57*	*160.50*	*0.006805198*
	Item 8. Mobilising resources	*1.31*	*85.00*	*0.00009924067*
	Item 9. Financial and economic literacy	*1.10*	*111.00*	*0.0015959482*
	Item 10. Mobilising others	*1.10*	*52.00*	*0.00001009796*
Into Action	*Item 11. Taking the initiative*	*1.16*	*25.00*	*0.0000008445153*
	Item 12. Planning and management	*1.17*	*85.50*	*0.00002049672*
	Item 13. Coping with ambiguity, uncertainty, and risk	*1.07*	*60.00*	*0.00001818967*
	Item 14. Working with others	*0.92*	*43.00*	*0.000005167887*
	Item 15. Learning through experience	*0.81*	*131.00*	*0.0008735562*

Figure 2 complements these results by graphically illustrating the evolution of students' entrepreneurial competencies across the two measurement points through a clustered diverging stacked bar chart. This visualization reveals both the magnitude and consistency of changes across competency levels.

Figure 2. Clustered diverging stacked bar chart



6. Research limitations:

This study is still at a preliminary analytical stage and should be considered both a pilot and a work-in-progress. As such, it presents several limitations. Most notably, the sample size is still small (41 respondents), limiting the ability to draw generalizable conclusions. Additionally, the EntreComp questionnaire relies on self-reporting, which may compromise objectivity due to cultural or personal biases (Schmidt & Hunter, 1998), as well as tendencies toward overestimation or underestimation of one's entrepreneurial competencies. To help mitigate these limitations, the authors will continue to expand the sample with a new round of data collection involving students enrolled in the next editions of the course. This new data will be incorporated into the broader study. Finally, the research team is also exploring the possibility of conducting a comparative study across different business schools, intending to examine how institutional and contextual factors may influence the development and retention of entrepreneurial competences, as well as the role of the teachers. Integrating a control group into the study, such as a comparable cohort of students who completed a non-CBL management course, would significantly enhance the internal validity of the findings by isolating the specific effect of the CBL methodology on

the observed competence acquisition and subsequent retention or decay.

7. Managerial implications:

This study offers valuable insights into the effective design and implementation of challenge-based learning (CBL) courses aimed at enhancing entrepreneurship education. Drawing on the experiences documented in this research, five key managerial implications are proposed to help educators and program administrators strengthen similar CBL-based initiatives and support students in developing and retaining entrepreneurial competencies (see Table 7).

7.1 Strategic Selection of Challenge Providers

Careful identification and preparation of challenge providers is critical. Organizations may require time and support to adapt to this interactive and non-traditional form of collaboration with students. CBL represents a departure from conventional pedagogical models, and not all organizations are immediately ready to engage in this new dynamic. Providers with clearly defined internal governance structures tend to offer more consistent guidance, which can boost student motivation and learning. Moreover, scheduling ample time for interaction between students and providers is essential to foster engagement and facilitate meaningful learning. Educators should prioritize partnerships with organizations that are open to collaboration, structured, and committed to investing time and resources in the educational process. To foster entrepreneurial thinking, organizations should present students with real-world, unresolved strategic challenges that demand creativity, initiative, and value creation. Sustained engagement with providers—through ongoing feedback and post-course mentoring—can help strengthen students' entrepreneurial identity and maintain their motivation beyond the course duration.

7.2 Early and Collaborative Challenge Design

The success of CBL depends heavily on the design of the challenge, which should be finalized well in advance of the course start. Objectives, deliverables, and project boundaries must be clearly defined in collaboration with the challenge providers to ensure clarity and coherence. Embedding milestones throughout the course—such as business model validation, structured feedback rounds, and customer discovery checkpoints—can enhance opportunity recognition and strategic planning skills. These checkpoints encourage critical thinking and structured initiative, both of which are central to the EntreComp framework.

7.3 Strong Theoretical and Methodological Foundations

Introducing relevant theoretical concepts and practical tools early in the course equips students with the necessary knowledge to address complex challenges. These tools (e.g., lean startup principles, design thinking, stakeholder mapping) should be embedded into the challenge work through interactive workshops, peer learning activities, and reflective exercises. Encouraging students to maintain a learning journal or entrepreneurial logbook can reinforce theoretical understanding and promote connections between course content and personal experience, supporting deeper learning and skill retention.

7.4 Extended Time for Solution Development and Validation

The course structure should provide sufficient time for students to test, refine, and validate their proposed solutions. Allowing room for experimentation and iteration increases the

relevance and feasibility of students' final outputs. Educators can also integrate deliberate "pivot points" into the course schedule—key moments when teams are encouraged to revisit their assumptions and potentially redirect their approach based on new insights or stakeholder feedback. This fosters adaptability, perseverance, and effective problem-solving.

7.5 Focus on Soft Skills and Personal Development

Finally, a crucial implication concerns the need to allocate dedicated time to soft skills development, with particular attention to creativity, stepping outside one's comfort zone, and managing stress. These goals can be supported through creative warm-up activities, improvisational exercises, resilience training, and structured team reflections. For longer-term impact, students can be guided to create Personal Development Plans (PDPs) that link entrepreneurial goals—such as self-efficacy—with ongoing behaviors and learning practices that extend beyond the course.

Table 7. Managerial implications and recommendations for stimulating and sustaining entrepreneurial skills

Managerial implications	***Recommendations***	***Suggestions to Stimulate and Sustain Entrepreneurial Skills***
1. Careful Selection of Challenge Providers	*Choose providers with clear governance and readiness for interactive collaboration.*	*Select real, unresolved strategic challenges.* *Encourage post-course mentoring from challenge providers.* *Foster long-term engagement with students.*
2. Effective Challenge Design	*Co-design challenges with clear objectives, outcomes, and boundaries.*	*Use milestone-based progress tracking.* *Integrate business model tools and customer validation steps.* *Conduct structured feedback and reflection sessions.*
3. Early Introduction of Theory and Tools	*Teach relevant frameworks and methods at the beginning of the course.*	*Link tools directly to challenge activities.* *Use applied workshops and peer-teaching.* *Assign learning journals or entrepreneurial logbooks.*
4. Time for Validation and Development	*Allow more time for iterative solution testing and validation.*	*Include prototyping, field testing, and stakeholder interviews.* *Introduce "pivot moments" for strategic reassessment.* *Encourage trial-and-error learning and adaptive thinking.*
5. Soft Skills Development	*Emphasize creativity, stepping out of the comfort zone, and stress management.*	*Use creativity exercises and improvisation games.* *Include stress resilience and reflection practices.* *Guide students in developing personal development plans (PDPs).*

8. Conclusion:

This study demonstrates the clear short-term effectiveness of the educational intervention across the EntreComp framework. Nevertheless, caution is warranted when interpreting this finding due to the study's relatively small sample size and associated methodological limitations. It provides a novel contribution by examining not only the development but also the retention of entrepreneurial competencies within a challenge-based learning (CBL) course in management education. Its originality lies in the cross-temporal analysis of data

collected at two points (pre-test and post-test) within the same course context. The study advances the literature on CBL in entrepreneurship education by investigating the immediate impact of entrepreneurial skill development. Ultimately, it contributes to a deeper understanding of how CBL can be strategically designed to enhance not only the acquisition but also the retention of entrepreneurial competencies, offering actionable insights for educators seeking to improve the effectiveness of entrepreneurship education.

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