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Professional Noticing in Entrepreneurship Education: Towards an Entrepreneurial Mindset in Higher Education

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Abstract

This study explores the integration of Professional Noticing (PN) into entrepreneurship education to foster entrepreneurial mindset in higher education. PN is defined as the ability to observe, interpret, and respond to salient information in professional contexts. Despite its potential, PN has remained underused in entrepreneurship education pedagogy. The research, conducted under the EU-funded PROMISE project, involved 15 pilot trainings across Austria, Finland, Spain, and Ireland. A mixed-methods approach was employed, including a student survey (n=183) and 15 semi-structured teacher interviews.

Findings indicate that PN enhances key entrepreneurial competences such as creativity, self-awareness, and opportunity recognition. Students reported moderate to significant improvements in their entrepreneurial competences. Factor analysis revealed six competence clusters, with the strongest loading in Factor 1, which showed the most significant transformation following the pilot training. All entrepreneurial competences and all four PN skills were strongly represented and showed high loadings.

Teacher interviews showed that PN supports a broad range of entrepreneurial competences, particularly opportunity recognition, creativity, reflective judgment, and risk management. Teachers highlighted PN's value in structuring learning, promoting learner-centred pedagogy, and bridging theory with practice.

The study concludes that PN is a promising pedagogical tool for entrepreneurship education, supporting the development of transversal skills essential in dynamic work environments.

Keywords: Professional Noticing, entrepreneurial competences entrepreneurship education, mixed method

1 Introduction

In contemporary societies characterised by rapid transformation, competences such as entrepreneurial thinking, problem-solving, and adaptability are increasingly recognised as essential across diverse professional domains. Over the past two decades, entrepreneurship education has evolved beyond its traditional business-centric paradigm, shifting toward the cultivation of entrepreneurial mindsets and individual agency.

Professional Noticing (PN) that is defined as the capacity to observe one's environment, discern salient information, interpret its relevance within a specific professional or organisational context, and make informed, purposeful decisions - has emerged as a critical, yet underutilised, pedagogical construct in this domain (Rooney & Boud, 2019). As a transversal skill, Professional Noticing enables learners to respond effectively to dynamic and uncertain conditions, while also identifying opportunities arising from environmental changes and disruptions.

Despite its growing recognition in academic literature, the integration of PN into entrepreneurship education pedagogy has remained underused. Embedding this approach within entrepreneurship education holds the potential to introduce innovative, student-centred, and practice-oriented learning experiences that better prepare students to navigate the complexities of an increasingly volatile and interconnected professional landscape.

To evaluate the effectiveness of PN in entrepreneurship education, we conducted an empirical study within the European Union (EU) funded PROMISE project (Professional Noticing to Improve Entrepreneurship Education). This Erasmus+ initiative aims at integrating PN into entrepreneurship and intrapreneurship education among students in higher education institutions. The empirical study was carried out across several courses at three higher education institutions in Austria, Finland and Spain, as well as in vocational education settings in Ireland. The study employed a mixed-methods research design: we collected the data through a student survey and teacher interviews.

The study was guided by the following research questions:

- RQ1: How effective is Professional Noticing as a methodology to improve entrepreneurial education from the point of view of students and teachers?
- RQ2: What entrepreneurial competences does Professional Noticing particularly support?

This paper is structured as follows: we begin with introducing the conceptual framework, which include Professional Noticing and entrepreneurial competences. We then present the research design and methods, followed by findings and concluding with a discussion.

2 Theoretical Framework

2.1 Professional Noticing

Professional Noticing refers to the intentional, selective process of attending to salient features of practice and experience, enabling informed and timely action within professional contexts. It involves both perception and interpretation, allowing professionals to actively discerning specific elements from the surrounding environment and making meaning from them in light of one's prior knowledge and goals (Mason, 2002; Boud & Walker, 1990; Rooney & Boud, 2019).

At its most basic level, noticing is the act of becoming aware of distinguishing and isolating something from the broader context in which it is embedded (Mason, 2002). In this sense, to notice can be taken to mean the same as to perceive or sense. This noticing occurs continuously and often unconsciously in everyday life and is typically casual and spontaneously (Mason, 2002). Human perception is limited by attentional capacity; while we are constantly bombarded by sensory input, only a small portion becomes consciously registered (Mason, 2002). Consequently, much of what surrounds us goes unnoticed, not because it is imperceptible, but because it lies outside the focus of our attention (Mason, 2002), or we don't focus on noticing what is important to do so.

Intentional noticing involves a shift in awareness, a movement from passive perception to active awareness. It involves recognising previously unattended aspects of a situation and interpreting them in meaningful ways. This shift is not simply a matter of seeing more, but of discerning what matters in a particular context (Mason, 2002; Bateson, 1994). Patterns of noticing in the professional field do not develop in isolation. As Goodwin (1994) explains through the concept of professional vision, groups of professionals with shared goals and experiences develop common perceptual and interpretive frameworks. These frameworks shape what is seen and how it is understood.

Noticing is a subjective process. What individuals attend to is shaped by personal history, social and cultural background, and current intentions (Fosnot, 2005; Walqui, 2000; Boud & Walker, 1990), what we could say is our personal frame. This subjective foundation predisposes individuals to notice certain features over others. In this sense, noticing is not purely objective but filtered through a personal lens, a reality that underscores the importance of intention and guidance in shaping what is seen and how it is interpreted. Professionals carry out this observation using what Borich (2016) refers to as a professional frame, which is a structured perspective shaped by experience. This framework allows them to evaluate situations objectively and respond with competence.

Noticing is seen as critical in many professional domains – no doubt because failure to notice salient aspects or significant behaviours can lead to poor outcomes, and in some professions, catastrophic repercussions (Dossey, 2008; Watson & Rebair, 2014). In this sense, PN can be understood as the intentional act of observing and interpreting significant aspects of professional situations to make informed, timely decisions. This includes recognising relevant patterns, diagnosing issues, identifying opportunities for action, and selecting responses from a repertoire of professional strategies (Mason, 2002; Rooney & Boud, 2019).

Building on this understanding, Professional Noticing has been conceptualised as a recursive process that unfolds in distinct but interrelated phases: (1) Perceiving/Attending, (2) Interpreting/Reasoning, and (3) Deciding (König et al., 2022). Some scholars extend this to a fourth phase, (4) Responding/Reacting, which emphasises how decisions are enacted in practice and feed back into future noticing cycles (Jacobs et al., 2010; van Es & Sherin, 2021). The process demands both increased sensitivity to situational cues and the readiness to draw upon relevant knowledge and practices as they become salient.

PN is critical across domains, as failure to notice significant behaviour can lead to poor outcomes (Dossey, 2008; Watson & Rebair, 2014). It involves observing and interpreting professional situations to make informed decisions, recognising patterns, diagnosing issues, and selecting appropriate responses (Mason, 2002; Rooney & Boud, 2019). PN unfolds in phases: perceiving, interpreting, deciding, and responding (König et al., 2022; Jacobs et al., 2010; van Es & Sherin, 2021).

This skill is learnable through guided observation, reflective practice, and repeated engagement (Mason, 1993, 2002; Goodwin, 1994; Borich, 2016; Tanner, 2006; Bazerman, 2014). Boud and Walker (1990) assert that noticing is a prerequisite for learning. PN also occurs when observing others in professional action and identifying transferable practices (Mason, 2002). Jacobs et al. (2010) and Rooney & Boud (2019) highlight PN as key to developing expertise, enabling experts to detect deviations and respond effectively.

The definition of Professional Noticing in entrepreneurship education pedagogy used in this research builds on the approaches described above. Professional Noticing refers to the ability of professionals to perceive situations in a work environment and to use their observations to make well-founded decisions and actions in everyday work. Developing this capacity helps learners navigate complexity and become reflective practitioners who keep learning from and within their entrepreneurial contexts.

2.2 Entrepreneurial Competences and Skills

The concept of competence has been widely discussed and subject to varied interpretations across disciplines and stakeholder groups (Van Overveld & Van Goudoever, 1997; Bron, 1999; Hayton & McEvoy, 2006; Hoffmann, 1999). Competence is typically defined as the ability to achieve specific actions, behaviours, or outcomes relevant to a given occupational context

(Cheng & Dainty, 2003). Similarly, Eraut (1998) frames competence as the capability to perform tasks and roles to an expected standard.

To bridge the gap between education and employment, the European Commission identified sense of initiative and entrepreneurship as one of the eight key competences for lifelong learning over a decade ago (Bacigalupo et al., 2016). Fostering entrepreneurial capacity among European citizens and organisations has since become a strategic objective at both EU and national levels.

In support of this aim, the European Commission developed the EntreComp framework, which serves as a reference model intended to promote entrepreneurship as a core competence across educational and professional settings. EntreComp adopts a broad definition of entrepreneurship, viewing it as the ability to create cultural, social, or economic value through proactive engagement with opportunities and ideas (Bacigalupo et al., 2016).

The EntreComp framework is organised into three interrelated competence areas: Ideas and Opportunities, Resources, and Into Action. These domains reflect the entrepreneurial process, which involves transforming ideas into action that generates value for others. The model emphasises the mobilisation of diverse resources: personal (e.g., self-awareness, self-efficacy, motivation, perseverance), material (e.g., financial capital, tools), and non-material (e.g., knowledge, skills, attitudes). Each of the three areas encompasses five individual competences, making up a total of fifteen that are interlinked and mutually reinforcing (see Table 1).

Table 1. Overview of three EntreComp competences

1. Ideas and opportunities	2. Resources	3. Into action
1.1 Spotting opportunities	2.1 Self-awareness & self-efficacy	3.1 Taking the initiative
1.2 Creativity	2.2 Motivation & perseverance	3.2 Planning & management
1.3 Vision	2.3 Mobilising resources	3.3 Coping with uncertainty
1.4 Valuing ideas	2.4 Financial & economic literacy	3.4 Working with others

1.5 Ethical & sustainable thinking	2.5 Mobilising others	3.5 Learning through experience

3 Methodology

3.1 Data collection and description of the pilots

We conducted an empirical study employing a mixed-methods approach, using a student survey and teacher interviews in 15 educational pilots that implemented Professional Noticing pedagogy. The pilots were conducted over two semesters (Autumn 2024 – Spring 2025) simultaneously at three European universities in Austria, Finland and Spain, and five vocational education settings in Ireland (see Table 2). A total of 187 students participated in the trainings, of whom 183 students provided consent to take part in the student survey. All teachers involved in the educational pilots, gave consent to participate in interviews.

A mixed-methods approach was employed to capture students' perceptions of their entrepreneurial competences and PN skills both prior to and following the pilot training. The primary data source for this study was a student survey. Additionally, qualitative data were collected through teacher interviews to enrich the understanding of the training process, the use open educational resources (OERs) for the teaching of PN, and the development of competences.

Table 2. Summary of the mixed-method data used in the research.

Method	Piloting countries				Role of the data in this research
	Austria	Finland	Ireland	Spain	
Student survey (n=183)	n=23	n=47	n=36	n=77	PRIMARY DATA: To reveal students' perceptions on the effectiveness of PN to improve their entrepreneurial skills.
Semi-structured teacher interviews (n=15)	n=2	n=4	n=5	n=4	To understand in-depth teachers´ perceptions on PN and its effectiveness on the development of students' entrepreneurial skills, and how they

					experienced the potential of this education pedagogy.

The various data sets and their specific roles in this research are discussed in greater detail in Sections 3.2 and 3.3.

OERs were piloted across a wide range of disciplines and educational levels (see Figure 1). The trainings were piloted in various educational courses, including creative incubator programmes, professional development workshops, undergraduate and postgraduate business courses, vocational education and training (VET) sector (such as equine studies, construction, catering, and fashion), as well as teacher education, MBA programmes, and marketing courses.

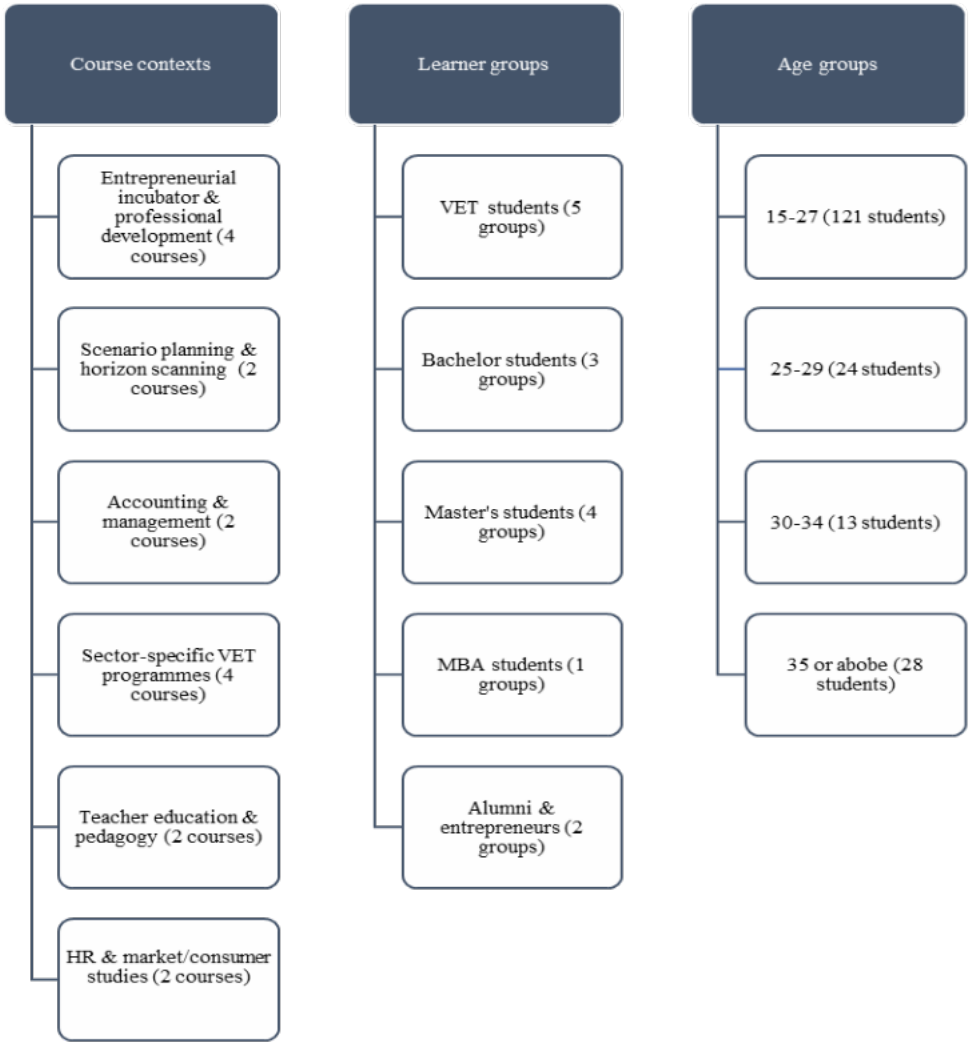

Figure 1. Course contents and learners

A total of 10 training sessions were conducted within higher education institutions, and five courses delivered in vocational education programmes. Learner cohorts were diverse, comprising start-up teams, alumni, first-year undergraduate students, cross-disciplinary groups, and final-year master's students. Most students participating the study were aged between 20 and 24. The youngest participant was in the 15–19 age group, while the oldest belonged to the 65–69 age group.

Training methodologies predominantly involved collaborative learning approaches, such as group or pair work, including brainstorming sessions, discussions, interviews, and other interactive activities. One training programme included one-on-one coaching. OERs were utilised at various stages of the courses: some instructors introduced them at the beginning, while others incorporated them mid-course or towards the end.

3.2 Student survey

A student survey was conducted to evaluate the effectiveness of Professional Noticing (PN) from the students' perspective as a methodology for enhancing entrepreneurial education. The survey was administered using Webropol. It is a survey and feedback platform used for the design and administration of surveys, supporting both structured and open-ended responses. All data are stored on servers located in Finland, with no transfer of personal information outside the European Union. The platform operates through an ISO 27001-certified data centre and employs encrypted data transmission as well as controlled access. In accordance with the General Data Protection Regulation (GDPR), Webropol includes functions for deleting or anonymising personal data and for managing "right to be forgotten" requests. The questionnaire was made available in three languages, English, German, and Spanish, allowing respondents to select their preferred language.

Preliminary information about the study was provided to students during the first lecture, either by the course teacher or a member of the research team. At the beginning of the survey (administered via Webropol), participants were presented with an information sheet, a data protection notice, and the full content of the consent form. Access to the survey was granted only after participants had reviewed these documents and indicated their informed consent by ticking a checkbox. Participation in the study was entirely voluntary, and students were explicitly informed of their right to decline consent without any consequences.

We assessed entrepreneurial competences, which were developed by adapting the European Commission's *EntreComp* framework for entrepreneurship competence (2016). During the design phase of the student questionnaire, the 15 competences of the EntreComp framework were reformulated into clearer and more concrete statements to make them easier for respondents to understand. To further simplify the survey and reduce potential interpretation challenges, the competencies *Mobilising others* and *Working with others* were merged into a single competence, expressed as: I inspire others to join me in making exciting things happen and work well with teams to achieve goals. Therefore, a total of 14 entrepreneurial competences were assessed. In addition, each of the four dimensions of Professional Noticing

— observe, identify, interpret, and react — was measured. To ensure clarity and accessibility, we employed simplified language in the formulation of each statement. For example, the item *"I think of different ways to improve things and come up with new ideas or solutions"* was used to represent entrepreneurial competence related to creativity.

The online questionnaire consisted of structured items, the majority of which were multiple-choice questions using a 5-point Likert scale. It also included three open-ended questions, which were optional for respondents.

In the first section of the survey, students assessed their own skills and competences prior to the lecture or training session in which the Professional Noticing (PN) OER was utilised. *In the second section,* students evaluated the extent to which their skills and competences had improved because of the training. To effectively measure learning outcomes, the questions related to skills and competences before and after the training were designed to be as similar as possible. *The third section* of the survey comprised seven background questions, including items on the respondent's age, gender, educational background, and status.

The survey data analysis began with an examination of descriptive variables and their cross-tabulation across background characteristics such as gender, age, and educational background. This was followed by correlation analysis using Pearson's correlation coefficient (ranging from –1 to +1) to assess the strength and direction of relationships between variables. While correlation indicates association, it does not imply causation. The final stage involved exploratory factor analysis to identify underlying structures within the data by grouping highly correlated variables into fewer latent factors, thereby reducing complexity and revealing meaningful dimensions.

3.3 Teacher interviews

We designed a predetermined set of open questions for teachers to assess effectiveness of the Professional Noticing approach in developing entrepreneurial competences and Professional Noticing skills. The interviews were planned as semi-structured interviews, which lasted about 30– 40 minutes. In the interview teachers assessed the effectiveness of the Professional Noticing approach in developing entrepreneurial competences. All 15 teachers who participated in the study were informed in advance through an information letter, which included a Privacy Notice. The letter outlined the purpose and rationale of the research. Participation in the interviews was entirely voluntary, and interview times were scheduled according to each participant's availability and preferences. The Privacy Notice detailed the rights of the participants as data subjects, the nature of the data collected, the purposes for which the data

were collected, and the measures taken to ensure data protection. Informed consent was obtained verbally at the beginning of each interview, after participants had received sufficient information to make an informed decision. Interviews were conducted either face-to-face or via video conferencing platforms (Zoom or Microsoft Teams), depending on the participant's preference. All the interviews were recorded and transcribed. Following that, all audio and video recordings were deleted, and only anonymised transcriptions of the audio recordings were retained for analysis.

The interview transcripts were analysed using thematic qualitative content analysis, following the approach outlined by Kuckartz (2019). This method was selected for its systematic yet flexible structure, which allows both deductive coding based on theoretical frameworks and inductive refinement based on the data.

We began by developing *main categories* derived from the research questions and the theoretical frameworks underpinning the PROMISE project, namely the PN phases of observe, identify, interpret and react (König et al., 2022; Jacobs et al., 2010; van Es & Sherin, 2021), and the EntreComp competence framework (Bacigalupo et al., 2016). The resulting codes and category structures were then compared, discussed, and refined collaboratively.

The final category system was applied to the full dataset. This enabled the identification of cross-case patterns and emerging themes, which were clustered around implementation contexts, learning outcomes, and perceived impact on teaching and learning. The findings were interpreted with reference to the two theoretical foundations of the PROMISE project, the Professional Noticing phases and the EntreComp framework, illustrating how targeted observation and reflection processes contributed to entrepreneurial competence development in varied educational contexts.

4 Results

4.1 Student survey

On average, students assessed that before the training they possessed entrepreneurial competences across all EntreComp areas: Ideas and Opportunities, Resources, and Into Action. Competences related to spotting opportunities and creativity were identified as the most prevalent entrepreneurial competences prior to the training. In contrast, the least developed competences were those related to coping with uncertainty and financial literacy.

When asked about the students' own perception of the improvement in their entrepreneurial competences, they reported moderate to significant perceived improvement, with an average score of 3.5/5 (see Figure 2). According to the results, the most significant improvement following the training was observed in entrepreneurial competence related to learning through experience "I reflect on my experiences and learn from both my successes and mistakes", with an average score of 3.7. Furthermore, creativity-related competence "I think of different ways to improve things and come up with new ideas or solutions" also demonstrated notable development and was similarly rated, with an average score of 3.7. The least improved entrepreneurial competences were related to financial literacy, mobilising resources, and coping with uncertainty. These competences also showed moderate improvement on average following the training.

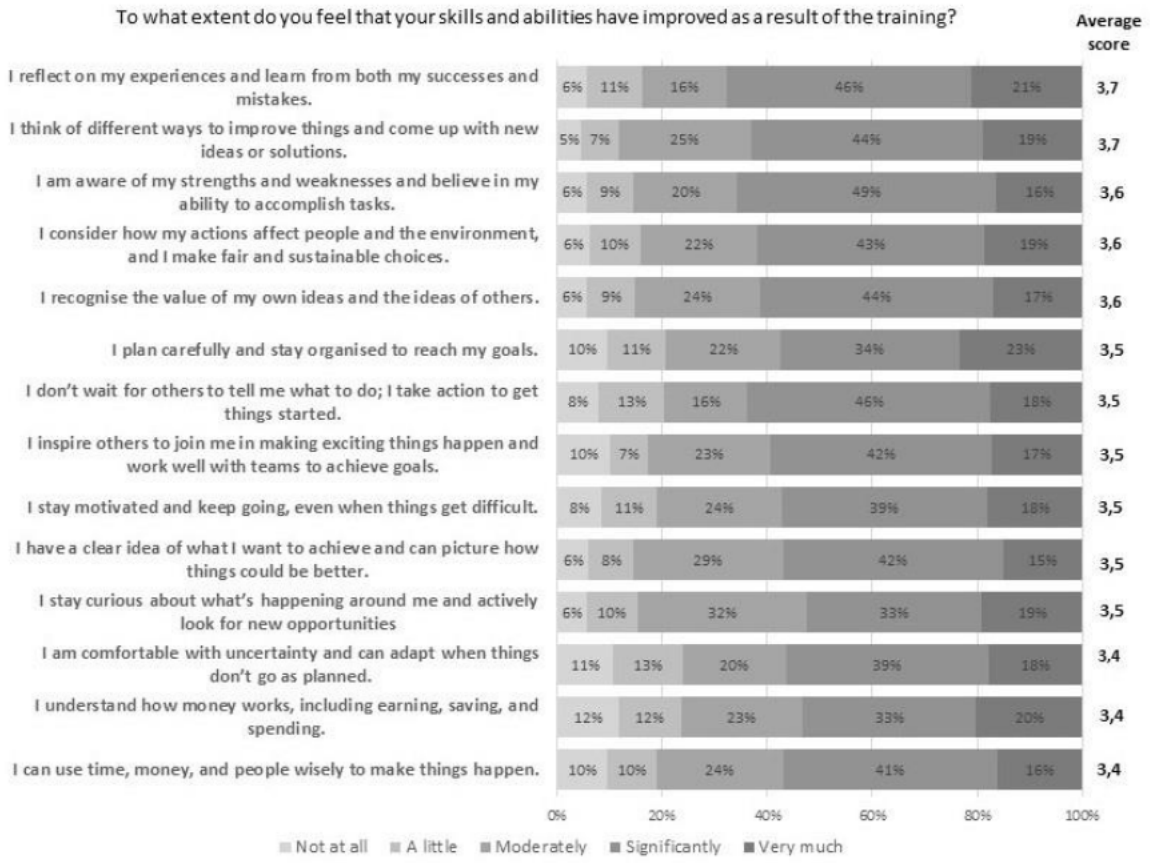

Figure 2. Students' perceptions on possible increase of entrepreneurial competences after the training

The cross-tabulations did not reveal any significant differences across demographic factors such as age, gender or educational level. Correlation analysis indicated relatively strong positive correlations within the statement groups, suggesting that these items measure interrelated dimensions of students' thinking and learning habits, such as autonomy and self-direction. In contrast, correlations with demographic variables, including age, gender, and educational level, were generally weak. This finding supports the results of the cross-tabulations and implies that learning characteristics are not strongly dependent on demographic background. Instead, the correlations show that students' responses to items concerning learning, problem-solving, and self-development are closely connected and together form a coherent construct describing self-directed learning skills.

Exploratory factor analysis (EFA) was conducted to identify underlying structures within the dataset. The analysis employed Principal Component Analysis (PCA) as the extraction method, which is commonly used to reduce data dimensionality by transforming correlated variables into a smaller set of uncorrelated components. To simplify interpretation, a Varimax rotation with Kaiser normalization was applied, which maximises the variance of factor loadings across variables and facilitates clearer factor separation. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was 0.89, indicating excellent suitability of the sample for factor analysis (values above 0.6 are generally considered acceptable). Bartlett's Test of Sphericity was significant ($p < 0.001$), confirming that the correlation matrix was factorable.

Factor loadings below 0.30 were initially excluded to reduce noise, and subsequently, loadings below 0.60 were removed to facilitate clearer interpretation of the factors. The higher threshold was used in this study because it eliminated parallel loadings between factors in the factor matrix, ensuring that each variable was strongly associated with a single factor.

A total of six factors were extracted, which together explained 61.28% of the total variance in the data. This level of explained variance is considered satisfactory in social science research and indicates that the six factors capture a substantial portion of the information contained in the original dataset.

Table 3. Total variance explained

		Initial eigenvalues		Extraction sums of squared loadings			Rotation sums of squared loadings		
Factor	Total	% of variance	Cumulative %	Total	% of variance	Cumulative %	Total	% of variance	Cumulative %
Entrepreneurial learner with enhanced noticing skills	10,780	29,944	29,944	10,780	29,944	29,944	10,288	28,579	28,579
Strategic financial and resource management	6,056	16,822	46,765	6,056	16,822	46,765	3,977	11,046	39,625
Motivation and team leadership	1,648	4,577	51,342	1,648	4,577	51,342	3,152	8,757	48,382
Tolerance for uncertainty	1,372	3,811	55,153	1,372	3,811	55,153	1,603	4,454	52,835
Empathy and social responsibility	1,142	3,171	58,324	1,142	3,171	58,324	1,599	4,441	57,276
Perception	1,065	2,960	61,284	1,065	2,960	61,284	1,443	4,008	61,284
...									
All	0,123	0,342	100,00						

Extraction method: Principal component analysis

Entrepreneurial learner with enhanced noticing skills (Factor 1), shows the most significant transformation following the training. All fourteen EntreComp competences and all four PN skills were strongly represented, with particularly high loadings in "Learning through experience" and "Planning and management." These results suggest that the training effectively fostered an entrepreneurial mindset, especially by encouraging learning through real-life situations and enhancing the ability to plan, prioritise, and follow through. Additionally, the PN skills of "Observing" and "Identifying" were notably strengthened, indicating improved attentiveness and the ability to recognise key elements in complex situations.

Strategic financial and resource management (Factor 2) was already well-developed before the training. High loadings in "Financial and economic literacy" and "Mobilising resources" reflect a solid foundation in practical managerial skills and financial competence. The associated noticing skills, "Interpreting" and "Reacting," further reinforce this interpretation, suggesting that participants were already capable of analysing and responding effectively to financial and resource-related challenges.

Motivation and team leadership (Factor 3) also showed strong pre-training development. The competences of "Motivation and perseverance," "Mobilising others," and "Valuing ideas" point to intrinsic motivation, curiosity, and the ability to lead and inspire teams. These traits were evidently present before the training, indicating that participants entered the program with a strong sense of purpose and leadership potential.

Tolerance for uncertainty (Factor 4) was characterised by a high loading in "Coping with uncertainty, ambiguity and risk," but only before the training. This suggests that adaptability and the capacity to navigate ambiguous situations were already part of the participants' skill set, and the training did not significantly alter this dimension.

Empathy and social responsibility (Factor 5) was similarly well-established prior to the training. The competence "Ethical and sustainable thinking" reflects a thoughtful approach to the consequences of actions and a commitment to responsible decision-making. This factor highlights the participants' pre-existing awareness of social and ethical implications in entrepreneurial contexts.

Perception (Factor 6) was defined by a high loading in the PN skill "Identifying salient aspects," again only before the training. This indicates that participants already possessed the ability to discern important elements in a situation and understand their relevance, a skill crucial for effective decision-making and problem-solving.

4.2 Teacher interviews

To complement the student survey, we conducted semi-structured interviews with 15 educators from Austria, Finland, Ireland, and Spain who had piloted PN in their courses. The interviews explored how teachers integrated PN into their teaching, how they perceived its impact on learning processes, and which entrepreneurial competences were most supported. Thematic analysis revealed several recurring themes, which are presented below in relation to the two research questions (RQ1 and RQ2).

RQ1 – Impact of Professional Noticing on Entrepreneurship Teaching

More structured teaching and clearer processes: Educators across institutions reported that PN's cycle (observation – noticing – interpretation – reaction) provided a transparent framework for entrepreneurship teaching. This structure helped scaffold sessions by directing students' attention to salient cues, guiding interpretation, and encouraging deliberate responses. Teachers noted that the framework supported reflective judgment and avoided superficial solutions: *"It gave us a structured way to talk about judgement, not just knowledge."* (I2)

Shift toward learner-centred education: PN was associated with a pedagogical shift from didactic instruction to facilitation. Teachers increasingly acted as coaches, prompting students to connect observations with theory, question assumptions, and co-construct decisions rather than seeking "correct answers." As one educator put it: *"PN shifted the dynamic from delivering content to facilitating student discussions."* (I5)

Application and professional preparation: Teachers emphasised that PN bridged classroom learning with practice by encouraging students to translate observations into actions: *"This iterative learning process is central to real-world entrepreneurship, where data is incomplete and decisions must be made under pressure."* (S3)

Reflection and team processes: PN was used to support team debriefings and group dynamics, leading to more balanced participation and stronger awareness of individual contributions to collective outcomes: *"PN enabled deeper insight into team failure, which is essential for opportunity recognition and decision-making."* (A1)

Challenges and constraints: The need for scaffolding was evident, especially for students at early study stages or those unused to reflective practice: *"They're used to following routines … slowing down and reflecting was new territory."* (I3)

Interpretation and reaction were seen as the most demanding phases. Students often looked for single right answers and felt uneasy in ambiguity. Time constraints in short workshops further limited depth. Educators recommended clearer facilitation materials, time-buffered schedules, and embedded reflection tools to mitigate these barriers.

RQ2 – Entrepreneurial competences supported by Professional Noticing

Opportunity recognition and ideation: A dominant theme was that PN sharpened students' ability to identify opportunities and generate creative ideas. By analysing team dynamics, interviewing entrepreneurs, or critiquing AI-generated concepts, learners practised spotting opportunities (EntreComp area Ideas and Opportunities). Teachers emphasised that PN encouraged students to move beyond surface observations toward actionable insights: *"Students were more attuned to emerging opportunities and could turn them into ideas worth exploring."* (A2)

Risk management and dealing with uncertainty: PN heightened awareness of risk signals and improved tolerance of ambiguity. Students learned to justify choices in uncertain situations rather than defaulting to impulsive reactions. This aligns with EntreComp's competence Coping with Uncertainty, Ambiguity and Risk: *"Through the PN lens, students were more attuned to ambiguity and capable of justifying their choices, a critical skill in both start-up and corporate contexts."* (S3)

Self-reflection and self-awareness: Teachers reported that PN supported the development of reflective practitioners. Students became more aware of how their own decisions affected others, articulating their reasoning and leadership potential. As one instructor noted: *"Extremely useful – supported self-reflection, leadership, and workplace improvement thinking."* (I3)

Critical thinking and decision-making: By questioning assumptions, validating data, and considering multiple interpretations, students cultivated critical thinking. Teachers observed stronger analytical skills and a greater capacity to evaluate options and justify decisions, resonating with Mason's (2002) claim that noticing enables more deliberate judgment.

Teamwork and collaboration: PN gave students tools to observe and manage group processes, which translated into more balanced participation, shared decision-making, and planning skills. This aligns with EntreComp's Working with Others competence: "Students recognised how their actions affected peers and adjusted their behaviour to strengthen the team's outcomes." (I5)

Confidence, motivation and perseverance: Activities such as interviewing entrepreneurs or practising noticing in real-world settings-built learners' confidence and persistence. Teachers highlighted improvements in leadership and students' willingness to persevere despite setbacks. These gains connect to EntreComp's Self-efficacy and Motivation and Perseverance.

5 Discussion

5.1 Summary of the results

We will now return to the two research questions presented at the beginning of this article. We will first discuss *Research Question 1: How effective did students find Professional Noticing?*

Quantitative findings showed that PN supports improvements of entrepreneurial competences. Students reported moderate to significant perceived improvements in their skills (average 3,5 out of 5). Factor analysis focused on identifying factors that captured students' perceptions of its usefulness, impact on learning, and ability to foster engagement. The first factor, which emerged most strongly in the post-pilot data, indicates that students viewed Professional Noticing as a tool that enhanced their ability to think critically, plan strategically, and reflect meaningfully on their actions. The strength and coherence of this factor suggest that students found PN to be an effective and valuable part of their learning experience, particularly in developing metacognitive and self-regulatory skills.

Qualitative data indicate that PN was perceived as a catalyst for structuring entrepreneurship education, shifting pedagogy toward learner-centeredness, bridging theory and practice, and supporting reflection in teams. However, challenges included time constraints, students' preference for certainty, and the need for stronger scaffolding at early learning stages.

In *Research Question 2,* we sought to uncover what entrepreneurial competences Professional Noticing supports. The results indicate an increase across all EntreComp competences. The largest increase was observed in learning through experience and creativity (average 3.7 out of 5). Financial literacy, mobilising resources and coping with uncertainty showed the smallest improvements. However, students still perceived their increase as moderate. The factor analysis revealed that Professional Noticing supports a range of entrepreneurial competences. Several distinct factors emerged, each representing a cluster of related skills. For example, one factor was associated with creativity and problem-solving. Factor groupings indicate that students linked Professional Noticing with a broad set of entrepreneurial behaviours, from generating innovative ideas to working effectively with others and taking ownership of their

learning process. In addition to post-pilot insights, the factor analysis also identified patterns in students' pre-pilot responses. A second major factor emerged from the baseline data, including items such as "I understand how money works," "I can use time, money, and people wisely," and "I know how to respond to situations." These items suggest that some students already possessed a degree of future thinking abilities before the training began. Other smaller factors captured more specific traits, such as motivation, comfort with uncertainty, and ethical awareness. While these components were less dominant, they provide exploratory insights into the diverse starting points students brought into the program and the areas where growth was most needed.

Qualitative analysis showed that PN supported a broad range of entrepreneurial competences, particularly opportunity recognition, creativity, reflective judgment, and risk management. Gains were most pronounced in the early phases of noticing (observing and interpreting), but evidence also pointed to improvements in decision-making, collaboration, and self-confidence. These findings demonstrate PN's potential to operationalise key EntreComp competences within entrepreneurship education.

5.2 Assessing limitations of the study

This study has several limitations. First, the research was conducted over a relatively short observation period, which restricts conclusions about the long-term impact of Professional Noticing. Longitudinal studies are needed to determine whether the observed competence gains are sustained over time. Second, the study was designed as an exploratory investigation, providing valuable insights and trends but not generalisable results. Third, cultural differences across participating countries may have influenced both teaching practices and students' engagement with Professional Noticing. Finally, Professional Noticing itself requires time and repeated practice that fully develops over repeated cycles to be fully developed; short interventions may not capture its full potential. The study's exploratory scope, short observation window, and reliance on self-report limit causal claims, but indicate positive directions going forward.

6 Conclusions

Our empirical study contribution is twofold. Conceptually, we frame PN (operationalised as observe, identify, interpret and react) as a practical lens that activates EntreComp competences. Empirically, across higher education and VET, we show it strengthens learners' capacity to notice salient cues, interpret them in context and act deliberately.

The results of this study, which was a pilot experience in four European countries, highlight the usefulness of the PN approach in improving entrepreneurial education. This study demonstrates that Professional Noticing has a positive impact on students' entrepreneurial capacities. The factor analysis confirms that Professional Noticing is closely associated with the development competencies related to anticipatory behaviour. Students perceived it as a meaningful and effective part of their learning, particularly in enhancing their ability to reflect, plan, and act with intention. Moreover, the analysis shows that PN supports a wide range of entrepreneurial competences, including creativity, initiative, and collaboration. These findings reinforce the value of PN as a foundational element in fostering both personal growth and entrepreneurial thinking among young learners.

The results point to the need for further research on how Professional Noticing can be adapted to different learning contexts to maximise its potential. Future work could include comparison groups and longitudinal studies.

Our work indicates that PN is a viable, scalable approach that helps learners notice, make sense and act with intention in complex settings. Unlike skills based on knowledge or technique, these competences are especially valuable in the workforce because they are less likely to be replaced by advances in digitalisation and artificial intelligence. All in all, these results support wider use of PN in entrepreneurship education.

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