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RESEARCH ARTICLE

Adoption of AI in entrepreneurship education: University teachers' perceptions

Marwa Belguith

Ph.D in Management, Research Laboratory in Economics and Management, Faculty of Economic Sciences and Management of Sfax, University of Sfax, Sfax, Tunisia

ABSTRACT

This study explores the perceptions of 147 entrepreneurship educators regarding the integration of artificial intelligence (AI) into their teaching practices. Using a mixed-methods approach combining qualitative interviews and a quantitative questionnaire, the research highlights varying levels of acceptance based on age, professional experience, digital proficiency, and academic discipline. While younger and early career teachers see AI as a tool for pedagogical innovation, more experienced educators express concerns about dehumanization and identity loss. The findings reveal both enthusiasm and reservations, shaped by limited training, insufficient resources, and a lack of institutional support. Despite these constraints, teachers generally acknowledge AI's potential to personalize and energize learning. The study underscores the need for targeted training and strategic support to foster responsible and ethical integration of AI in higher education, particularly in contexts like Tunisia where its adoption is still emerging.

KEYWORDS

Artificial intelligence (AI); entrepreneurship education; technology adoption; teacher perceptions; UTAUT model; educational innovation

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1. Introduction

Entrepreneurship is increasingly recognized as a strategic competence for fostering innovation, supporting economic competitiveness, and addressing contemporary societal challenges (Fayolle & Gailly, 2008; Nabi et al., 2017; OECD, 2019; European Commission, 2018). In higher education, this recognition has led to the growing inclusion of entrepreneurship modules and dedicated programs. However, traditional pedagogical approaches, often based on top-down

CORRESPONDING AUTHOR Marwa Belguith ✉ marwa.belguith20@gmail.com Ph.D in Management, Research Laboratory in Economics and Management, Faculty of Economic Sciences and Management of Sfax, University of Sfax, Sfax, Tunisia

knowledge transmission, have shown limited effectiveness in engaging students and fostering the development of complex entrepreneurial competencies (Kuratko, 2005; Pittaway & Cope, 2007). Skills such as creativity, problem-solving, leadership, and initiative are particularly difficult to assess using conventional tools focused primarily on theoretical knowledge (Gibb, 2002; Bacigalupo et al., 2016).

In response to these limitations, recent research highlights experiential approaches such as business creation projects or entrepreneurial simulations as more effective contexts for assessing such transversal skills in action. These pedagogical challenges open new opportunities to explore technological solutions capable of supporting personalized learning and contextualized assessment. In this context, artificial intelligence (AI) technologies, which are rapidly evolving, are beginning to profoundly transform several sectors, including education (Holmes et al., 2019; UNESCO, 2021). With their capabilities in big data analysis, natural language processing, and adaptive interactivity, AI systems enable the design of individualized learning pathways, more qualitative and contextual competency assessment, and remote project monitoring (Chen, & Lin, 2020; Zawacki-Richter et al., 2019).

These affordances are particularly relevant in the field of entrepreneurship education, where the targeted competencies are dynamic, transversal, and difficult to measure through traditional methods. Moreover, recent studies have emphasized the need to adapt entrepreneurial pedagogies to labor market transformations by promoting creativity, collaboration, autonomy, and flexibility (OECD, 2019; European Commission, 2018; Lackéus, 2020; Secundo et al., 2021). In this regard, cognitive technologies appear as promising levers for creating more experiential, collaborative, and digitally enhanced learning environments. However, the use of learner-generated digital data raises significant concerns about data protection especially in countries governed by strict legal frameworks such as the GDPR in Europe (Drachsler & Greller, 2016). Therefore, several scholars call for a reasoned and ethically guided integration of digital technologies in entrepreneurship education to maximize pedagogical benefits while ensuring transparency and informed consent.

Despite this growing interest, few studies have explored how higher education instructors perceive the integration of AI into entrepreneurship education, nor what individual, institutional, or pedagogical factors influence their adoption of such tools. This gap in the literature calls for an in-depth analysis of teachers'

perceptions, beliefs, and practices regarding these innovations. Accordingly, this study aims to explore how higher education instructors perceive innovative entrepreneurship pedagogies incorporating AI and to identify the key factors that shape these perceptions and their translation into teaching practices. A qualitative methodology is employed to gain a nuanced understanding of these dynamics. The research is guided by the following questions:

- How do instructors perceive the integration of artificial intelligence into entrepreneurship education?
- What individual, institutional, and pedagogical factors influence the adoption or rejection of such technologies?

The goal is to inform the design of more adaptive, innovative, and learner-centered entrepreneurship education frameworks that meet the evolving needs of 21st-century learners.

2. Literature review

The interest in technology-supported pedagogical practices for entrepreneurship education is not a recent phenomenon. As early as the 1980s, foundational work laid the groundwork for this field. Hägg & Kurczewska (2021) underscored the potential of digital tools in entrepreneurship teaching, while Vesper & McMullan (1988) explored the use of computer-based business games to provide students with experiential learning opportunities. In more recent years, Tseng et al. (2023) examined the integration of online platforms into entrepreneurship pedagogy, signaling a continued and evolving interest in the use of digital tools to cultivate entrepreneurial mindsets among learners. This line of research has steadily gained traction, as reflected in the growing attention it receives in contemporary literature (UNESCO, 2021). Technological advances, particularly in artificial intelligence (AI), have opened new possibilities for enhancing both the quality and personalization of learning experiences. Several studies (Tseng et al., 2023; Bachy, 2021; Kuratko, 2005; European Commission, 2018) have highlighted the promise of digital tools for entrepreneurship education.

Recently, Sitaridis & Kitsios (2023) emphasized that digital entrepreneurship (DE) education is emerging as a distinct research field that demands updated pedagogical models, better alignment with digital entrepreneurial ecosystems, and the integration of new conceptual frameworks. They argue that the growing

interdisciplinarity of DE often outpaces current instructional designs, creating a gap between required digital skills and existing educational practices. Their proposed four-dimensional framework (pedagogy, success factors/barriers, behavioral approaches, and ecosystems) provides a valuable roadmap for rethinking educational interventions in light of digital transformation. However, most existing research has primarily focused on descriptive or exploratory analyses, often lacking a robust theoretical framework for explaining educators' actual adoption behaviors. Moreover, there is limited empirical evidence on the factors influencing teachers' acceptance of AI-driven technologies, especially in higher education contexts. This is consistent with findings from other educational settings, such as the study by Sivanganam et al. (2025) on Malaysian ESL teachers' perceptions of AI. Their research revealed generally positive attitudes towards AI integration, coupled with significant uncertainty stemming from limited experience and training. Teachers perceived AI as useful and moderately easy to apply but lacked full confidence in its use. Such insights highlight the importance of considering teachers' perceptions and the need for targeted support and capacity building to foster effective AI adoption across diverse educational contexts.

To address this theoretical and empirical gap, our study draws on the Unified Theory of Acceptance and Use of Technology (UTAUT), developed by Venkatesh et al. (2003). Widely applied in the field of technology adoption, the UTAUT model offers a comprehensive framework for analyzing user intentions and behaviors. It identifies four core constructs performance expectancy, effort expectancy, social influence, and facilitating conditions that influence behavioral intention, which in turn predicts actual usage. Additionally, it introduces four moderating variables (gender, age, experience, and voluntariness of use) that account for individual differences in the adoption process. These features make the model particularly suitable for examining how higher education educators perceive and integrate AI-based tools in entrepreneurship teaching.

2.1. The UTAUT model in entrepreneurial education

Building on its widespread application in technology acceptance research, the UTAUT model provides a particularly useful lens for examining the specific dynamics of digital tool adoption in educational contexts. Figure 1 illustrates the relationships in the UTAUT model, clearly distinguishing between explanatory

variables, mediators, and outcomes. In the context of entrepreneurial education, this model is particularly relevant to understanding educators' perceptions regarding the integration of digital tools especially AI-based ones and the factors influencing their intention to adopt such technologies in their teaching.

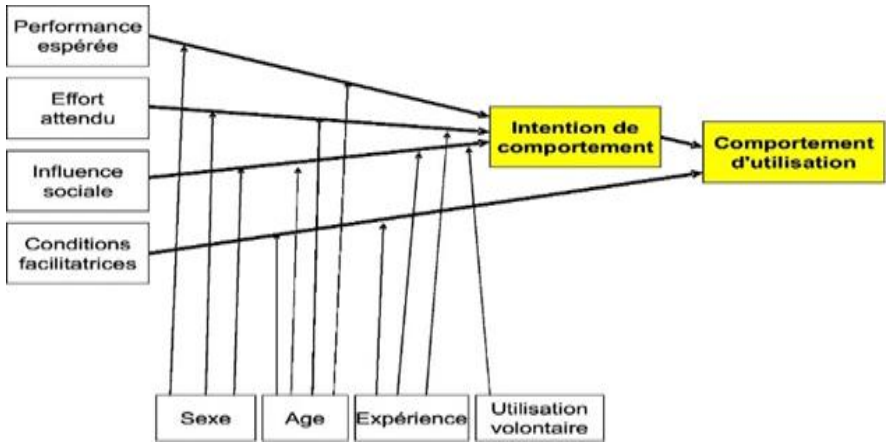

Figure 1. UTAUT Model (2003), proposed by Venkatesh et al. (2003).

This model provides a robust theoretical framework for analyzing factors influencing technology adoption across various contexts, especially in education. It identifies four key independent variables performance expectancy, effort expectancy, social influence, and facilitating conditions that shape behavioral intention, which in turn directly affects actual usage. The four moderating variables (gender, age, experience, voluntariness of use) influence the strength of these relationships.

2.1.1. The UTAUT model in entrepreneurial education

Performance expectancy

Performance expectancy refers to the degree to which an individual believes that using a particular technology will enhance their job performance. In the context of higher education, this dimension reflects teachers' perceptions of how artificial intelligence tools can support their pedagogical objectives, improve student engagement, or enable more effective assessment of entrepreneurial skills. A high level of performance expectancy is generally associated with a stronger intention to adopt and integrate the technology into one's teaching practices. Sivanganam

et al. (2025) showed that teachers perceive AI as useful in supporting their teaching activities, although their confidence in applying it effectively is often limited by lack of experience.

Effort expectancy

Effort expectancy refers to the perceived ease of learning and using technologies. This factor is crucial in the acceptance of digital tools by educators, especially for complex technologies such as artificial intelligence. A recent study by Chen & Zhang (2023) revealed that teachers often perceive AI tools as requiring significant effort in terms of time, training, and technical understanding, which can hinder their adoption. This perception is further amplified by concerns related to academic integrity and the impact of AI on critical thinking. Similarly, Sivanganam et al. (2025) found that teachers' limited experience and training in AI contributes to uncertainty and moderate confidence in its use.

Social influence

This dimension refers to the weight that users give to the opinions of their social environment (peers, management, institution). In educational settings, organizational culture, leadership support, and the example set by colleagues greatly influence decisions to adopt technology. Teo (2009) demonstrated that teachers' acceptance of educational technologies is often linked to the implicit or explicit expectations of their professional environment. Therefore, normative pressures must be taken into account.

Facilitating conditions

This factor pertains to the perception of the availability of technical resources, support, and training necessary for effective technology use. In the case of artificial intelligence, this involves providing appropriate tools, access to digital infrastructure, and ongoing technical support. Tondeur et al. (2017) developed a framework to assess teachers' digital competencies, highlighting the availability of resources and organizational support as essential conditions for successful integration. The need for adequate support and training echoes findings by Sitaridis & Kitsios (2023), who argue that digital entrepreneurship education

requires updated pedagogical models and institutional alignment to effectively incorporate emerging technologies like AI.

2.1.2. Key moderating variables in the UTAUT model

The UTAUT model highlights several moderating variables age, gender, professional experience, and voluntariness of use that influence the relationships between the core factors (performance expectancy, effort expectancy, social influence, facilitating conditions) and intention or actual use of a technology.

Age

Age is arguably one of the most influential moderators. Literature shows younger teachers generally possess stronger digital literacy and are more receptive to integrating technology into their teaching. Tondeur et al. (2017) found a significant negative correlation between teacher age and mastery of essential 21st-century digital competencies. Fraillon et al. (2014) similarly reported younger teachers' superior readiness for digital tools. These differences partly stem from less exposure among older teachers (Vekiri, 2010). Pedagogical beliefs also evolve with age; younger teachers tend to favor student-centered approaches and are more open to educational innovations including AI (Ertmer et al., 2012; Tondeur et al., 2017), while more traditional educators may resist these tools.

Gender

Gender has also been explored as a moderating factor. While sometimes less pronounced than age effects, research suggests gender differences influence perceptions of usefulness, trust in digital tools, and motivation to integrate them (Ong & Lai, 2006). Female teachers, for example, sometimes experience higher technology-related anxiety, though this decreases with growing digital competence. These nuances impact how male and female teachers perceive effort expectancy and social influence regarding AI adoption.

Professional Experience

Professional experience, often correlated with age but also reflecting exposure frequency to technologies, influences adoption behaviors. More experienced teachers may resist tools perceived as disruptive to established routines, such as

AI. However, extensive experience combined with progressive pedagogical values can encourage experimentation, as noted by Baek et al. (2008) and Ottenbreit-Leftwich et al. (2010), who underscore the role of individual beliefs and career trajectories in acceptance.

Institutional Context

Lastly, institutional context plays a crucial moderating role. Perrotta (2013) demonstrated that teachers in well-equipped, innovation-promoting institutions tend to have more positive attitudes toward technology use. Organizational support, training, and techno pedagogical policies can amplify or mitigate the effects of other variables. Similarly, Rüth et al. (2022) showed that teachers' digital skills and pedagogical values significantly impact adoption of digital educational games, a concrete AI application.

2.2. Critical evaluation and research

While the literature reviewed is comprehensive and provides strong theoretical grounding, it remains somewhat fragmented, with scattered thematic organization and limited critical evaluation of existing studies. Notably, few studies systematically explore the interplay of UTAUT variables in the specific context of AI-based tools for entrepreneurship education. Moreover, the moderating effects of individual and institutional factors require deeper empirical investigation, particularly in diverse educational settings. Our research addresses these gaps by offering a holistic, theory-driven analysis of entrepreneurship educators' perceptions and adoption behaviors regarding AI tools, incorporating the full spectrum of UTAUT dimensions and moderators. By doing so, it contributes to advancing understanding of technology acceptance in innovative educational contexts and informs targeted strategies for effective AI integration.

3. Methodology

This study adopts a qualitative-dominant mixed-methods design, guided by the need to capture educators' subjective representations while enabling some generalization through a relatively broad participant base. To answer the research questions regarding educators' perceptions and the determinants of AI adoption in entrepreneurial education, the following methodological framework was

adopted. The overall design is anchored in Grounded Theory principles (Glaser & Strauss, 1967; Charmaz, 2006), which support the emergence of categories from the data itself. While inductive in spirit, the study uses the UTAUT model as an initial deductive framework to guide analysis, enabling a theoretical enrichment grounded in participant discourse.

3.1. Research design

The methodological approach combines qualitative exploration (semi-structured interviews) with descriptive quantification of recurrent themes. This choice was made to ensure both the depth of interpretation and a certain comparability of perceptions across participants. The study does not introduce a new method but adapts established qualitative techniques to the context of AI integration in entrepreneurship education. This alignment of method with the research objective ensures both contextual relevance and theoretical robustness.

3.2. Population and sampling

The target population includes 147 entrepreneurship educators (79 women, 68 men), aged between 30 and 55, with teaching experience ranging from 1 to 15 years. The sampling strategy is non-probabilistic and purposive, aiming for heterogeneity in gender, age, and professional experience to enhance the richness of responses and facilitate theoretical saturation (Strauss & Corbin, 1998). Participants were selected based on professional diversity, ensuring a representative range of teaching profiles in entrepreneurship, and to maximize the variation of cases, thereby reinforcing the transferability of findings.

3.3. Data collection

Data were collected through semi-structured, face-to-face interviews conducted on-site in participants' institutions, with each session lasting an average of 50 minutes. A theory-informed interview guide was designed, structured around the five core dimensions of the UTAUT model: performance expectancy, effort expectancy, social influence, facilitating conditions, and perceptions of AI in entrepreneurship pedagogy. The guide included open-ended questions to encourage spontaneous expression of views, as well as targeted closed questions

to facilitate cross-case comparisons. All interviews were audio-recorded with participants' informed consent, ensuring both ethical integrity and data accuracy, and then fully transcribed for subsequent analysis.

3.4. Data processing and analysis

The data analysis followed a Grounded Theory-inspired approach and was conducted using Sonal software for qualitative coding. The process unfolded in three main steps: open coding, involving a line-by-line identification of meaning units; axial coding, which consisted of grouping these codes into sub-themes and broader categories; and thematic cross-analysis, where the emergent categories were mapped onto the predefined UTAUT dimensions, while remaining open to the emergence of additional constructs. This stepwise approach ensured that findings were both grounded in the data and theoretically coherent. This iterative process continued until data saturation was reached. In parallel, descriptive statistical analyses were performed to quantify the frequency of key perceptions and to identify general patterns across participants' responses, thereby reinforcing the interpretation of qualitative findings.

3.5. Ethical considerations

All participants were informed of the study's purpose and voluntarily consented to participate. Anonymity, voluntary participation, and data confidentiality were rigorously respected throughout, in accordance with ethical research standards.

4. Results

This study, adopting a mixed-methods approach, primarily draws on an in-depth qualitative analysis of interviews with teachers to explore their beliefs, motivations, and reservations regarding artificial intelligence (AI) in educational settings, especially within entrepreneurship education. Complementary quantitative data from a supplementary questionnaire are used descriptively to illustrate general trends without claiming exhaustive quantification.

4.1. Performance expectancy

A marked contrast appears between younger teachers (under 45) and their older colleagues. Younger educators view AI as a promising opportunity for pedagogical

innovation, notably through interactive tools like augmented reality and serious games. For instance, a 34-year-old teacher remarks, "With AI, I see the possibility of making lessons more dynamic, like with augmented reality or educational games. Students immediately engage." In contrast, several senior teachers express concerns over the potential dehumanization of teaching. A 52-year-old female teacher explains, "What worries me is that AI might replace human contact. Teaching is also about feeling, adjusting, listening. A machine cannot do that." This apprehension extends beyond fear of dehumanization; some express anxiety over a loss of professional identity, feeling gradually supplanted by automated tools. Questionnaire data confirm this polarization: 110 teachers under 45 favor AI use, highlighting stimulating tools, whereas 37 older teachers express reservations, fearing diminished human interaction.

Professional seniority also influences attitudes. Early-career teachers (less than 4 years' experience) are notably receptive to digital tools, approaching AI with openness and flexibility, as one states, "I don't have a fixed method yet, so trying AI tools feels natural to me. I mainly see it as help." Conversely, teachers with over 15 years of experience tend to be cautious, emphasizing the effectiveness of traditional methods and noting the lack of institutional support for confident AI integration: "It took me years to build my courses. Redoing all that with AI, without proper training? It would be too time-consuming and perhaps not so beneficial." Some experienced teachers also report feelings of alienation, perceiving AI as a threat to their expert and mentor roles, corroborated by questionnaire results showing that 87 novice teachers are enthusiastic about new technologies, while 60 senior teachers prefer established methods and fear the investment required for AI adoption.

Familiarity with digital technologies emerges as another critical factor. Teachers comfortable with digital tools perceive AI as a powerful lever for individualizing learning, while those with limited digital skills experience cognitive overload: "We are told about AI, but we haven't even mastered the basic tools yet. It's like building a house without foundations." Moreover, educators in scientific or technical fields generally show greater inclination to adopt AI, viewing it as an extension of their practice. A physics teacher notes, "In my courses, AI allows me to offer interactive simulations to students. It changes everything." In contrast, teachers in literature or arts express concerns about pedagogical standardization. Quantitative data support this dichotomy: 60% of teachers with advanced digital

skills (107 respondents) express enthusiasm and comfort with AI integration, while 40% with limited skills find AI demanding and complex. Additionally, 78% of teachers in scientific/technical disciplines are open to AI's benefits, whereas 22% of literary and artistic teachers fear standardization of pedagogy.

Regarding AI's educational potential, teachers generally recognize its capacity to personalize learning pathways, improve assessment of entrepreneurial skills, and offer individualized remote monitoring. Yet, several acknowledge a superficial understanding of AI's possibilities. For example, Professor 6 admits, "I do not have a precise idea of all the pedagogical opportunities offered by AI." Some, like Professor 3, worry about losing the richness of face-to-face human interaction: "There is a risk of neglecting the richness of human interactions in face-to-face settings." Conversely, others such as Professor 8 highlight positive aspects: "Serious games and adaptive MOOCs can truly energize learning in an engaging way, even outside the classroom." While MOOCs are not strictly AI in themselves, their combination with AI-powered tools such as adaptive learning systems and automated feedback offers promising avenues for scalable and personalized entrepreneurship education. Overall, teachers show openness but often lack critical distance on these emerging technologies, though a few pioneers already drive responsible pedagogical experimentation.

Table 1. Differences in performance expectancy by age, seniority, and digital skills

Analysis	Group	N	Mean	Std. Dev	Statistic	df	p-value
t-test – Age	30-44 years	110	4.25	0.56	t=3.45	145	0.001
	45-55 years	37	3.72	0.68			
Chi-square test – Seniority	1-4 years (AI acceptance)	87	-	-	χ^2=7.12	1	0.008
	15+ years (reservations)	60	-	-			
t-test – Digital Skills	Advanced	107	4.30	0.52	t=4.20	145	<0.001
	Limited	40	3.65	0.74			

Statistical results confirm a significant difference in the perception of performance expectancy according to age, seniority, and mastery of digital tools. Younger teachers, early-career educators, and those more comfortable with digital technologies show a more positive attitude toward integrating AI into their teaching practices (see Table 1)

4.2. Effort expectancy

The perceived complexity of AI usage varies widely. Digitally adept teachers tend to find AI intuitive, whereas others see it as opaque and difficult. Professor 10 comments, "There is a lack of simple tutorials and concrete examples. It feels like AI is reserved for experts." Resistance is also fueled by the perceived workload, with the time needed to rework materials, train, and reassess cited as barriers: "Integrating AI means redoing materials, training, reassessing... with no workload reduction, by the way." Beyond technical difficulties, feelings of marginalization or professional replacement add an emotional burden, making adaptation more challenging. Hence, effort expectancy is a critical factor, with teachers emphasizing the need for user-friendly tools and adequate support for effective adoption.

Table 2. Differences in effort expectancy by pedagogical approach and digital skills

Analysis	Group	N	Mean	Std. Dev	Statistic	df	p-value
t-test – Pedagogy Type	Active pedagogy	98	4.10	0.55	t=2.98	145	0.003
	Traditional approach	49	3.45	0.65			
t-test – Digital Skills	Advanced	107	3.90	0.60	t=4.12	145	<0.001
	Limited	40	3.10	0.75			

Questionnaire results show that 67% of teachers favoring active pedagogies see technologies as valuable for fostering engagement, critical thinking, and learner autonomy, while only 33% of those favoring traditional, transmissive approaches share this view. Despite challenges, all 147 surveyed teachers acknowledge AI's potential to energize learning in playful and interactive ways. Examples include Professor 1's "possibility of complex simulations and individualized scenarios," Teacher 5's vision of "analyzing data from students' social networks to better understand their learning paths," and Professor 147's suggestion to "use serious games to learn while having fun and expand one's network." Others, such as Professors 122 and 29, view MOOCs as means to engage new audiences. This collective creativity underscores teachers' enthusiasm for AI's interactive opportunities and points to fertile ground for responsible experimentation. It also highlights the importance of institutional support and recognition to harness this momentum and adapt solutions to local university contexts. Involving teachers in

co-constructing these innovations appears vital for successful AI integration in education.

Statistical analyses highlight that teachers favoring active pedagogies perceive the effort required to use AI as lower and the benefits as greater compared to those preferring traditional approaches. Digital skills also significantly affect this perception (see Table 2).

4.3. Facilitating conditions

The 147 teachers surveyed average 7 years of experience in entrepreneurship education, ranging from 2 to 15 years. They predominantly employ active pedagogies, including case studies, projects grounded in local economic contexts, and practical simulations. Teacher 26 notes, "I work extensively with regional cases involving local companies." Nonetheless, many cite a lack of resources as a significant barrier. Professor 33 laments, "The faculty's limited budget does not always allow experimenting with new tools," while Professor 4 identifies "resistance to change" as another obstacle. Professor 89 mentions "fear of the unknown" regarding digital innovations. Despite their expertise, teachers face structural constraints that limit innovation.

This tension between the desire to innovate and budgetary realities enhances interest in AI as a promising resource to revitalize pedagogy. Teachers advocate for supportive frameworks; for example, Professor 1 calls for "short, practical training sessions to understand opportunities before committing," and Teacher 109 urges "a multi-year development plan involving all stakeholders." Collaboration between experienced and hesitant teachers is viewed as crucial, as Professor 142 states, "Collective intelligence is the key to change." Teachers express strong interest in immersive educational technologies such as serious games, virtual and augmented reality, virtual assistants, and hybrid formats like MOOCs, which they see as concrete means to enrich entrepreneurship education, develop practical skills, personalize learning pathways, and promote autonomous, interactive learning. Social influence also plays a major role; peer perspectives and institutional attitudes strongly affect teachers' willingness to adopt innovations. Facilitating conditions including continuous training, technical support, progressive guidance, and access to dedicated resources are essential to trigger a collective dynamic. To overcome barriers related to professional identity loss, training and support must

emphasize teachers' unique roles by actively involving them in designing and integrating AI tools, thereby preserving their professional status while fostering innovation.

Overall, testimonies reveal a teaching community aware of challenges yet optimistic and forward-looking. Unlocking AI's educational potential will require aligning individual and collective efforts around a shared project adapted to local realities but open to experimentation.

Statistical analyses confirm that more experienced teachers perceive a greater lack of resources and institutional support as barriers to AI integration. A strong negative correlation indicates that lower perception of available resources increases resistance to change (see Table 3).

Table 3. Perception of resources as facilitating conditions by teaching experience

Analysis	Experience Group	N	Mean	Std. Dev	Statistic	df	p-value
C	1–5 years	45	3.80	0.60	F = 4.67	2, 144	0.011
	6–10 years	52	3.50	0.65			
	11–15 years	50	3.10	0.70			

5. Discussion

The analysis of data collected from the 147 surveyed teachers reveals several key findings regarding the integration of artificial intelligence (AI) in entrepreneurship education. These teachers perceive AI as a set of intelligent digital tools offering new possibilities for personalized support and learning pathways. Three main advantages emerge: personalization of educational pathways, enhanced interactivity, and increased learner motivation. These results align with previous studies highlighting the potential pedagogical benefits associated with the integration of AI in higher education (Luckin & Holmes, 2016; Popenici & Kerr, 2017).

However, this positive perception is accompanied by a caution regarding the risk of neglecting the relational dimension inherent in face-to-face interactions, thereby emphasizing the necessity of balancing human mediation with technological support. This concern echoes the literature advocating for an ethical and balanced approach to AI integration in education (Du Boulay, 2023). Moreover, several recurring barriers to the effective integration of AI have been identified, notably the lack of financial and material resources, as well as some

resistance to change within the teaching community. These obstacles underscore the critical importance of appropriate support and ongoing training for educational teams to facilitate the adoption of these emerging technologies. This is consistent with calls in the literature for strong institutional engagement to support innovation (Zawacki-Richter & Latchem, 2018; Popenici & Kerr, 2017).

This reflection invites us to consider deeper theoretical perspectives: AI's integration cannot be approached solely as a technological enhancement but must be framed within a broader pedagogical transformation. In particular, entrepreneurship education, rooted in experiential learning and local economic realities, requires careful alignment between digital innovation and real-world applicability. Current pedagogical practices reflect a community of experienced teachers, with an average seniority of seven years in entrepreneurship education, often engaged in active methods such as case studies and projects directly linked to the local economic environment. This finding is in line with earlier works that emphasize the value of experiential learning in entrepreneurship education (Luckin et al., 2016; Popenici & Kerr, 2017). This orientation toward learning by doing demonstrates a strong commitment to effectively preparing students for the professional world. However, these practices are frequently constrained by budgetary limitations and resistance to innovation, which hinder pedagogical renewal despite high teacher motivation. This paradox between innovation willingness and limited resources is also observed in international contexts, reinforcing the relevance of AI as a possible lever (Zawacki-Richter & Latchem, 2018).

Regarding knowledge and perception of AI tools, while their potential is broadly recognized, several teachers acknowledge a still superficial understanding of the concrete possibilities offered by these emerging technologies. This training gap generates reservations, notably related to concerns about the potential decline in the richness of face-to-face human interactions. This echoes studies showing that lack of familiarity with AI fosters reluctance among educators (Sivanganamet al. 2025). Nevertheless, some pioneers hold a broader vision of the possible benefits, citing, for example, serious games and adaptive MOOCs as levers likely to energize learning beyond the classroom. Thus, despite a clear openness, it appears necessary to support this community in a responsible and critical exploration of educational AI through appropriate training programs. In practical terms, the successful integration of AI will depend on political will and institutional

engagement to mobilize the necessary resources. This includes not only technical support but also the creation of co-development spaces where teachers can help design and adapt AI tools. Teachers' proposals show that integrating AI is not a passive adoption but an opportunity for co-innovation.

Beyond pedagogical effort, successful integration requires strong political will to mobilize the indispensable resources, combining human support and institutional backing to overcome resistance and fully exploit the educational potential of AI. Interest in the modalities of AI tool usage is also conditioned by the ease of their adoption and adequate support determinant factors for their uptake in educational contexts. Teachers demonstrate notable creativity in usage proposals, envisioning complex simulations, personalized data analyses, serious games, or MOOCs as means to make learning more playful, interactive, and tailored to students' needs. Such creative projections are consistent with international studies promoting participatory and student-centered AI tools (Karimov et al., 2024). In particular, several teachers emphasized that MOOCs enhanced by AI such as adaptive content sequencing, automatic grading, and real-time feedback could significantly increase learner engagement and allow for individualized learning paths. This imagination suggests fertile ground for innovative pedagogical experiments aligned with the promotion of ethical and qualitative use of emerging technologies. The integration of these tools, designed with the active participation of pioneering teachers, appears promising for developing solutions genuinely adapted to local realities and learner needs.

Regarding barriers and drivers for deployment, the lack of financial resources constitutes a major obstacle, limiting teachers' ability to experiment with new tools despite their motivation. Furthermore, resistance to change, fueled by fear of the unknown, underscores the need for gradual support and concrete training to facilitate the transition. Support from decision-makers, through the implementation of multi-year development plans and collective mobilization, is also perceived as a crucial lever. Collective intelligence, based on collaboration between pioneering and more resistant teachers, appears as an effective strategy to foster acceptance and overcome resistance. Moreover, social influence and the importance attributed to the opinions of peers and the institution reinforce the idea that facilitating conditions such as training, technical support, and resource allocation are essential for the adoption of pedagogical innovations.

From a methodological standpoint, this qualitative study faces certain limitations. The Tunisian context, where AI tools are still at an early stage of implementation, limited the opportunity to triangulate findings with student feedback or in-class observations. The perceptions gathered are more prospective than experiential. In addition, certain innovative digital practices are beginning to establish themselves in developed countries and show significant promise for entrepreneurship education. Serious games and virtual or augmented reality technologies allow students to immerse themselves in concrete entrepreneurial simulations, promoting practical skills such as decision-making and project management. These results confirm the findings of previous international studies (Casau et al., 2023; Sitaridis & Kitsios, 2023). Chatbots and virtual assistants offer personalized remote support, notably for business plan writing and student project monitoringas highlighted by Sitaridis, & Kitsios (2023) and Chinedu & Ade-Ibijola, (2021). Innovative formats such as MOOCs and flipped classrooms, supported by data analysis, encourage collaborative work and concrete projects, with benefits identified by Cisel (2014) and Gené et al. (2022). Mixed reality, combining virtual reality and connected objects, also opens promising pedagogical perspectives by simulating complex professional environments. Thus, the reasoned integration of AI in entrepreneurship education offers concrete prospects for personalizing learning and assessing complex entrepreneurial competencies. Achieving this requires methodical support, including the establishment of a continuous training network for teachers and online exchange communities. In the long term, the development of MOOCs and SPOCs integrating these technologies could promote more flexible and accessible learning aligned with contemporary pedagogical evolutions.

Another key factor highlighted by the analysis concerns the facilitating conditions necessary for the successful integration of artificial intelligence in entrepreneurship education. Teachers express widespread dissatisfaction with the absence of concrete institutional support, lamenting the lack of sufficient financial and pedagogical resources to train themselves or experiment with AI tools. This structural deficiency, coupled with the absence of formal digital competence development programs specifically targeting AI, fuels their apprehensions and hinders their engagement in innovative initiatives. Furthermore, the role of the organizational context appears crucial: the perceived disengagement of management, notably the lack of assertive leadership and a clear institutional

strategy, undermines the legitimacy of AI-related initiatives. Teachers are sensitive to the institutional signals sent by their hierarchies, and the lack of mobilization from decision-makers tends to reinforce a form of collective inertia. Such findings are consistent with literature stressing the key role of governance and leadership in supporting digital transformation (Zawacki-Richter & Latchem, 2018; Du Boulay, 2023).

With the widespread adoption of new technologies, the gradual integration of artificial intelligence (AI) in the educational sector raises numerous questions. Indeed, while its intelligent digital tools appear promising for personalizing and stimulating learning, their adoption poses the challenge of articulating them ethically and as a qualitative complement to human interactions. In this context, the present study aims to analyze the perceptions of 147 entrepreneurship teachers regarding the opportunities and challenges linked to the pedagogical integration of AI. The objective is to identify the most promising perspectives for innovatively and ethically revitalizing the teaching of this discipline through artificial intelligence. Moreover, this article has provided an in-depth analysis of the potential and challenges related to AI integration in entrepreneurship education. However, the effective deployment of these technologies in Tunisian universities faces significant difficulties, such as budgetary constraints and digital infrastructure issues previously highlighted by studies conducted in the country.

While the majority of teachers surveyed recognize the pedagogical value of certain AI tools, their widespread adoption will require substantial investments in the development of adapted content and the training of educational teams. It will therefore be essential to consider the local cultural context for the successful adoption of these technological innovations. Complementary research, similar to experiments conducted in other countries, will allow for a more thorough assessment of the alignment between AI's potential and the specific needs of the Tunisian entrepreneurial ecosystem.

This exploratory qualitative study lays the foundation for an emerging reflection on these promising topics for the future of higher education in Tunisia. Among the limitations of this study is the Tunisian context itself, where digital tools are not yet widely used in entrepreneurship education. This situation may have constituted a methodological constraint, limiting the possibility of triangulating data through classroom observations using these technologies or conducting focus groups with students. The more recent deployment of AI tools in the country thus did not allow

for collecting opinions based on concrete practical experience. It would be valuable to replicate this type of qualitative study in a few years to analyze the evolution of perceptions among Tunisian teachers and students regarding these new educational tools, whose integration still appears to be in its early stages in the country. This local context underscores the interest of conducting similar research in other geographic areas to assess the possible generalization of the results.

6. Conclusion

This study contributes significantly to understanding the perceptions of entrepreneurship teachers regarding the integration of artificial intelligence (AI) in education. It highlights a critical paradox between teachers' strong pedagogical expertise and motivation, and the structural constraints limiting innovation, such as budgetary restrictions and institutional support gaps. These insights enrich existing literature by emphasizing the necessity of balancing technological innovation with human mediation and ethical considerations in AI deployment.

Practically, the findings underscore the urgent need for tailored and continuous training programs, co-construction approaches involving teachers in AI tool design, and clear institutional strategies backed by sustained political will. Implementing multi-year development plans and fostering collective intelligence through collaboration between pioneering and resistant teachers appear essential for successful adoption.

For future research, this study opens avenues for longitudinal investigations to track the evolution of perceptions and practices around AI in entrepreneurship education. Exploring students' perspectives and conducting comparative studies across different cultural and institutional contexts will also deepen understanding and support the development of context-sensitive AI integration strategies.

Conflict of interest

The author declares that they have no conflict of interest.

ORCID

Marwa Belguith https://orcid.org/0009-0007-6562-2037

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