Entrepreneurship 4.0: Young learners' perspectives on traditional and techno-pedagogical approaches

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Abstract. This study examines how Moroccan university students ($n = 94$, aged 18–25) perceive traditional versus techno-pedagogical approaches to entrepreneurship education in the context of Entrepreneurship 4.0. A mixed-methods design combines a questionnaire with an exploratory workshop in which two groups ($n = 10$, $n = 12$) worked on the same entrepreneurial task under different pedagogical conditions, including a simulated technical breakdown for the digital group. Findings show a strong preference for techno-pedagogical approaches, valued for their interaction and engagement; traditional methods are seen as clearer in structure but less effective for innovation and autonomy. Both modalities face constraints: digital tools require infrastructure and teacher preparation; traditional methods struggle to develop practical and creative competencies. The results support a hybrid model that pairs the stability of conventional teaching with the interactivity of digital tools.

Keywords: Entrepreneurship 4.0, techno-pedagogical approaches, hybrid learning, entrepreneurship education

1. Introduction

Digital technologies are reshaping entrepreneurial practice. The rise of Entrepreneurship 4.0 – built on artificial intelligence (AI), the Internet of Things (IoT), robotics, virtual and augmented reality (VR/AR), and online learning environments – requires educational systems to prepare students for increasingly complex entrepreneurial contexts [22].

Techno-pedagogical approaches – the deliberate use of digital tools in the classroom to improve learning outcomes, engagement, and personalisation [17] – support entrepreneurial competencies such as creativity, critical thinking, autonomy, and problem-solving [15]. Implementation is constrained, however, by uneven infrastructure, limited teacher readiness, and unequal access to technology.

Understanding how young learners perceive these strategies against standard pedagogy is crucial for developing effective entrepreneurship education [13]. This study addresses two research questions:

1. How do young learners perceive traditional versus technological instructional methods?
2. To what extent do traditional and techno-pedagogical approaches support the development of entrepreneurial competencies such as innovation, autonomy, and problem-solving?

Three hypotheses guide the analysis: (H1) learners prefer traditional methods for their structure and familiarity [1]; (H2) learners find techno-pedagogical approaches more engaging and more relevant to digital entrepreneurship [20]; (H3) learners prefer a hybrid model that combines the strengths of both approaches [11].

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2. Definitions of key concepts

2.1. Entrepreneurship 4.0

Entrepreneurship is a foundational economic concept with evolving definitions. Classical economic theory describes the entrepreneur as an economic agent who bears market uncertainty [5], an innovator introducing disruptive change [21], or a change-exploiter [9]; contemporary work emphasises process and context [4, 12]. Entrepreneurship 4.0 is its current evolution, integrating AI, IoT, big data, cloud computing, and blockchain into entrepreneurial practice to support agility and innovation [6, 14].

2.2. The concept of innovation

Innovation is a key idea in the realm of entrepreneurship, serving as a catalyst for change, differentiation, and competitiveness. It can be defined as the successful implementation of new ideas, products, processes, or organizational models in a given setting with the goal of creating value. Schumpeter [21] was among the first to theorize the role of innovation in economic dynamics, arguing that development is based on "new combinations", thus developing the concept of creative destruction, in which innovation breaks current equilibria in order to generate new ones. This viewpoint regards the entrepreneur as a change agent and a catalyst for disruption.

More recently, the OECD/Eurostat [19] stressed that innovation has more than only technological dimensions; it also includes organizational, marketing, and social advances, widening its scope. In the context of Entrepreneurship 4.0, innovation is inextricably linked to the incorporation of digital technology and the entrepreneur's ability to harness data, automate processes, and customise client experiences. It thus becomes a cross-cutting competency required of entrepreneurial training programs, not only to encourage adaptation but also to cultivate a proactive position in the face of the complexity of modern surroundings [18].

2.3. Techno-pedagogical innovation and entrepreneurship: what is at stake?

Techno-pedagogical innovation integrates digital tools into teaching to improve efficacy, personalise learning, and increase engagement [20]. In entrepreneurship education, these tools support transversal abilities such as creativity, cooperation, critical thinking, and autonomy [13], and virtual learning environments, digital simulations, and collaborative platforms provide practice-oriented experience that mirrors entrepreneurial realities [8]. Implementation is constrained, however, by infrastructure, teacher training, and accessibility [15, 16], and successful adoption depends on institutional readiness and stakeholder engagement [3].

3. Methodology

This research employed a mixed-methods design, combining a questionnaire survey with a pedagogical experiment in order to analyse learners' preferences and to evaluate the comparative effectiveness of different approaches to entrepreneurship education.

3.1. Data collection and analysis

A questionnaire was administered to one hundred participants, ninety-four of whom responded. Quantitative data were analysed with descriptive statistics (frequencies and percentages). Given the exploratory single-institution sample ($n = 94$), inferential tests are not reported; findings are interpreted as patterns rather than as evidence of population-level effects.

3.2. Experimental workshop design

A four-hour workshop was then conducted, dividing learners into two groups:

Group 1 based on printed materials and lecture-style delivery;

Group 2 incorporating interactive digital tools such as collaborative online documents, creative platforms, and web-based resources.

The 4-hour total comprised 3.5 hours of group work and 30 minutes for the final presentation (see table 5). The duration was selected to enable participants to complete a full entrepreneurial task cycle (idea generation, project design, and presentation) while avoiding excessive fatigue.

3.3. Planned technical breakdown

To assess the robustness of the pedagogical approaches, a deliberate technical breakdown was introduced in Group 2 (temporary loss of access to digital tools). This intervention had two primary objectives:

1. To evaluate learners' ability to sustain engagement and problem-solve under conditions of disruption, an essential entrepreneurial competency.
2. To compare the resilience of traditional versus techno-pedagogical modalities when confronted with real-world uncertainties.

4. Study results

Four tables summarise the questionnaire results: sample characteristics (table 1), perceptions of traditional methods (table 2), use and perceptions of innovative methods (table 3), and stated preferences and perceived competencies (table 4). Table 5 compares the experimental workshop's two groups.

Table 1
Sample characteristics ($n = 94$).

Characteristic	Category	Frequency	Percentage (%)
Gender	Female	63	67.0
Age	18–25 years	52	55.3
Education level	High school to 2-year degree	66	70.2

Table 2
Perceptions of traditional pedagogical methods ($n = 94$).

Variable	Frequency (n)	Percentage (%)
Lecture satisfaction	59	62.8
Effectiveness of presentations	64	68.1
Assessment adequacy	49	52.1

4.1. Questionnaire results

Among the 94 respondents, lecture-based instruction (62.8%) and presentations (68.1%) were valued, but only 52.1% considered conventional assessments adequate. Innovative methods were used infrequently (19.1%), yet learners reported high engagement with serious games (52.1%),

Table 3
Use and perceptions of innovative methods ($n = 94$).

Variable	Frequency (n)	Percentage (%)
Frequent use	18	19.1
Serious games Engagement	49	52.1
Flipped classroom effectiveness	66	70.2
Technological flexibility	72	76.6
Online collaboration	37	39.4

Table 4
Preferences and perceived competencies ($n = 94$).

Variable	Frequency (n)	Percentage (%)
Sufficient autonomy	37	39.4
Entrepreneurship adaptation	62	66.0
Increased involvement	64	68.1
Desire for creation	71	75.5

Table 5
Exploratory workshop: traditional vs. techno-pedagogical approaches in entrepreneurial training.

Analysis criteria	Group 1: Traditional methods	Group 2: Innovative techno-pedagogical approaches
Number of participants	10 participants	12 participants
Learners' profile	Youth in entrepreneurial training	Youth in entrepreneurial training
Workshop duration	3.5 hours of work + 30-minute presentation	3.5 hours of work + 30-minute presentation
Pedagogical tools	Paper and pens; printed project sheets; paper boards	Google Docs; Canva; Miro; web resources
Support modalities	Lecture-based delivery; oral instructions; no digital support	Interactive support; Internet access; technical support
Output format	Oral presentation; paper handouts; whiteboard support	Digital slideshow; concept map; video pitch
Observed results	Structured content; conventional ideas; limited dynamics	Impactful visuals; original ideas; collaboration

flipped classrooms (70.2%), and digital flexibility (76.6%); online collaboration was rated less favourably (39.4%). Stated preferences skewed toward greater involvement (68.1%) and project creation (75.5%), consistent with a desire for autonomy and creative application.

4.2. Workshop observations

The workshop comparing traditional pedagogical methods (Group 1) and techno-pedagogical approaches (Group 2) shows a marked difference in learning experience. Group 1 used tangible, traditional instruments (paper, project sheets, and boards), along with lecture-based delivery and verbal instructions. This delivery style ensured content clarity but constrained autonomy and inventiveness. In contrast, Group 2 worked in a multi-tool digital environment that included Google Docs, Canva, Miro, web-based resources, and Kahoot for interactive quizzes. These tools allowed for interactive facilitation, immediate access to materials, and real-time formative feedback.

The output formats also demonstrate this divergence. G1 was limited to an oral presentation with accompanying paper materials; G2 created digital slideshows, idea maps, and video pitches that demonstrated creativity, teamwork, and the capacity to visually enhance projects.

This planned technical breakdown produced distinct outcomes. In the techno-pedagogical group, the simulated loss of access to digital tools initially disrupted the workflow, but participants reorganised their tasks, redistributed roles, and sustained collaboration. This response suggests adaptability and problem-solving in conditions of uncertainty, consistent with a thin-slice reading of organisational resilience [24]. The active-learning structure of the digital environment supported adaptation during the disruption and helped sustain engagement [2].

The traditional group was not directly affected by the technical breakdown, since its activities relied on paper-based materials and verbal instructions. The group produced more conventional outputs and showed less interaction during the workshop, an observation consistent with self-determination theory's claim that autonomy and interaction sustain intrinsic motivation [7], and with cognitive load theory's claim that rigid instructional formats can increase extraneous load on complex tasks [23].

These observations suggest that techno-pedagogical approaches can support resilience and adaptability when learners are assisted by flexible digital practices.

The questionnaire data show a consistent pattern between the method learners perceived as best adapted to contemporary entrepreneurship and the method they reported as more engaging. Of the 94 respondents, 76.6% rated digital flexibility positively (table 3) and 68.1% reported increased involvement with innovative methods (table 4). A similar pattern appeared between the method perceived as best adapted to contemporary entrepreneurship and the method reported as most likely to stimulate real project creation, with 75.5% expressing a desire for creation (table 4). The convergence across these three items, all skewed toward the innovative end of the response scale, supports H2 and H3, with H1 (preference for traditional methods for structure) appearing only on the lecture-satisfaction item (62.8%, table 2).

5. Discussion

5.1. Toward a hybrid approach

The questionnaire and workshop converge on the same conclusion: traditional and innovative teaching methods are complementary rather than competing in this study. Traditional methods are valued for clarity and structure (62.8% lecture satisfaction, table 2); innovative methods are valued for engagement and adaptability (76.6% digital flexibility, 70.2% flipped-classroom effectiveness, table 3). Neither modality alone, however, satisfies the full range of entrepreneurial competencies the participants identify as important: autonomy, creativity, and problem-solving (table 4).

The findings align with the technological pedagogical content knowledge (TPACK) framework [17], which holds that effective technology integration emerges from the interaction of technological, pedagogical, and content knowledge rather than from the addition of digital tools to existing instruction. The hybrid model observed in this study can be read as such an interaction: lecture-based delivery provides content knowledge, the workshop design provides pedagogical structure, and the digital tools provide technological affordances. The hybrid is therefore not a compromise but a coherent instructional design.

In line with the DigCompEdu framework for educator digital competence [20], equipping teachers with the skills to design, deliver, and reflect on hybrid instruction is a prerequisite for the model observed here. The framework's Area 3 (Teaching and Learning) and Area 5 (Empowering Learners) most directly support the kind of structured-but-flexible pedagogy this study describes. Without deliberate teacher preparation, hybrid instruction tends to collapse into either fully traditional lectures with appended digital tools, or fully student-led exploration with no scaffolding; neither of these alternatives was evaluated favourably by the participants.

All three hypotheses are supported. H1 (learners prefer traditional methods for structure and familiarity) is supported by the 62.8% lecture-satisfaction rating (table 2). H2 (learners find techno-pedagogical approaches more engaging and more relevant to digital entrepreneurship) is supported by the high ratings for flipped learning (70.2%) and digital flexibility (76.6%, table 3). H3 (learners

prefer a hybrid model) is supported by the simultaneous high preferences for involvement (68.1%) and creation (75.5%, table 4), reinforced by the workshop's qualitative findings.

Future directions

Three lines of further work are warranted. First, the present single-institution sample ($n = 94$ for the questionnaire; $n = 22$ for the workshop) limits generalisability; a multi-institution replication across Moroccan universities and beyond would test the external validity of the hybrid-model finding. Second, the workshop tested only a 4-hour intervention; longitudinal designs that follow learners through a full entrepreneurship programme would clarify whether the stated intentions translate into observed venture-creation behaviour. Third, the simulated technical breakdown was a single event; studying how learners adapt to recurring disruptions of different types would help identify the conditions under which digital and traditional pedagogies support or undermine each other.

5.2. Practical implications for educators and curriculum designers

Hybrid instructional designs should be intentionally structured rather than assembled as a default combination of digital and traditional elements. Practical guidance for educators includes: (i) align each digital tool with a specific entrepreneurial learning outcome (e.g., Miro for idea mapping, Canva for visual communication, Google Docs for collaborative drafting); (ii) preserve a structured lecture component to maintain content clarity; (iii) schedule controlled disruptions or problem-based scenarios to cultivate adaptability; and (iv) support teacher professional development so that the integration of digital tools is purposeful rather than decorative. Programme directors should allocate instructional time for hybrid design and provide technical support during the transition.

5.3. Limitations of the study

The study has four main limitations. First, the questionnaire sample ($n = 94$) is drawn from a single Moroccan institution, which restricts the generalisability of the percentage findings to other universities and to other national education systems. Second, the reliance on self-assessment introduces social-desirability and interpretation biases; participants may have overstated their preference for innovative methods, which would inflate the percentages in tables 3 and 4. Third, the workshop group sizes (10 vs. 12) were small and unequal; the slightly larger techno-pedagogical group may have facilitated richer collaboration, confounding the comparison. Future studies should consider longer or repeated workshops with balanced group sizes. Fourth, the workshop context, although useful for the controlled technical breakdown, does not reproduce the time pressures and resource constraints of real-world entrepreneurship training; the adaptability the digital group showed may not transfer to authentic settings such as incubators, entrepreneurship courses, or start-up programmes.

6. Conclusion

This study asked how Moroccan university students ($n = 94$) perceive traditional and techno-pedagogical approaches to entrepreneurship education. Three findings stand out.

Finding 1. Learners value structure but want more interactivity than traditional methods alone provide. Lecture-based delivery and presentations remain highly rated (62.8% and 68.1%, table 2), but conventional assessments are seen as adequate by only 52.1% of respondents.

Finding 2. Techno-pedagogical methods are perceived as more aligned with contemporary entrepreneurship than traditional methods, with the questionnaire items on digital flexibility (76.6%), flipped-classroom effectiveness (70.2%), and intention to create (75.5%) all skewed toward the innovative end. The workshop, including a simulated technical breakdown, showed that participants in the digital group could reorganise their work and maintain collaboration when their primary tools were disrupted.

Finding 3. The strongest support in the data is for a hybrid model that combines the strengths of both approaches. The percentages for engagement, autonomy, and creation preferences exceed those for either pure modality, and the workshop observations reinforce this. The hybrid approach also addresses the modality-preference diversity that learners bring to entrepreneurship education [10], since participants who prefer visual or collaborative modes engage more with the digital workshop tasks while participants who prefer structured reading engage more with the lecture-based materials.

The next step is a longitudinal study that pairs the current survey with venture-initiation tracking over 12–24 months, to test whether the stated intentions translate into observed entrepreneurial behaviour. Teacher preparation in the DigCompEdu Areas 3 and 5 – Teaching and Learning, and Empowering Learners – is the practical lever for making such a model work in practice [20].

Data availability statement

Due to ethical and privacy restrictions related to participant confidentiality, the dataset is not publicly available. However, anonymized data may be provided upon reasonable request.

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