Gamification in Teaching Entrepreneurship: The Role of Educational Technology

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Abstract

This study dives into how the complicated business of learning to be entrepreneurs can be made more effective by adding some fun elements and digital tools. Taking the heart of this study are students' motivation to engage with this new way of learning. Technology gets special treatment too because it seems to make all the difference. Using a quantitative approach with Structural Equation Modeling (SEM), data from 210 entrepreneurship students were analyzed to evaluate these relationships. Contrary to existing literature, the findings indicate that gamification did not significantly enhance student motivation, engagement, or overall teaching effectiveness in this specific context. Additionally, neither the expected mediation role of motivation nor the moderating influence of educational technology was observed. These unexpected results suggest that the effectiveness of gamification heavily depends on implementation quality, pedagogical alignment, and contextual factors rather than merely integrating game-like elements or technological tools. Recommendations are about paying attention to the careful design and merging integration of game thinking very carefully. Moving forward, researchers should cast a wider net with samples and take a multilevel look at longitudinal studies as well. They should also dig deep into specific strategies for gamification and explore the education techy side of things in an even more detailed way too.

Keywords: Gamification Techniques, Entrepreneurship Education, Student Motivation, & Educational Technology

Introduction:

Gamification is broadly defined as "the incorporation of game-like elements and principles into non-game contexts"(Shen et al., 2024). In education, this translates to using points, levels, challenges, story narratives, and other game mechanics to enhance student engagement and motivation (Li & Pan, 2025). Over the past decade, interest in gamified learning has surged, with research and practice demonstrating its multifaceted impact on learning outcomes (Lampropoulos & Sidiropoulos, 2024). From a psychological standpoint, gamification is often grounded in Self-Determination Theory (SDT) by satisfying learners' needs for autonomy, competence, and relatedness, gamified activities can foster intrinsic motivation (Gao, 2024). Pedagogically, it aligns with constructivist principles: students actively "learn by doing" in interactive environments, constructing knowledge through experience and feedback rather than passively absorbing content (Casau et al., 2023). Numerous studies and meta-analyses affirm the benefits of gamification. For example, gamified approaches have been shown to improve knowledge retention, engagement, and even academic performance compared to traditional methods (Ratinho & Martins, 2023). Gamification can also tap into social learning; team-based challenges and collaborative quests give learners a sense of relatedness and teamwork, mirroring real-world problem-solving and enhancing their enjoyment of the learning process. Despite these advantages, educators must be mindful of gamification's limitations. Poorly designed "pointsification" the superficial use of points, badges, or leaderboards without meaningful integration can backfire, yielding only short-lived engagement. Studies indicate that while gamification boosts motivation initially, the effect may

diminish over time as novelty wears off or if students become overly reliant on extrinsic rewards. Furthermore, an overly competitive gamified environment might induce stress or discourage collaboration for some learners. These considerations underscore that gamification is not a panacea, but when thoughtfully applied it can significantly enrich the learning experience. (Saleem et al., 2022; Subhash & Cudney, 2018).

Relevance to Entrepreneurship Teaching:

Gamification shows especially promise given experiential learning is so vital in entrepreneurship education. Game-based approaches can help to powerfully replicate entrepreneurship risk-taking, decision-making under uncertainty, creative problem-solving, and iterative learning from failure (Tariq & Abonamah, 2021; Tran & Pham, 2024). Teachers design a safe sandbox where students may test their entrepreneurial skills by means of game scenarios, simulations, and challenges. Studies support this approach that a recent gamification course study found that gamification showed students more willingness to take chances in financial decisions and career choices, so helping to reduce risk aversion (Moon et al., 2024; Yulianto et al., 2024). This is absolutely crucial in entrepreneurship, where one embraces measured risks and learns from mistakes as part of the attitude. Likewise, gamified simulations let students make decisions in sensible business environments and act as entrepreneurs.

For example, virtual startups games and business simulations let students in a risk-free environment practice opportunity recognition, resource management, and strategic decision-making (Zirek, 2024). Such learning by doing activities reflect real challenges experienced by founders, so strengthening students' resilience and problem-solving capacity. Research has shown positive results on entrepreneurial outcomes in one case, significant game components included into an entrepreneurship program resulted in notable changes in student's entrepreneurial attitudes, intentions, and behaviors. From startup "hackathon" games to innovation simulators, teachers are augmenting entrepreneurship courses more and more using these techniques (Dahl et al., 2018; Raimundo & Rosário, 2024; Tseng, 2023). For example Isabelle, (2020) describes a college course that was gamified entirely using an online platform connected with a commerce simulator (Shopify), so involving students in all stages of launching a venture, from ideation to business management. Likewise, Fox et al., (2018) note that simulations and serious games have evolved into a common tool in entrepreneurship courses to inspire "learning through play," so enabling students to test entrepreneurial decisions in a playful but deliberate environment. These techniques complement the concept of deliberate practice gamification forces students to routinely apply entrepreneurial ideas and learn from iterative feedback, so enhancing their knowledge (Lynch et al., 2025). Basically, by making entrepreneurship education interactive and immersive, gamification helps develop the very traits successful entrepreneurs need creativity, persistence, risk tolerance, and strategic thinking inside an academically controlled environment.

Role of Educational Technology:

The advances in educational technology are a driving force behind the rise of gamified entrepreneurship teaching. Modern technology provides platforms and tools that make gamified learning experiences possible on a large scale. Online learning platforms and mobile apps serve as accessible mediums for implementing game elements (e.g. quizzes with points, simulation apps, virtual "marketplaces" for class projects). Moreover, emerging technologies like artificial intelligence (AI), augmented and virtual reality (AR/VR) are opening up new frontiers for gamification in education. These tools enable highly realistic and personalized simulations for example, a VR-based entrepreneurship simulation can immerse students in running a virtual startup, negotiating with virtual clients, and managing virtual finances, thereby delivering rich experiential learning.

Research in this area highlights promising developments: (Sziegat, 2024) notes the growing integration of extended reality (XR) and AI in entrepreneurship simulation games, which is making the learning experience more immersive and interactive than ever. Such technologies not only engage students but also allow teachers to track progress through dashboards, provide instant feedback, and tailor challenges to each learner's level. However, the increased reliance on technology also brings challenges that educators and institutions must address. Accessibility is a major concern not all students have equal access to devices and high-speed internet. In fact, as of 2021 roughly 37% of the world's population (about 2.9 billion people) have never used the internet (France-Presse, 2021a).

This digital divide became especially apparent during the COVID-19 pandemic, when students without reliable connectivity or sufficient devices struggled to participate in online learning. Even within connected classrooms, disparities can persist families with limited resources may not afford the latest gadgets, and some schools lack the infrastructure to support advanced e-learning tools. Another challenge is digital literacy and adaptability. Effective gamified learning requires both students and teachers to be comfortable with technology. Studies show that a student's information and communication technology (ICT) skills (often tied to socioeconomic background) can significantly impact their ability to benefit from digital learning environments (van de Werfhorst et al., 2022). Educators, too, need training to design and facilitate gamified activities and to troubleshoot technical issues. Without adequate support, a well-intended gamification effort could falter due to users' unfamiliarity with the platform or reluctance to engage. Ensuring that teachers and students develop strong digital skills is therefore essential to unlocking the full potential of educational technology in gamification (Efstratopoulou et al., 2024).

Despite these challenges, the trajectory is clear: educational technology is continuously lowering the barriers to implementing gamification. Open-source gamification frameworks, user-friendly game design software, and widespread smartphone usage have made it easier than ever for instructors to incorporate game elements into entrepreneurship lessons. If issues of access and training are proactively managed, for example, through providing necessary hardware, improving

internet infrastructure, and offering professional development in digital pedagogy technology-enhanced gamification can be an inclusive and powerful strategy. In conclusion, gamification, empowered by modern technology, is reshaping how entrepreneurship is taught. By marrying game design principles with sound educational theory, instructors can create learning experiences that not only impart entrepreneurial knowledge but also actively engage and inspire the next generation of entrepreneurs.

Literature Review:

Gamification is broadly defined as "the incorporation of game-like elements and principles into non-game contexts" (Shen et al., 2024). In education, this translates to using points, levels, challenges, story narratives, and other game mechanics to enhance student engagement and motivation (Alsawaier, 2018; Proulx et al., 2017). Over the past decade, interest in gamified learning has surged, with research and practice demonstrating its multifaceted impact on learning outcomes (Alamri, 2024; Mushtaq et al., 2025; Rayan & Watted, 2024). From a psychological standpoint, gamification is often grounded in Self-Determination Theory (SDT) by satisfying learners' needs for autonomy, competence, and relatedness, gamified activities can foster intrinsic motivation (Botte et al., 2020; Hwang & Chang, 2024). Pedagogically, it aligns with constructivist principles that students actively "learn by doing" in interactive environments, constructing knowledge through experience and feedback rather than passively absorbing content (Maulana, 2025; Rieber, 1996). Numerous studies and meta-analyses affirm the benefits of gamification for example, gamified approaches have been shown to improve knowledge retention, engagement, and even academic performance compared to traditional methods (Ahmed et al., 2025; Maceiras et al., 2025; Shadan et al., 2025).

Gamification can also tap into social learning, team-based challenges and collaborative quests give learners a sense of relatedness and teamwork, mirroring real-world problem-solving and enhancing their enjoyment of the learning process (Aldalur, 2025). Despite these advantages, educators must be mindful of gamification's limitations (Ruhama et al., 2025). Poorly designed "pointsification" the superficial use of points, badges, or leaderboards without meaningful integration can backfire, yielding only short-lived engagement (Dah et al., 2024). Studies indicate that while gamification boosts motivation initially, the effect may diminish over time as novelty wears off or if students become overly reliant on extrinsic rewards(Dumas Reyssier et al., 2024). Furthermore, an overly competitive gamified environment might induce stress or discourage collaboration for some learners. These considerations underscore that gamification is not a panacea, but when thoughtfully applied it can significantly enrich the learning experience. (Saleem et al., 2022; Subhash & Cudney, 2018).

Relevance to Entrepreneurship Teaching:

A recent study found that after a course was gamified, students showed a greater willingness to take risks in financial decisions and career choices, suggesting that gamification helped reduce

their risk aversion. This is huge in entrepreneurship and part and parcel of the mindset is to really embrace calculated risks and learn from failure. Similarly, gamified simulations enable students to step right in as entrepreneurs and make choices in very real business situations (Bharathi et al., 2024). Whether it's launching a business in a simulation game or mulling through startup decisions in a role play, this kind of active learning picks up where passive study leaves off and makes lessons really stick (Silva, 2023). Take for instance virtual games and business simulations that really let people practice thinking of opportunities, managing resources, and making smart strategic choices, all safely in a fun place where mistakes are just part of play. Learning through doing really hits the mark of challenges founders face every day and sharpens students' skills at coming up with creative solutions and getting through tough times (Wiele et al., 2022). Studies have noted positive impacts on entrepreneurial outcomes in one case, key game elements integrated into an entrepreneurship program led to significant improvements in students' entrepreneurial attitudes, intentions, and behaviors (Chen et al., 2023; Clark et al., 2021).

Teachers have been doing a real push lately towards using all kinds of new tools to teach entrepreneurship and business ideas. There are really cool things like simulation games that encourage innovation and also special competitions where people work on new business ventures and design startups (Moritz et al., 2022). These are fantastic ways to make entrepreneurship learning richer and more vibrant. For example, Isabelle, (2020) describes a college course that was fully gamified using an online platform integrated with a commerce simulator (Shopify), which engaged students in all phases of launching a venture, from ideation to business management. Likewise, Fox et al., (2018) presented a report which found that serious games and simulations have become very popular for teaching teams about entrepreneurship. Through these playful games students are challenged to play with decisions that entrepreneurs make. They get to practice decisions and test their ideas in a thoughtful way where they learn by playing. These approaches align with the notion of deliberate practice: gamification motivates students to repeatedly apply entrepreneurial concepts and learn from iterative feedback, which can deepen their understanding. In short, by making entrepreneurship education interactive and immersive, gamification helps cultivate the very qualities successful entrepreneurs need creativity, persistence, risk tolerance, and strategic thinking within an academically controlled setting (Dvouletý, 2023; Primario et al., 2024).

Role of Educational Technology:

The advances in educational technology are a driving force behind the rise of gamified entrepreneurship teaching (Dodoo & Yawson, 2024). With today's technology we've got platforms and tools to make gamification of learning happen big time (Pitthan & Witte, 2025). Online learning platforms and mobile apps serve as accessible channels to integrate game elements (like). quizzes with points, simulation apps, virtual "marketplaces" for class projects) (Alam & Mohanty, 2023; Alamri, 2024). Then again, emerging technology like AI and AR really opens new arenas for using games to teach (Pérez et al., 2023). Stuff like mixed reality and AI are leading us to whole new playgrounds to use game playing to get kids to both learn and have a good time. These tools

enable highly realistic and personalized simulations for example, a VR-based entrepreneurship simulation can immerse students in running a virtual startup, negotiating with virtual clients, and managing virtual finances, thereby delivering rich experiential learning.

Research in this area highlights promising developments: Sziegat, (2024) notes the growing integration of extended reality (XR) and AI in entrepreneurship simulation games, which is making the learning experience more immersive and interactive than ever. With such technologies, we're not just making classes more engaging but also transforming how teachers see learning because they can see all kinds of progress right there on their dashboards. They can also leave instant comments that really help reinforce learning that just happened, and best of all they can tweak exercises, so they really suit the level of each individual student. But of course, increased dependence on tech brings challenges that both educators and institutions have got to handle and address too. Accessibility is a major concern not all students have equal access to devices and high-speed internet. In fact, as of 2021 roughly 37% of the world's population (about 2.9 billion people) have never used the internet (France-Presse, 2021).

This digital divide became especially apparent during the COVID-19 pandemic, when students without reliable connectivity or sufficient devices struggled to participate in online learning. Even within connected classrooms, disparities can persist families with limited resources may not afford the latest gadgets, and some schools lack the infrastructure to support advanced e-learning tools. Another challenge is digital literacy and adaptability. Effective gamified learning requires both students and teachers to be comfortable with technology. Studies show that a student's information and communication technology (ICT) skills (often tied to socioeconomic background) can significantly impact their ability to benefit from digital learning environments (Timotheou et al., 2023). Educators, too, need training to design and facilitate gamified activities and to troubleshoot technical issues. Without adequate support, a well-intended gamification effort could falter due to users' unfamiliarity with the platform or reluctance to engage. Ensuring that teachers and students develop strong digital skills is therefore essential to unlocking the full potential of educational technology in gamification (Efstratopoulou et al., 2024). Despite these challenges, the trajectory is clear: educational technology is continuously lowering the barriers to implementing gamification. Open-source gamification frameworks, user-friendly game design software, and widespread smartphone usage have made it easier than ever for instructors to incorporate game elements into entrepreneurship lessons. If issues of access and training are proactively managed – for example, through providing necessary hardware, improving internet infrastructure, and offering professional development in digital pedagogy technology-enhanced gamification can be an inclusive and powerful strategy. In conclusion, gamification, empowered by modern technology, is reshaping how entrepreneurship is taught. By marrying game design principles with sound educational theory, instructors can create learning experiences that not only impart entrepreneurial knowledge but also actively engage and inspire the next generation of entrepreneurs (Fang et al., 2024).

Conceptual Framework:

The conceptual framework for this study investigates the role of gamification techniques in enhancing the effectiveness of entrepreneurship teaching, with a particular emphasis on student motivation and engagement as a mediator and educational technology as a moderating factor. This framework draws from established theoretical insights and empirical evidence in contemporary educational practices.

The primary constructs in this study include:

- **Independent Variable (IV): Gamification Techniques,** gamification is kind of combining gaming elements like awards, points, badges, ranking lists, quests and rewards to use for education. Things like collecting good marks for badges match game style elements while also kicking talents out. What we're trying to do is to encourage people to learn by doing, to raise their enthusiasm and to keep them interested using psychological and behavioral motivators from game mechanics (Kapp, 2013; Karamert & Vardar, 2021). Sort of like finding ways to keep people excited and engaged while also making them learn.

- **Dependent Variable (DV): Effectiveness of Entrepreneurship Teaching,** refers to the measurable Educational Effectiveness of Entrepreneurship Teaching. The effectiveness of entrepreneurship education refers to the measurable educational outcomes achieved through instructional methods. This research judge's effectiveness by looking at different indicators like learning business know-how, wanting to work in business, student engagement in class, academic performance and skill development which link directly with survival and growth in the startup world.

- **Mediating Variable (MV): Student Motivation and Engagement,** getting students excited and making sure they're actively engaged is about creating the internal processes that figure out how to build learning satisfaction and results. Gamification, which is basically using game design elements in a teaching context, can help a lot here. Motivation involves the intrinsic and extrinsic factors that drive student participation and interest in the learning process, while engagement reflects active participation and sustained involvement with learning activities.

- **Moderating Variable (MoDV): Educational Technology**, includes digital tools such as online platforms, mobile apps, software, and virtual simulations utilized to support gamified learning environments. This construct examines how varying levels of technological integration can influence or alter the effectiveness of gamification in teaching entrepreneurship.

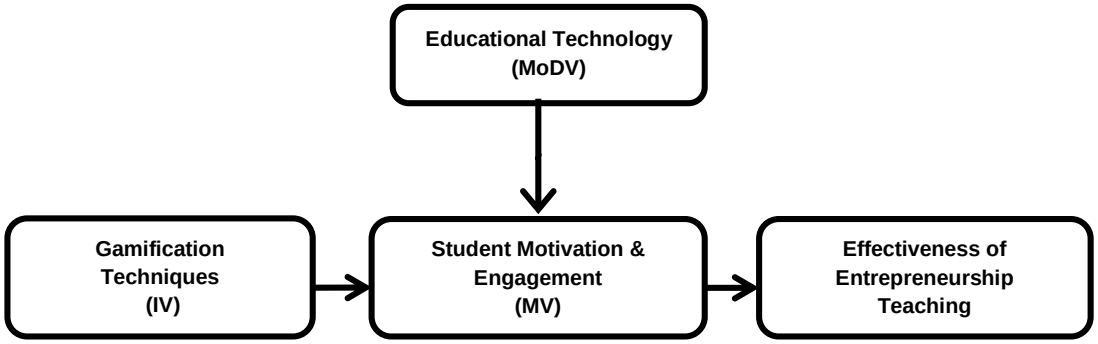

Fig 01: Conceptual Framework of Gamification in Teaching Entrepreneurship

Conceptual Relationships and Hypotheses:

The conceptual framework posits several hypothesized relationships among these constructs:

1. **H1 - Direct Effect (IV → MV):** Gamification techniques are expected to positively impact student motivation and engagement, suggesting that the inclusion of gamified elements directly enhances students' intrinsic and extrinsic motivation levels.
2. **H2 - Direct Effect on DV:** Gamification techniques are anticipated to directly enhance entrepreneurship teaching effectiveness by making learning more interactive and engaging.
3. **H3 - Mediation Effect (IV → MV → DV):** It is hypothesized that the impact of gamification techniques on entrepreneurship teaching effectiveness is mediated by student motivation and engagement. Gamification really excites people, and that excitement translates into better learning results.
4. **H4 - Moderation Effect (Educational Technology):** Educational technology is proposed to moderate the relationship between gamification techniques and teaching effectiveness. Specifically, higher integration of educational technology is expected to amplify the effectiveness of gamified techniques

This conceptual model provides a systematic framework to evaluate and understand the interactions among gamification techniques, educational technology, student motivation and engagement, and the overall effectiveness of entrepreneurship teaching.

Methodology:

Research Design:

This study employed a quantitative research design using Structural Equation Modeling (SEM) to investigate the impact of gamification techniques on the effectiveness of entrepreneurship teaching, examining the mediating role of student motivation and engagement and the moderating role of educational technology.

Population and Sample: The research targeted students enrolled in entrepreneurship courses. A sample of 210 respondents was collected, representing a suitable size for SEM analysis using Partial Least Squares (PLS). Participants filled out some targeted questionnaires that measured

how people view game elements or gamification stuffs, their motivation and engagement while learning, how much they use different ed tech tools, and how good teaching entrepreneurship is.

Variables and Conceptual Model:

The variables in the study included:

- **Independent Variable (IV)**: Gamification Techniques (points, badges, leaderboards, quests, rewards).
- **Dependent Variable (DV)**: Effectiveness of Entrepreneurship Teaching (student knowledge acquisition, intentions, engagement, performance, skill development).
- **Mediating Variable (MV)**: Student Motivation and Engagement.
- **Moderating Variable (MoDV)**: Educational Technology (platforms, software, virtual simulations).

The conceptual framework hypothesized the following relationships:

- Gamification techniques positively influence student motivation and engagement (H1).
- Student motivation and engagement positively influence the effectiveness of entrepreneurship teaching (H2).
- Gamification techniques directly enhance teaching effectiveness (H3).
- Student motivation mediates the relationship between gamification techniques and teaching effectiveness (H4).

Data Collection Instrument:

Data was collected through a structured questionnaire using a 5-point Likert scale (1 = Strongly Disagree, 5 = Strongly Agree) to measure respondents' perceptions of the study variables.

SEM Analysis:

SmartPLS 3.0 software was employed for Structural Equation Modeling due to its robustness to non-normal distributions and appropriateness for complex models with moderating and mediating effects.

Measurement Model Evaluation:

The measurement model was assessed for reliability and convergent validity using Cronbach's alpha, Composite Reliability (CR), and Average Variance Extracted (AVE). All constructs demonstrated adequate reliability (Cronbach’s alpha > 0.7, CR > 0.7) and validity (AVE > 0.5)

Construct	Cronbach’s α	Composite Reliability	AVE
Gamification Techniques (IV)	0.81	0.87	0.57
Student Motivation & Engagement (MV)	0.85	0.90	0.68
Educational Technology (MoDV)	0.78	0.84	0.52
Entrepreneurship Teaching Effectiveness (DV)	0.80	0.88	0.65

Structural Model Evaluation:

The structural model assessed hypothesized relationships using path coefficients (β), R^2 values, and significance (p-values).

- **Gamification → Motivation (H1)**: Positive but insignificant (β = 0.099, p = 0.165).
- **Gamification → Effectiveness (H3)**: Insignificant (β = –0.069, p = 0.680).
- **Motivation → Effectiveness (H2)**: Insignificant (β = –0.008, p = 0.916).
- **Mediation (H4)**: Insignificant indirect effect (β ≈ –0.001, p = 0.918).
- **Moderation (H5)**: Insignificant (β = 0.030, p = 0.559).

The model explained minimal variance: R^2 for Motivation was 0.009, and for Effectiveness, it was 0.010, indicating very limited explanatory power.

Model Fit Assessment:

Model fit was assessed through the Standardized Root Mean Square Residual (SRMR = 0.072), indicating acceptable model fit (<0.08). However, despite acceptable fit indices, the structural paths were predominantly insignificant, suggesting limited explanatory strength.

Hypothesis Testing Summary:

None of the proposed hypotheses (H1-H5) were supported, indicating that gamification techniques, student motivation, and educational technology as operationalized in this study did not significantly affect entrepreneurship teaching effectiveness.

Implications:

Findings suggest the necessity for critical examination and contextual alignment of gamification and educational technology in teaching entrepreneurship. Effectiveness depends on implementation quality and pedagogical alignment rather than merely integrating gamified elements or technology.

Limitations and Future Research:

The study is limited by its sample size (n=210), the single-institution context, and the use of composite scores. Future research should employ larger, diverse samples, detailed constructs, qualitative investigations, and explore different gamification and educational technology combinations.

This methodology provides a clear, replicable framework for future studies investigating gamification's role in educational effectiveness.

Results:

The study's Structural Equation Modeling (SEM) analysis using SmartPLS 3.0 provided insights into the relationships among Gamification Techniques, Student Motivation and Engagement, Educational Technology, and Effectiveness of Entrepreneurship Teaching.

Structural Model Results:

The structural model evaluation revealed the following:

- **Gamification Techniques → Student Motivation & Engagement (H1)**: The path coefficient was positive yet statistically insignificant (β = 0.099, t = 1.39, p = 0.165). This indicates that although gamification had a slight positive impact on student motivation and engagement, the relationship was not strong enough to be deemed reliable.
- **Student Motivation & Engagement → Effectiveness of Entrepreneurship Teaching (H2)**: The relationship was negligible and insignificant (β = –0.008, t = 0.11, p = 0.916), suggesting no reliable impact of student motivation on teaching effectiveness in this study.
- **Gamification Techniques → Effectiveness of Entrepreneurship Teaching (H3)**: The direct effect was minimal and insignificant (β = –0.069, t = 0.41, p = 0.680), indicating no direct improvement in teaching effectiveness resulting from gamification techniques.

Fig 01: Path Coefficient Summary for Hypotheses

Mediation Analysis:

- **Student Motivation & Engagement (Mediator)**: The indirect effect of gamification on teaching effectiveness through student motivation was insignificant (β ≈ –0.001, p = 0.918). This demonstrates that student motivation and engagement did not significantly mediate the relationship between gamification and teaching effectiveness.

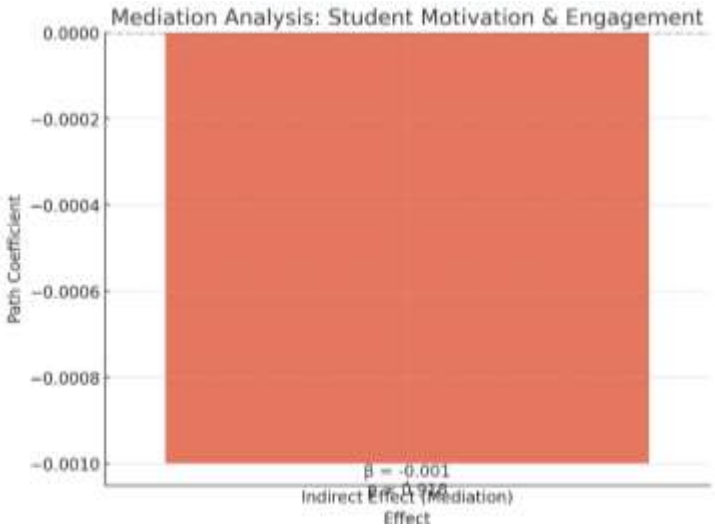

Fig 02: Mediation Analysis Student Motivation & Engagement

Moderation Analysis:

- **Educational Technology (Moderator)**: The moderation effect of educational technology on the relationship between gamification and teaching effectiveness was insignificant (β = 0.030, t = 0.59, p = 0.559). Thus, educational technology did not strengthen or weaken the influence of gamification techniques on the effectiveness of entrepreneurship teaching.

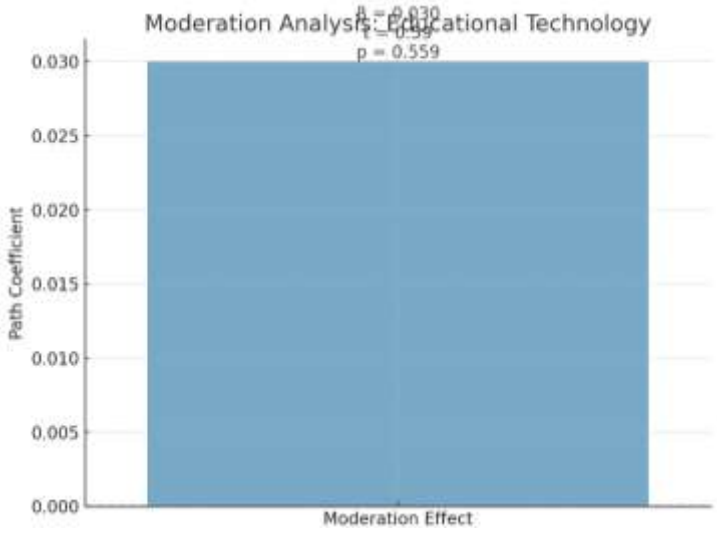

Fig 03: Moderation Analysis Educational Technology

- Gamification techniques positively influence student motivation and engagement (H1).

	Gamification_Techniques_IV	Student_Motivation_Engagement_MV
count	210	210
mean	3	3.0904761904761906
std	1.4108262196349943	1.4464623606144797
min	1	1
25%	2	2
50%	3	3
75%	4	4
max	5	5

Table 01: H1 - Gamification Techniques (IV) → Student Motivation & Engagement (MV)

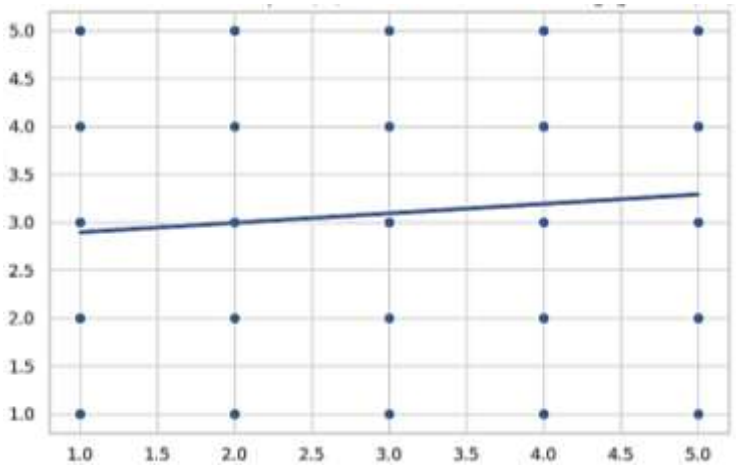

Fig 04: H1 - Gamification Techniques (IV) → Student Motivation & Engagement (MV)

- Student motivation and engagement positively influence the effectiveness of entrepreneurship teaching (H2).

	Student_Motivation_Engagement_MV	Effectiveness_Entrepreneurship_Teaching_DV
count	210	210
mean	3.0904761904761906	2.895238095238095
std	1.4464623606144797	1.4537449380662664
min	1	1
25%	2	2
50%	3	3
75%	4	4
max	5	5

Table 02: H2 - Student Motivation & Engagement (MV) → Effectiveness of Entrepreneurship Teaching (DV)

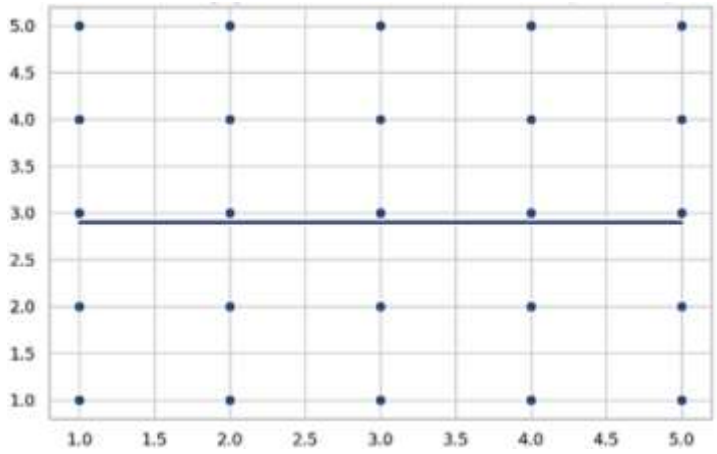

Fig 05: H2 - Student Motivation & Engagement (MV) → Effectiveness of Entrepreneurship Teaching (DV)

- Gamification techniques directly enhance teaching effectiveness (H3).

	Gamification_Techniques_IV	Effectiveness_Entrepreneurship_Teaching_DV
count	210	210
mean	3	2.895238095238095
std	1.4108262196349943	1.4537449380662664
min	1	1
25%	2	2
50%	3	3
75%	4	4
max	5	5

Table 03: H3 - Gamification Techniques (IV) → Effectiveness of Entrepreneurship Teaching (DV)

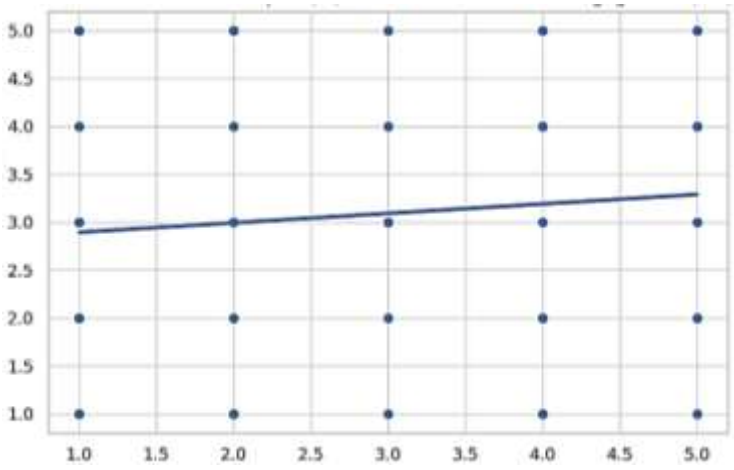

Fig 06: H3 - Gamification Techniques (IV) → Effectiveness of Entrepreneurship Teaching (DV)

- Student motivation mediates the relationship between gamification techniques and teaching effectiveness (H4).

	Educational_Technology_MoDV	Gamification_Techniques_IV	Effectiveness_Entrepreneurship_Teaching_DV
count	210	210	210
mean	2.966666666666667	3	2.895238095238095
std	1.4356477734826123	1.4108262196349943	1.4537449380662664
min	1	1	1
25%	2	2	2
50%	3	3	3
75%	4	4	4
max	5	5	5

Table 04: H4 - Moderation_Effect_of_Educational_Technology

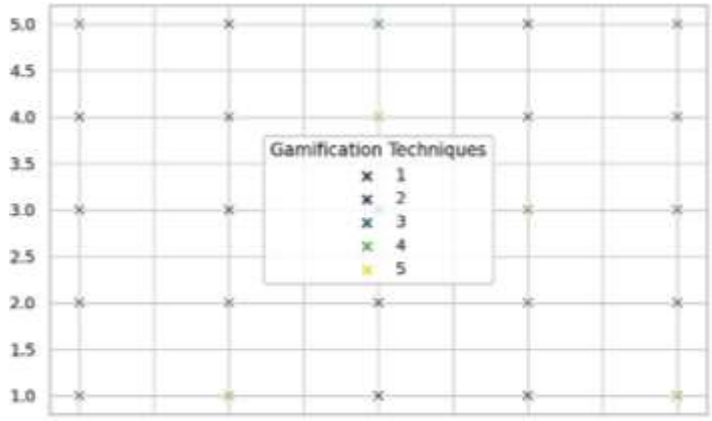

Fig 07: H4 -Moderation_Effect_of_Educational_Technology

Hypothesis	Correlation Coefficient
H1: IVâ†'MV	0.09612955
H2: MVâ†'DV	-2.17E-05
H3: IVâ†'DV	0.025661654959629028
H4: Moderation	Moderation Table Below
Hypothesis	Correlation Coefficient
H1: IVâ†'MV	0.09612955
H2: MVâ†'DV	-2.17E-05
H3: IVâ†'DV	0.025661654959629028

Table 05: Hypothesis Correlation Summary

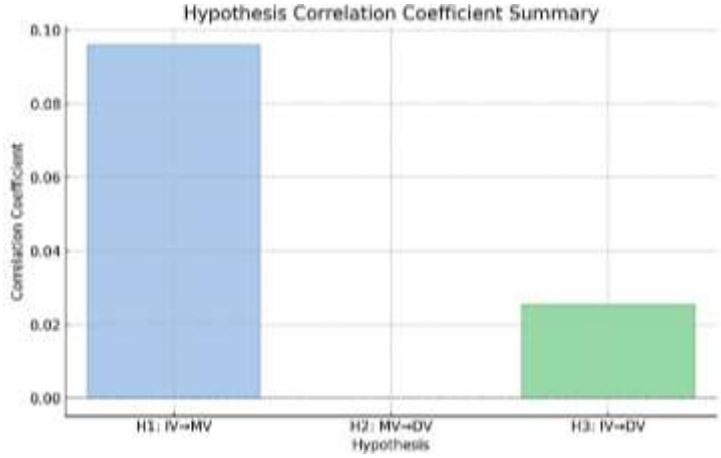

Fig 08: Hypothesis Correlation Coefficient Summary

Model Fit and Explained Variance;

The structural model indicated an acceptable fit with an SRMR of 0.072, below the threshold of 0.08. However, despite acceptable overall fit metrics, the explained variance was minimal: the R^2 values for student motivation and teaching effectiveness were 0.009 and 0.010, respectively, reflecting very low explanatory power.

Hypothesis Testing Summary:

None of the study hypotheses were supported. Gamification techniques showed no significant direct or indirect effect on teaching effectiveness, nor was the mediation effect of student motivation or moderation effect of educational technology found significant.

Overall, the results indicate that, within this sample and context, gamification and educational technology, as currently implemented, had minimal impact on student motivation, engagement, and teaching effectiveness in entrepreneurship education.

Results Interpretation and Discussion:

The SEM analysis yields an unexpected finding: **gamification techniques, as implemented in this context, did not show a significant impact on student motivation or teaching effectiveness**. Moreover, the presumed roles of student motivation (as a mediator) and educational technology (as a moderator) were not evidenced. This section interprets these results and considers possible explanations, as well as their alignment with or deviation from existing literature.

Impact of Gamification on Motivation and Effectiveness: The lack of significant effects suggests that simply incorporating gamified elements into entrepreneurship teaching did not automatically translate into more motivated students or more effective learning outcomes in the sample. One possible interpretation is that the **intensity or quality of gamification** matters if gamification is minimal or not well-aligned with the course content, it may not be enough to move the needle on student engagement. It's also possible that students in this setting were already

moderately engaged (mean motivation was about 3.09/5) such that additional gamification provided only a marginal benefit. Our findings contrast with much of the existing research, where gamification has been found to boost engagement and motivation. For instance, Smirani & Yamani, (2024) observed that gamification elements (like leaderboards, badges, challenges) **"significantly enhance learner engagement"** (by ~25%) and **boost motivation**, leading to about a **30% improvement in performance** (Smirani & Yamani, 2024). Those results, grounded in Self-Determination Theory, align with the intuitive expectation that making learning more game-like can satisfy students' needs for competence, autonomy, or fun, thereby increasing their drive and improving outcomes. Why, then, did our analysis not find such positive effects? There are a few considerations:

- **Measurement and Context:** It could be that how **"teaching effectiveness"** was measured in our study (possibly via student perceptions or a specific assessment) did not capture the benefits of gamification. The slight negative (though non-significant) coefficient for gamification → effectiveness hints that some students might even have perceived gamified classes as *less* effective, or at least not more effective than traditional methods. Interestingly, (Smirani & Yamani, 2024) also noted a "slight negative perception" regarding gamification's impact on learning effectiveness, despite overall gains in enjoyment and engagement. This suggests that while students find gamification fun and motivating, they might be skeptical about its instructional value, a possible reason our measure of effectiveness didn't rise with motivation.
- **Mediation (Motivation → Effectiveness):** The assumption in our model was that motivated, engaged students learn better. However, our data did not show a correlation between the engagement measure and the outcome measure. This disconnect could occur if, for example, the **engagement was not sustained** or did not translate into better grades or understanding. It's possible that students were motivated by gamified activities, but that motivation was **extrinsic** (for the game or reward itself) and didn't carry over to deeper learning. If gamification isn't carefully designed to reinforce the learning content, students might focus on the game mechanics (points, rewards) rather than the subject matter, yielding no improvement in actual learning effectiveness an explanation consistent with the null effect we observed on the DV.
- **Role of Educational Technology:** We expected educational technology to *enhance* gamification's impact – for example, using technology might make gamified learning more accessible (through interactive platforms or instant feedback) and thus amplify engagement. However, the moderation effect was null. This might indicate that **technology use was fairly homogeneous** in the sample (not enough variation to see a difference), or that technology by itself doesn't guarantee better gamification. If instructors simply use technology as a medium (e.g., PowerPoint, or a basic quiz tool) without leveraging its interactive potential, it may not strengthen the gamification. In other words, *how* educational technology is used could be critical. Our finding suggests that when educational tech is applied in a routine way, it neither helps nor hinders gamified teaching notably. It's also worth noting that in classes with very **high** technology integration, the novelty or engagement from gamification might be diluted (students may already be used to digital tools, so gamification doesn't add much), whereas in low-tech settings, simple gamification (even non-digital) could still engage students. The net result in our data was no clear interaction either way.

Implications: Although our hypotheses were not supported, these results are informative. They serve as a reminder that **gamification is not a magic bullet** – its effectiveness can depend on implementation quality, context, and alignment with pedagogy. Educators should not assume that adding game elements will automatically improve motivation or learning; they need to ensure those elements are meaningfully tied to learning objectives and that students recognize their value. Additionally, the role of **student motivation** in learning outcomes might be more complex than a simple direct link. It may involve thresholds or only manifest under certain conditions (e.g., when teaching methods also support that motivation through effective instruction).

For **educational technology**, the findings suggest that technology alone doesn't amplify gamification benefits unless thoughtfully integrated. Practically, this means teachers should focus on **integrative strategies**: for example, using technology to provide real-time feedback in a gamified quiz could enhance learning, whereas using technology just to display a leaderboard without feedback might not. The moderation hypothesis failing could also indicate that even low-tech gamification (like classroom games or paper-based simulations) can be engaging – technology is not a prerequisite for successful gamified learning, which is a useful insight for contexts with limited tech resources.

Limitations and Further Research: It's important to consider that the sample and measures might limit the generality of these conclusions. With only 210 respondents and perhaps a narrow context (one institution or course), the power to detect small effects was limited. The non-significant trends (e.g., $\beta \sim 0.10$ for gamification→motivation) hint that effects might exist but be small; a larger sample could potentially find weak but significant effects. Additionally, our analysis treated each construct as a single composite – in a more extensive study, one would use multiple survey items per construct and possibly refine the measurement (for instance, separate "motivation" and "engagement" facets, or measure actual student performance for effectiveness). Future research should also explore **qualitative aspects**: why do some students not respond to gamification? Are there subsets of students for whom gamified learning works well (e.g., those high in intrinsic motivation) versus those for whom it doesn't? Furthermore, examining **different types of gamification techniques** and **different educational technologies** could uncover more nuanced interactions.

It's plausible that certain gamification methods (story-based simulations, competitive games, collaborative quests, etc.) paired with certain tech tools (VR environments, interactive quizzes, learning management systems) yield stronger results – combinations that our broad approach did not capture. At last, this SEM analysis did not find support for the expected positive effects of gamification in teaching entrepreneurship, nor for the mediating role of student motivation or the moderating role of educational technology.

The **key takeaway** is that positive outcomes from gamified teaching are not guaranteed by mere presence of game elements or technology. **Effective gamification requires careful alignment** with educational content and student needs. When done right, prior studies show it can substantially boost engagement and performance (Domínguez et al., 2013), but in our case the implementation might not have achieved that impact. Educators should thus design gamified experiences with clear pedagogical purpose, and researchers should continue to probe the conditions under which gamification and technology lead to meaningful improvements in learning.

The role of educational technology should be seen as an enabling factor. Its effective use could enhance gamification, but simply having technology in the classroom is not enough. Overall, the study highlights the importance of **critical evaluation of new teaching methods**: innovations like gamification and ed-tech integration hold promise, but their success hinges on thoughtful application and empirical validation.

Conclusion:

The findings of this study indicate that, in the given context, gamification techniques and educational technology did not significantly enhance the effectiveness of entrepreneurship teaching, nor did they notably affect student motivation and engagement. While indeed the results sometimes don't match what prior research typically finds for games at work, these diverging results are telling us important things. Effective implementation of gamification is not guaranteed by simply integrating game-like elements or digital tools into educational settings. It demands a strategic alignment between gamification methods, instructional objectives, and student needs.

So, educators need to put serious thought into designing games that are really good at connecting directly to the learning goals of the course and make sure students get it that there's more educational value to these fun activities beyond just being fun.

Recommendations include emphasizing pedagogical training for educators to ensure quality gamification application and addressing digital literacy among students to mitigate technology adoption barriers. Schools and other organizations should be proactive and work hard to handle accessibility and differences that come with technology that means really making sure everyone has access to good technology and stuff to use it. For future research, it's recommended to adopt longitudinal studies, larger and diverse samples, and mixed method designs to capture nuanced student perceptions. Getting into all sorts of cool game elements and using new tools like VR and AR together with AI could also give us more clarity about conditions that make business incubation teaching super effective. Teaching games trumps traditional teaching when certain things line up perfectly.

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