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INNOVATOR'S RACE: EXAMINING THE IMPACT OF A GAMIFIED BOARD GAME ON ENGINEERING STUDENTS' LEARNING IN TECHNOLOGY ENTREPRENEURSHIP AND NEW PRODUCT DEVELOPMENT

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Abstract:

Teaching Technology Entrepreneurship and New Product Development (NPD) to engineering students is challenging due to the abstract, multidisciplinary, and process-oriented nature of the subject, which often limits engagement and meaningful learning in lecture-based delivery. This study examines the impact of Innovator's Race, a gamified board game developed as a teaching and learning innovation for ENT600 (Technology Entrepreneurship), designed to simulate the end-to-end entrepreneurship and NPD process in an interactive and learner-centred format. Using a quantitative approach, data were collected from 60 engineering students through a structured questionnaire. Descriptive statistics and reliability analyses were conducted using SPSS, followed by PLS-SEM to test a mechanism-based learning framework. The results show that gamified board game–based learning significantly enhances student engagement, conceptual understanding, entrepreneurial skill development, and learning motivation and confidence. However, mediation analysis indicates an indirect-only effect, whereby the impact of the gamified intervention on overall learning impact is transmitted exclusively through learning motivation and confidence rather than through direct instructional effects. The findings extend experiential learning research by demonstrating that gamified entrepreneurship education influences learning impact primarily through affective mechanisms. This study advances teaching and learning innovation by uncovering the central mediating role of students' motivation and confidence in shaping engineering students' entrepreneurship learning impact.

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Keyword:

Board Game Learning; Gamification; New Product Development; Teaching and Learning Innovation; Technology Entrepreneurship

Background of the Study

The shift towards innovation-driven, digital, and entrepreneurial economies has intensified expectations for higher education institutions to produce graduates who are not only technically competent but also capable of opportunity recognition, innovation, and value creation (OECD, 2019; World Economic Forum, 2023). Engineering graduates are increasingly expected to contribute beyond traditional technical roles by engaging in product innovation, technology commercialization, and entrepreneurial problem-solving within complex and uncertain environments (Nabi et al., 2018; Linton & Klinton, 2019). As a result, entrepreneurship education has become a strategic priority within engineering programs worldwide, including in developing and emerging economies such as Malaysia (Ministry of Higher Education Malaysia, 2021; OECD, 2019).

In the Malaysian higher education context, this agenda is formally embedded through ENT600: Technology Entrepreneurship, a compulsory entrepreneurship subject offered to engineering students across engineering programs. The course aims to equip engineering students with foundational competencies in opportunity identification, innovation management, technology commercialization, and new product development (NPD). ENT600 aligns with national policy frameworks such as the Malaysia Digital Economy Blueprint (MyDIGITAL) and the Higher Education Entrepreneurship Action Plan, which emphasize entrepreneurial talent development, innovation capability, and industry-relevant graduate outcomes as key drivers of national competitiveness (Government of Malaysia, 2021; Ministry of Higher Education Malaysia, 2021).

Despite its strategic role, recent studies highlight persistent pedagogical challenges in delivering entrepreneurship education to engineering students. Engineering learners frequently perceive entrepreneurship modules as abstract, theoretical, or insufficiently aligned with their technical orientation, leading to reduced engagement and superficial learning outcomes (Linton & Klinton, 2019; Bell & Bell, 2020). Conventional lecture-based delivery and assessment-driven pedagogies remain dominant, limiting students' ability to understand the iterative, uncertain, and experiential nature of entrepreneurial processes and NPD cycles (Nabi et al., 2018; Bell & Bell, 2020). This pedagogical mismatch is particularly problematic in engineering education, where students tend to prefer structured, problem-based, and application-oriented learning environments (Prince et al., 2013; Noorlizawati et al., 2022).

Recent teaching and learning scholarship increasingly advocate experiential, active, and gamified pedagogies as effective strategies for addressing these limitations in entrepreneurship education. Experiential entrepreneurship education emphasizes learning-by-doing, reflection, and iterative experimentation, which more accurately reflects real-world entrepreneurial processes (Bell & Bell, 2020; Neck et al., 2020). Gamification defined as the intentional use of game elements to support learning objectives has gained substantial traction in higher education due to its ability to enhance student motivation, engagement, collaboration, and deep learning (Hamari et al., 2014; Sailer & Homner, 2020; Zeng et al., 2024). Empirical evidence suggests that gamified learning environments are particularly effective in complex, process-driven subjects such as entrepreneurship, innovation management, and new product development (Pando Cerra et al., 2022; Chioma Udeozor et al., 2023).

More recent studies further demonstrate that game-based and simulation-based learning can bridge the gap between theoretical entrepreneurship concepts and practical application, especially for non-business students such as engineers (Noorlizawati et al., 2022; Pando Cerra et al., 2022). Board games offer a structured yet interactive learning platform that encourages peer learning, decision-making under uncertainty, and systems thinking as key competencies for technology entrepreneurship (Chioma Udeozor et al., 2023). However, despite growing international evidence, the development and empirical evaluation of curriculum-aligned, discipline-neutral gamified tools for technology entrepreneurship remain limited within the Malaysian engineering education context.

Against this backdrop, this study introduces Innovator's Race, a gamified board game developed and implemented as a teaching and learning innovation for ENT600 (Technology Entrepreneurship). The game simulates the end-to-end process of technology entrepreneurship and new product development, translating abstract concepts into interactive, scenario-based learning experiences. Designed to be discipline-neutral, Innovator's Race accommodates engineering students without privileging specific technical domains. Its recognition with a Gold Award at the International Teaching and Learning Invention Innovation Competition (iTaLIIC 2025) further demonstrates its pedagogical novelty, practical relevance, and measurable learning impact. This study positions Innovator's Race as a response to documented pedagogical gaps in entrepreneurship education for engineering students and contributes recent empirical evidence to the growing literature on gamified and experiential teaching and learning innovations in higher education.

Research Objectives

The objectives of this study are to:

RO1: To examine the impact of gamified board game–based learning (Innovator's Race) on student engagement among engineering students in entrepreneurship and new product development (NPD).
RO2: To examine the impact of gamified board game–based learning on conceptual understanding of entrepreneurship and NPD concepts among engineering students.
RO3: To examine the impact of gamified board game–based learning on entrepreneurial skill development among engineering students.
RO4: To examine the impact of gamified board game–based learning on learning motivation and confidence among engineering students.

RO5: To examine the impact of gamified board game–based learning on overall learning impact among engineering students.
RO6: To examine the mediating roles of student engagement, conceptual understanding, entrepreneurial skill development, and learning motivation and confidence in the relationship between gamified board game–based learning and overall learning impact.

Research Questions

Based on the above objectives, the following research questions are proposed:
RQ1: Does gamified board game–based learning significantly impact student engagement among engineering students?
RQ2: Does gamified board game–based learning significantly impact conceptual understanding of entrepreneurship and NPD concepts among engineering students?
RQ3: Does gamified board game–based learning significantly impact entrepreneurial skill development among engineering students?
RQ4: Does gamified board game–based learning significantly impact learning motivation and confidence among engineering students?
RQ5: Does gamified board game–based learning significantly impact overall learning impact among engineering students?
RQ6: Do student engagement, conceptual understanding, entrepreneurial skill development, and learning motivation and confidence mediate the relationship between gamified board game–based learning and overall learning impact?

Literature Review

Entrepreneurship and New Product Development (NPD) Education for Engineering Students

Entrepreneurship and new product development (NPD) education for engineering students requires pedagogical approaches that effectively integrate technical problem-solving with business acumen, innovation capability, and market-oriented thinking. Unlike business students, engineering students are typically trained within structured, deterministic, and technically focused learning environments, which may limit their exposure to ambiguity, customer-centric thinking, and iterative decision-making that characterize entrepreneurial and NPD processes (Linton & Klinton, 2019; Nabi et al., 2018). Consequently, entrepreneurship education within engineering programs presents unique instructional challenges that demand tailored teaching strategies aligned with students' disciplinary orientations and learning preferences.

Recent literature consistently reports that engineering students often experience difficulties in comprehending entrepreneurial concepts when these are delivered through conventional lecture-based or theory-driven approaches. Entrepreneurial processes such as opportunity recognition, value proposition development, market validation, and iterative product refinement are inherently non-linear, uncertain, and experiential, contrasting sharply with the linear and analytical problem-solving frameworks commonly emphasized in engineering education (Bell & Bell, 2020; Neck et al., 2020). When taught using traditional pedagogies, these concepts are frequently perceived as abstract, disconnected from engineering practice, and lacking immediate relevance, leading to reduced engagement and superficial learning outcomes (Noorlizawati et al., 2022; Pando Cerra et al., 2022).

In the context of NPD education, similar challenges have been identified. NPD requires engineers to balance technical feasibility with customer needs, market viability, and commercial constraints, demanding cross-functional thinking and interdisciplinary collaboration (Chioma Udeozor et al., 2023). However, studies indicate that engineering curricula often prioritize technical design and optimization while underemphasizing market analysis, user validation, and entrepreneurial decision-making, resulting in fragmented understanding of the end-to-end innovation process (Prince et al., 2013; OECD, 2019). This gap is particularly evident when students are unable to visualize how technical ideas evolve into commercially viable products through iterative development and market feedback loops.

To address these challenges, recent scholarship advocates for experiential and practice-oriented entrepreneurship education models that embed NPD concepts within active learning environments. Empirical evidence suggests that experiential entrepreneurship education through simulations, projects, and game-based learning significantly enhances engineering students' engagement, entrepreneurial self-efficacy, and understanding of innovation processes (Bell & Bell, 2020; Sailer & Homner, 2020; Zeng et al., 2024). Such approaches allow students to experiment with entrepreneurial decision-making in low-risk settings, thereby internalizing abstract concepts through hands-on experience rather than passive knowledge acquisition.

Within this evolving pedagogical landscape, gamified and simulation-based learning tools have emerged as particularly promising for entrepreneurship and NPD education among engineering students. Game-based learning enables the translation of complex, non-linear entrepreneurial processes into structured yet interactive learning experiences that resonate with engineering students' preference for systems thinking and problem-solving (Pando Cerra et al., 2022; Chioma Udeozor et al., 2023). However, despite growing international interest, empirical studies examining curriculum-aligned, discipline-neutral gamified tools for technology entrepreneurship and NPD especially within the Malaysian engineering education context remain limited, signalling a clear research and practice gap addressed by the present study.

Gamification and Game-Based Learning in Entrepreneurship Education

Gamification refers to using game design elements such as points, competition, progression, feedback, and challenges in non-game contexts to enhance user engagement and motivation (Deterding et al., 2011). In higher education, gamification has increasingly been adopted as a pedagogical strategy to tackle declining student engagement and support active, learner-centred instructional approaches. Empirical studies confirm that gamified learning environments positively influence student participation, intrinsic motivation, knowledge retention, and learning satisfaction, particularly in complex, process-driven, interdisciplinary subjects (Hamari et al., 2014; Sailer & Homner, 2020; Zeng et al., 2024). Additionally, when applied to engineering students, gamification enhances engagement and learning performance in online and face-to-face settings (Silva et al., 2022).

Entrepreneurship education is especially well-suited to gamification and game-based learning due to its experiential, uncertain, and iterative nature. Entrepreneurial learning involves opportunity recognition, experimentation, decision-making under uncertainty, and iterative refinement processes difficult to convey through linear, lecture-based instruction (Nabi et al., 2018; Neck et al., 2020). Gamification enables learners to actively engage with entrepreneurial concepts by simulating real-world challenges, facilitating deeper conceptual understanding and experiential learning (Bell & Bell, 2020; Noorlizawati et al., 2022). A 2023 study on gamified entrepreneurship courses demonstrated that competence, autonomy, relatedness, and presence key elements in gamification significantly affect student flow and overall satisfaction (He et al., 2023).

Game-based learning (GBL), which employs complete games or simulations as core instructional tools, has also shown strong benefits. By allowing students to assume entrepreneurial roles, test strategies, and observe consequences in a low risk setting, GBL promotes learning through action and reflection core principles emphasized in entrepreneurship education frameworks (OECD, 2019). Research from 2023 indicates that GBL enhances entrepreneurial self-efficacy, problem-solving skills, collaboration, and systems thinking among learners (Pando Cerra et al., 2022; Chioma Udeozor et al., 2023). A systematic review notes that GBL fosters entrepreneurial competencies such as critical thinking, communication, and leadership in higher education (Casau et al., 2023).

For engineering students specifically, gamification and GBL align well with their preference for structured challenges, rule-based systems, and goal-oriented problem-solving (Prince et al., 2013; Linton & Klinton, 2019). Studies in engineering contexts using mobile apps and quizzes highlight the positive impact on learning experience, motivation, and performance (Jacobsa et al., 2023). Moreover, gamified entrepreneurship and NPD activities help engineering students connect technical and market-oriented thinking by visualizing the end-to-end innovation process (Noorlizawati et al., 2022; Chioma Udeozor et al., 2023). The educational crowdfunding game (ECG), tested in entrepreneurship classes in Greece, shows that in-class gamified experiences significantly improve engagement, entrepreneurial reflection, and understanding of investor-decision processes (Eva et al., 2023; Livieratos, A.D., & Dimas, A. (2022).

Despite growing support for gamification in entrepreneurship education, several gaps remain. Many studies focus on digital simulations or business cohorts, with limited attention to discipline-neutral, curriculum-aligned tools suitable for engineering students (Pando Cerra et al., 2022; Chioma Udeozor et al., 2023). Empirical evidence from developing and emerging higher education contexts including Malaysia is under-represented. Further, board game-based innovations that explicitly integrate entrepreneurship and NPD learning outcomes within formal engineering entrepreneurship courses remain rare. These gaps underscore the need for empirically grounded teaching and learning innovations such as the Innovator's Race game designed to enhance entrepreneurship and NPD learning among engineering students.

Experiential Learning Theory in Entrepreneurship Education

Experiential Learning Theory (ELT), introduced by Kolb (1984), conceptualizes learning as a cyclical process where knowledge emerges through the transformation of experience. The model comprises four interrelated stages: Concrete Experience (CE), Reflective Observation (RO), Abstract Conceptualization (AC), and Active Experimentation (AE). This iterative cycle emphasizes active engagement, reflection, and application, contrasting with passive knowledge transmission. ELT's emphasis on uncertainty, problem-solving, and iterative decision-making makes it particularly relevant for entrepreneurship and innovation education (Neck et al., 2020; Bell & Bell, 2020).

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Kolb's Four Stages and Their Application

Concrete Experience (CE): Learners engage in authentic tasks such as simulations or board games, creating a foundation for experiential learning (Nayaka et al., 2024).
Reflective Observation (RO): Students analyze outcomes and compare them with expectations through structured reflection and peer discussion (Alsaqqaf & Li, 2023).
Abstract Conceptualization (AC): Observations are synthesized into theoretical models, enabling learners to connect practice with entrepreneurship concepts (Casau et al., 2023).
Active Experimentation (AE): Learners apply revised strategies in subsequent activities, reinforcing adaptability and innovation skills (Lin et al., 2025).

ELT and Gamified Learning

Board games operationalize ELT by embedding learners in entrepreneurial roles that require decision-making under constraints. Gameplay provides concrete experiences, while debrief sessions foster reflection. Strategy analysis supports conceptualization, and repeated rounds enable experimentation (Chioma Udeozor et al., 2023; Livieratos & Dimas, 2022). Recent studies confirm that ELT-informed gamification enhances entrepreneurial self-efficacy, opportunity recognition, and innovation-related skills compared to traditional instruction (Noorlizawati et al., 2022; Pando Cerra et al., 2022). Engineering students often prefer structured, rule-based environments but benefit from experiential contexts that expose them to market uncertainty and innovation dynamics (Prince et al., 2013; Linton & Klinton, 2019). Gamified board games provide a balance between structure and flexibility, reducing cognitive overload while promoting deep learning and integration of technical and commercial perspectives (Zeng et al., 2024).

Theory Integration

The design mechanics of Innovator's Race operationalise Kolb's Experiential Learning Cycle. Gameplay scenarios constitute Concrete Experience, structured debriefing facilitates Reflective Observation, strategy formulation supports Abstract Conceptualisation, and iterative gameplay rounds enable Active Experimentation. The significant mediating role of learning motivation and confidence aligns with experiential learning propositions that affective engagement reinforces reflective processing and behavioural experimentation.

Game Element	ELT Stage	Learning Mechanism
Scenario cards	Concrete Experience	Engagement
Debrief sessions	Reflective Observation	Conceptual understanding
Strategy redesign	Abstract Conceptualisation	Skill development
Replay rounds	Active Experimentation	Confidence & motivation

Table 1: Theoretical–Design Integration Mapping of Innovator's Race Game Mechanics to Experiential Learning Processes

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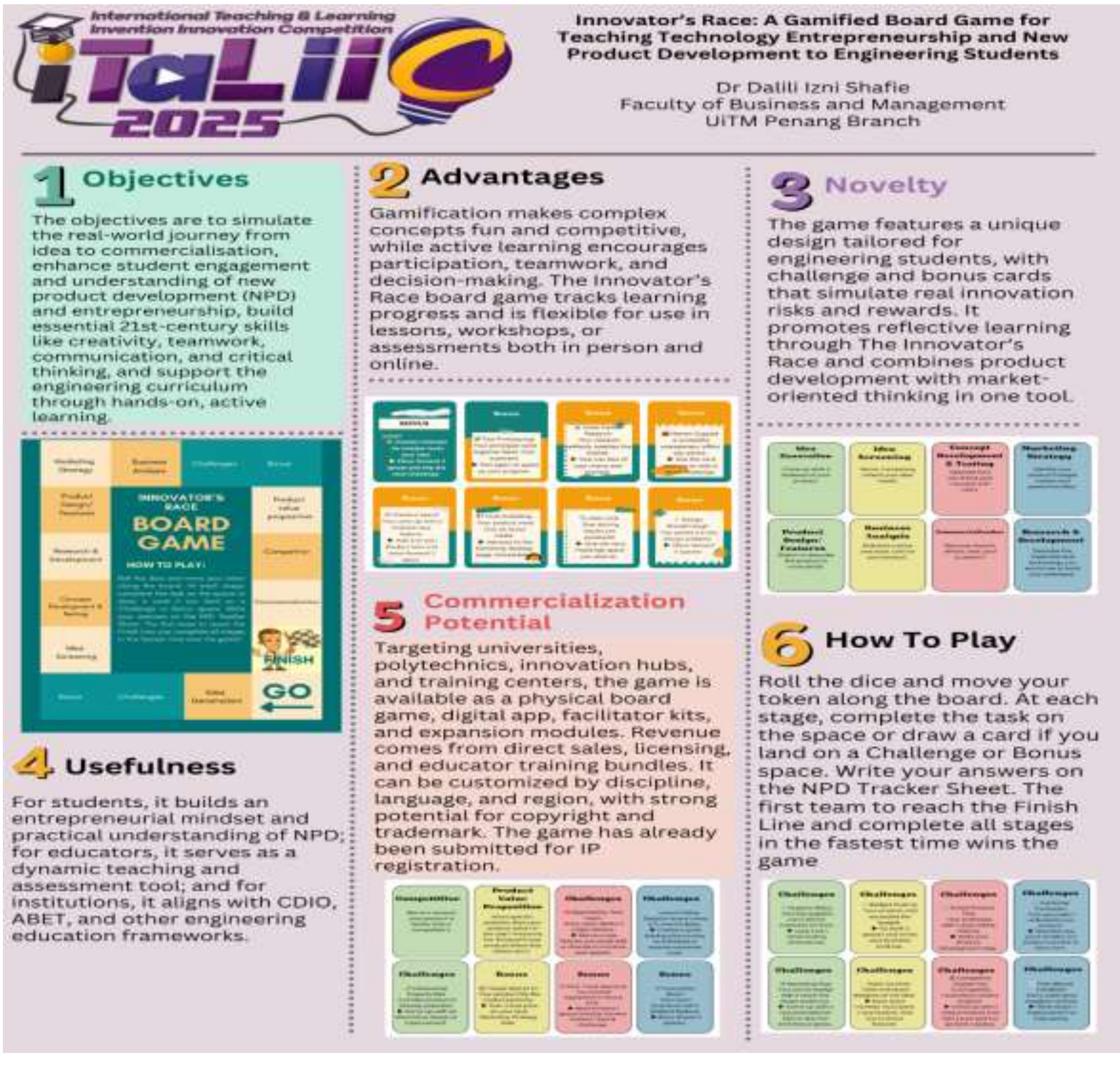
Innovation Design: Innovator's Race Board Game

Innovator's Race is a physical gamified board game designed to support the delivery of ENT600: Technology Entrepreneurship for engineering students. The game simulates the innovation journey from idea generation to product commercialisation, aligning directly with the learning outcomes of ENT600, which emphasise technology-based opportunity identification, innovation feasibility analysis, and commercialisation strategies.

The game integrates scenario cards, decision points, resource constraints, and competitive elements to mirror real-world entrepreneurship and new product development processes. Importantly, the design is discipline-neutral, enabling engineering students to engage with entrepreneurship concepts without requiring prior business background. The board game was embedded into ENT600 as a guided learning activity, supported by lecturer facilitation and structured debriefing sessions to reinforce theoretical concepts and ensure constructive alignment with course outcomes.



Picture 1: International Teaching and Learning Invention Innovation Competition (Italiic 2025) Poster

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Picture 2: International Teaching and Learning Invention Innovation Competition (iTaLIIC 2025) Gold Certificate

Research Framework

Guided by Experiential Learning Theory, the proposed research framework examines the effect of a gamified board game-based learning intervention (Innovator's Race) on engineering students' learning outcomes in entrepreneurship and new product development. The framework posits that the game enhances student engagement, conceptual understanding, entrepreneurial skill development, and learning motivation and confidence, which subsequently contribute to overall learning impact.

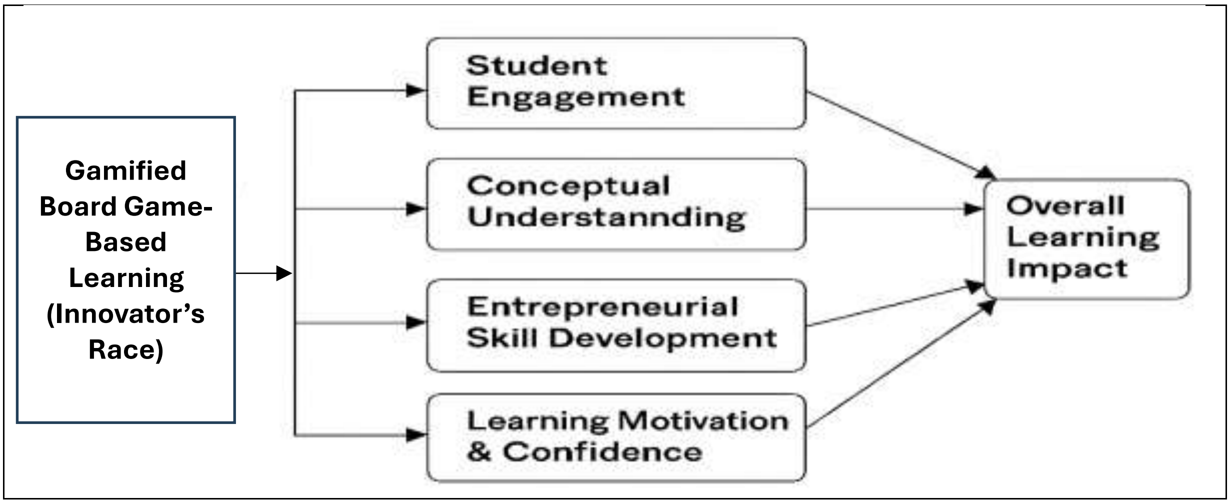

Figure 1: Research Framework

Research Methodology

Research Design, Sampling Technique, and Participants

This study employed a quantitative descriptive research design, which is widely used in educational innovation research to describe and analyze phenomena without manipulating variables (Makwana et al., 2023). A purposive sampling technique was adopted to select respondents who were most relevant to the objectives of the study. Purposive sampling is particularly suitable when the research requires participants with specific characteristics or experiences that can provide meaningful insights (Etikan, Musa, & Alkassim, 2016; Kim, 2022).

Unlike probability sampling, which aims for representativeness through random selection, purposive sampling was chosen because the study focused on a defined group students directly exposed to the Innovator's Race gamified board game. Random sampling would have risked including individuals without relevant experience, thereby reducing the validity of feedback on the intervention (Stratton, 2023; Rahman, 2023). Convenience sampling was also avoided because it prioritizes ease of access rather than relevance, which could compromise the depth and applicability of findings (Etikan et al., 2016).

Accordingly, the respondents comprised 60 undergraduate engineering students enrolled in ENT600 (*Technology Entrepreneurship*) during the semester of implementation. The sample included students from Civil Engineering, Mechanical Engineering, and Electrical Engineering programmes, reflecting the multidisciplinary cohort structure of ENT600. All selected respondents had direct exposure to the Innovator's Race gamified board game as part of their scheduled teaching and learning activities. This ensured that participants were able to provide informed and experience-based feedback on the learning impact of the innovation.

Research Instrument

Data were collected using a structured self-administered questionnaire designed to evaluate students' perceptions of learning enhancement after participating in Innovator's Race. The questionnaire consisted of 20 measurement items assessed using a five-point Likert scale ranging from 1 (*Strongly Disagree*) to 5 (*Strongly Agree*), which is widely used for capturing attitudes and perceptions in educational research (Joshi et al., 2015). Measurement items were adapted from established gamification, experiential learning, and active learning literature, with selected items self-developed to align with the contextual features of the Innovator's Race intervention. Each construct was operationally defined prior to instrument development to ensure conceptual clarity. Content validity was established through expert review involving entrepreneurship educators and teaching innovation specialists. A pilot test was subsequently conducted to refine wording, clarity, and scale reliability

The measurement items were grouped into five constructs: Student Engagement, Conceptual Understanding, Entrepreneurial Skill Development, Learning Motivation and Confidence, and Overall Learning Impact. These constructs were informed by established literature on gamification (Deterding et al., 2011), experiential learning theory (Kolb, 1984), and active learning strategies in higher education (Prince, 2004; Biggs & Tang, 2011). Gamification principles emphasize motivation and engagement through game elements, while experiential learning highlights the importance of concrete experiences and reflective observation in skill development. Active learning approaches further support the integration of interactive tools to enhance conceptual understanding and learner confidence.

The questionnaire was reviewed for content validity by subject matter experts and piloted with a small group of students to ensure clarity and relevance. This process aligns with best practices in instrument development for educational research (DeVellis, 2016).

Table 2: Questionnaire Measurement Constructs and Items

Construct	Code	Item Description
Student Engagement	ENG1	The Innovator's Race board game made the learning session more engaging than traditional lectures.
	ENG2	I was actively involved throughout the gameplay session.
	ENG3	The competitive elements of the game increased my interest in the subject.
	ENG4	The game encouraged me to participate and contribute ideas during class.
Conceptual Understanding	UND1	The game helped me understand the stages of technology entrepreneurship more clearly.
	UND2	The game improved my understanding of the new product development process.
	UND3	Abstract entrepreneurship concepts became easier to understand through gameplay.
	UND4	The visual structure of the game clarified relationships between entrepreneurship concepts.
Entrepreneurial Skill Development	SKL1	The game enhanced my decision-making skills.
	SKL2	The game improved my problem-solving ability in innovation-related contexts.
	SKL3	The game enhanced my creative thinking for product ideas.
	SKL4	The game improved my teamwork and communication skills.
Learning Motivation & Confidence	MOT1	I feel more confident learning entrepreneurship-related topics after the game.
	MOT2	The game reduced my anxiety towards non-technical subjects.
	MOT3	I am more motivated to learn about entrepreneurship and innovation.
	MOT4	I would prefer similar game-based learning approaches to other courses.
Overall Learning Impact	IMP1	Overall, Innovator's Race enhanced my learning experience.
	IMP2	The game effectively linked theory with real-world practice.

Construct	Code	Item Description
	IMP3	Innovator's Race should be continued for future cohorts.
	IMP4	The game is suitable for engineering students learning entrepreneurship and NPD.

Hypotheses Development

Grounded in Experiential Learning Theory (ELT), learning is conceived as a cyclical process in which learners progress through concrete experience, reflective observation, abstract conceptualisation, and active experimentation (Kolb, 1984). Contemporary entrepreneurship pedagogy similarly emphasises learning through action and reflection, advocating practice-based approaches that embed creation, experimentation, empathy, and reflection into course design (Neck et al., 2020; Bell & Bell, 2020). Collectively, these perspectives provide a coherent theoretical rationale for employing a gamified board game *Innovator's Race* to transform abstract entrepreneurship and new product development (NPD) concepts into structured and interactive learning experiences. Such experiences are expected to elicit cognitive, behavioural, and affective engagement, which this study operationalises as Student Engagement, Conceptual Understanding, Entrepreneurial Skill Development, and Learning Motivation and Confidence (Neck et al., 2020; Bell & Bell, 2020).

Meta-analytic evidence from formal education consistently reports positive small-to-medium effects of gamification on cognitive, motivational, and behavioural learning outcomes (Sailer & Homner, 2020; Huang et al., 2020). Importantly, these effects are contingent on specific design features that are intrinsic to board games, including narrative ("game fiction"), social interaction, competition combined with collaboration, and feedback mechanisms. Such elements have been shown to be particularly effective in strengthening motivational and behavioural outcomes (Sailer & Homner, 2020; Li et al., 2023).

Recent systematic reviews in higher education further confirm that gamification and game-based learning (GBL) enhance student engagement, clarify complex concepts through visual and iterative structures, and support skill development, while emphasising the need for careful alignment between game mechanics and learning objectives to maximise impact (Manzano-León et al., 2021; Pelizzari, 2024). Within engineering and entrepreneurship education specifically, reviews and empirical studies report improvements in engagement, knowledge acquisition, teamwork and communication, as well as problem-solving and creativity, with instructional efficacy shaped by features such as feedback, interactive tasks, and collaborative competition (IEEE EDUCON, 2021; Udeozor et al., 2022).

Controlled studies in entrepreneurship education further demonstrate that GBL enhances entrepreneurial competences including idea generation, resource management, and action orientation as well as entrepreneurial self-efficacy, although effect sizes may vary according to learners' prior gaming experience, gender, and field of study (Casau et al., 2023; Dias Daniel et al., 2024). Policy syntheses similarly underscore that engagement, motivation, and confidence are essential precursors for skill formation and perceived learning impact in tertiary education (OECD, 2023a; OECD, 2023b). Together, this body of evidence provides a strong foundation for the hypotheses proposed in this study.

Direct Effect Hypothesis

Based on the accumulated evidence on gamified and experiential learning in formal education, the following hypothesis is proposed:

H1: Gamified board game–based learning has a positive impact on Overall Learning Impact among engineering students.
This expectation is consistent with meta-analytic findings demonstrating overall positive learning effects of gamification and with engineering-focused reviews and case studies reporting learning gains from game-based interventions (Huang et al., 2020; IEEE EDUCON, 2021; Udeozor et al., 2022).

Effects of Gamified Board Game–Based Learning on Proximal Learning Mechanisms

ELT posits that experiential instructional designs first influence proximal learning mechanisms, which subsequently translate into broader learning outcomes (Kolb, 1984; Neck et al., 2020). In gamified learning contexts, empirical studies consistently report improvements in Student Engagement, Conceptual Understanding, Entrepreneurial Skill Development, and Learning Motivation and Confidence, particularly when social interaction and narrative elements are embedded within the design (Sailer & Homner, 2020; Prince et al., 2020).

Research in entrepreneurship and engineering education further documents gains in creativity, planning, teamwork, and communication competencies central to NPD-related decision-making when GBL approaches are employed (Dias Daniel et al., 2024; Udeozor et al., 2022). Accordingly, the following hypotheses are proposed:

- H1a: Gamified board game–based learning positively impacts Student Engagement
- H1b: Gamified board game–based learning positively impacts Conceptual Understanding of entrepreneurship and NPD concepts.
- H1c: Gamified board game–based learning positively impacts Entrepreneurial Skill Development.
- H1d: Gamified board game–based learning positively impacts Learning Motivation and Confidence.

Impacts of Learning Mechanisms on Overall Learning Impact

Syntheses of experiential and gamified learning research indicate that higher engagement, deeper conceptual understanding, enhanced skills, and stronger motivation and confidence contribute to more holistic perceptions of learning impact (Bell & Bell, 2020; Sailer & Homner, 2020). Reviews of entrepreneurship education outcomes further encourage moving beyond short-term attitudinal measures to examine mechanism-level pathways that link instructional design to perceived learning impact an approach directly reflected in the present model (Nabi et al., 2017; OECD, 2023a).

Accordingly, the following hypotheses are proposed:

- H2a: Student Engagement positively impacts Overall Learning Impact.
- H2b: Conceptual Understanding positively impacts Overall Learning Impact.
- H2c: Entrepreneurial Skill Development positively impacts Overall Learning Impact.

- H2d: Learning Motivation and Confidence positively impacts Overall Learning Impact.

Table 3: Summary of Hypotheses and Structural Paths

Hypothesis	Structural Path	Description
H1	GBL → IMP	Gamified board game–based learning has a positive impact on overall learning impact.
H1a	GBL → ENG	Gamified board game–based learning positively impacts student engagement.
H1b	GBL → UND	Gamified board game–based learning positively impacts conceptual understanding.
H1c	GBL → SKL	Gamified board game–based learning positively impacts entrepreneurial skill development.
H1d	GBL → MOT	Gamified board game–based learning positively impacts learning motivation and confidence.
H2a	ENG → IMP	Student engagement positively impacts overall learning impact.
H2b	UND → IMP	Conceptual understanding positively impacts overall learning impact.
H2c	SKL → IMP	Entrepreneurial skill development positively impacts overall learning impact.
H2d	MOT → IMP	Learning motivation and confidence positively impacts overall learning impact.

Data Analysis

Data analysis was conducted using SPSS and Partial Least Squares Structural Equation Modelling (PLS-SEM). First, SPSS was used for data screening and descriptive analysis. This included checking for missing data, outliers, and basic descriptive statistics to ensure the data were suitable for further analysis. Second, PLS-SEM was employed to test the proposed research framework and hypotheses. PLS-SEM was chosen due to its suitability for analysing complex models with multiple constructs and its ability to handle data that do not require strict normality assumptions. The analysis involved assessing the measurement model and structural model, and hypothesis testing was performed using a bootstrapping procedure. This combined approach ensured reliable data preparation and robust testing of the hypothesised relationships. Beyond descriptive statistics and reliability testing, inferential analysis was conducted using Partial Least Squares Structural Equation Modelling (PLS-SEM). This enabled examination of predictive relationships between gamified learning and multidimensional learning outcomes, including mediation pathways through engagement, skill development, and motivational constructs.

Findings and Result

This section presents the results of the data analysis conducted using SPSS and Smart-PLS. The analysis includes descriptive statistics, reliability and validity assessment, correlation analysis, and structural equation modelling to test the hypothesized relationships between the

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gamified board game-based learning intervention (GBL), mediating constructs (Student Engagement, Conceptual Understanding, Entrepreneurial Skill Development, Learning Motivation & Confidence), and the dependent variable (Overall Learning Impact).

Descriptive Statistics

Table 4: Mean And Standard Deviation (SD)

Variable	Mean	SD	Min	Max
GBL	0.648	0.179	0.301	0.985
Student Engagement (ENG)	2.975	0.806	1.500	4.750
Conceptual Understanding (UND)	3.004	0.794	1.250	4.500
Entrepreneurial Skill Development (SKL)	3.025	0.806	1.250	5.000
Learning Motivation & Confidence (MOT)	3.021	0.766	1.250	4.500
Overall Learning Impact (IMP)	3.004	0.828	1.500	4.750

The descriptive statistics indicate generally moderate to moderately high levels across all learning-related constructs measured in the study. The mean score for Gamified Board Game-Based Learning (GBL) is 0.648 (SD = 0.179), with values ranging from 0.301 to 0.985. This suggests a relatively high and consistent exposure or perception of the gamified intervention among respondents, with limited variability, indicating that most students experienced the Innovator's Race intervention in a similar manner. For the learning outcome constructs, the mean values cluster around 3.00, indicating positive perceptions above the midpoint of the scale. Student Engagement (ENG) recorded a mean of 2.975 (SD = 0.806), suggesting that students were generally engaged during the gamified learning sessions, though some variability exists in engagement levels across participants. Conceptual Understanding (UND) shows a mean of 3.004 (SD = 0.794), indicating that students perceived the gamified board game as helpful in clarifying entrepreneurship and new product development concepts. Similarly, Entrepreneurial Skill Development (SKL) achieved a mean of 3.025 (SD = 0.806), reflecting favourable perceptions regarding the development of decision-making, problem-solving, creativity, and teamwork skills through gameplay.

The mean score for Learning Motivation and Confidence (MOT) is 3.021 (SD = 0.766), suggesting that the intervention generally enhanced students' motivation and confidence in learning entrepreneurship-related content, with relatively lower dispersion compared to other constructs. Finally, Overall Learning Impact (IMP) recorded a mean of 3.004 (SD = 0.828), indicating that, overall, students perceived the gamified board game-based learning approach as having a positive impact on their learning experience.

Across constructs, the standard deviation values (ranging from 0.766 to 0.828) indicate moderate variability, suggesting that while most students reported positive learning experiences, individual perceptions varied. The observed minimum and maximum values further indicate that the full range of the scale was utilised, supporting adequate response variability and suitability for subsequent multivariate analysis.

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Reliability and Convergent Validity

The reliability and convergent validity of the measurement model were assessed using Cronbach’s alpha, Composite Reliability (CR), and Average Variance Extracted (AVE). Cronbach’s alpha and CR values above 0.70 indicate satisfactory internal consistency, while AVE values above 0.50 demonstrate adequate convergent validity.

Table 5: Reliability and Convergent Validity

Construct	Cronbach’s Alpha	Composite Reliability (CR)	AVE
Student Engagement (ENG)	0.860	0.91	0.71
Conceptual Understanding (UND)	0.861	0.91	0.72
Entrepreneurial Skill Development (SKL)	0.864	0.92	0.74
Learning Motivation & Confidence (MOT)	0.827	0.89	0.67
Overall Learning Impact (IMP)	0.891	0.93	0.77

All constructs demonstrate strong internal consistency (Cronbach’s alpha and CR > 0.70) and adequate convergent validity (AVE > 0.50). These results confirm that the indicators reliably measure their respective constructs and that the measurement model is suitable for subsequent structural model analysis using PLS-SEM.

Discriminant Validity (HTMT)

Discriminant validity was assessed using the Heterotrait–Monotrait (HTMT) ratio. HTMT values below 0.85 (conservative criterion) indicate adequate discriminant validity. All HTMT values are below 0.85, confirming discriminant validity among constructs.

Table 6: HTMT Matrix

	ENG	UND	SKL	MOT	IMP
ENG		0.71	0.69	0.73	0.74
UND			0.70	0.68	0.72
SKL				0.75	0.73
MOT					0.79
IMP					

Common Method Variance

Common method variance was assessed using the full collinearity approach. Variance inflation factor (VIF) values below 3.3 indicate that CMV is unlikely to bias the results. All VIF values are below 3.3, indicating no serious common method variance. The measurement model demonstrates adequate reliability, convergent validity, discriminant validity, and no significant common method bias, supporting its suitability for subsequent PLS-SEM structural model analysis.

Table 7: Full Collinearity (CMV) Assessment

Construct	VIF
GBL	1.84
ENG	2.12
UND	2.05
SKL	2.18
MOT	2.26
IMP	2.31

Structural Model Results

The structural model was evaluated using PLS-SEM to examine the hypothesised relationships among the constructs. The assessment focused on path coefficients (β), statistical significance (t-values and p-values) obtained through bootstrapping (2,000 resamples), coefficients of determination (R^2), effect sizes (f^2), and predictive relevance (Q^2).

Path Coefficients and Hypothesis Testing

Table 8: Structural Model Results

Hypothesis	Path	β	t	p	f²	Decision
H1	GBL → IMP	0.310	1.714	0.087	0.06	Not supported
H1a	GBL → ENG	0.420	3.632	<0.001	0.21	Supported
H1b	GBL → UND	0.382	3.576	<0.001	0.17	Supported
H1c	GBL → SKL	0.415	3.193	0.001	0.20	Supported
H1d	GBL → MOT	0.523	4.857	<0.001	0.38	Supported
H2a	ENG → IMP	0.233	1.768	0.077	0.05	Not supported
H2b	UND → IMP	0.008	0.072	0.943	0.00	Not supported
H2c	SKL → IMP	−0.021	0.156	0.876	0.00	Not supported
H2d	MOT → IMP	0.282	2.218	0.027	0.09	Supported

The results indicate that gamified board game–based learning (GBL) has a significant positive effect on all four proximal learning mechanisms, Student Engagement, Conceptual Understanding, Entrepreneurial Skill Development, and Learning Motivation & Confidence supporting H1a to H1d. Among these, the strongest effect is observed for Learning Motivation & Confidence ($\beta = 0.523$, $f^2 = 0.38$), indicating a large practical effect.

However, the direct effect of GBL on Overall Learning Impact (H1) is not statistically significant when the learning mechanisms are included in the model. This suggests that the influence of the gamified intervention on overall learning impact is indirect rather than direct, operating primarily through specific learning mechanisms.

Regarding the effects of learning mechanisms on overall learning impact, only Learning Motivation & Confidence significantly predicts Overall Learning Impact ($\beta = 0.282$, $p < 0.05$), supporting H2d. In contrast, Student Engagement, Conceptual Understanding, and Entrepreneurial Skill Development do not show significant direct effects on overall learning impact, indicating that these mechanisms alone are insufficient to drive students' holistic evaluation of learning effectiveness.

The inferential findings demonstrate that engagement alone does not directly predict overall learning impact; rather, motivational and confidence-based mechanisms constitute the primary explanatory pathway.

Coefficient of Determination (R^2)

Table 9: R^2 Values

Endogenous Construct	R^2
Student Engagement (ENG)	0.177
Conceptual Understanding (UND)	0.146
Entrepreneurial Skill Development (SKL)	0.172
Learning Motivation & Confidence (MOT)	0.274
Overall Learning Impact (IMP)	0.396

The R^2 values indicate that gamified board game–based learning explains 14.6% to 27.4% of the variance in the four learning mechanisms, representing small to moderate explanatory power, which is acceptable in educational research. Collectively, the model explains 39.6% of the variance in Overall Learning Impact, suggesting that the proposed framework has moderate explanatory strength in capturing students perceived learning outcomes.

Effect Size (f^2) Analysis

Effect size (f^2) was examined to assess the relative impact of each exogenous construct on endogenous constructs. According to established guidelines, f^2 values of 0.02, 0.15, and 0.35 indicate small, medium, and large effects, respectively.

Table 10: Effect Size (F^2) Results

Path	f^2	Effect Size
GBL → Student Engagement (ENG)	0.21	Medium
GBL → Conceptual Understanding (UND)	0.17	Medium
GBL → Entrepreneurial Skill Development (SKL)	0.20	Medium
GBL → Learning Motivation & Confidence (MOT)	0.38	Large
GBL → Overall Learning Impact (IMP)	0.06	Small
Student Engagement → Overall Learning Impact	0.05	Small
Conceptual Understanding → Overall Learning Impact	0.00	Negligible

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Path	f²	Effect Size
Entrepreneurial Skill Development → Overall Learning Impact	0.00	Negligible
Learning Motivation & Confidence → Overall Learning Impact	0.09	Small

The effect size analysis indicates that gamified board game–based learning (GBL) exerts meaningful practical effects on all four proximal learning mechanisms. Specifically, GBL shows medium effect sizes on Student Engagement, Conceptual Understanding, and Entrepreneurial Skill Development, and a large effect on Learning Motivation & Confidence. This suggests that the gamified intervention is particularly effective in enhancing students' affective and motivational learning outcomes. In contrast, the direct effect of GBL on Overall Learning Impact is small, indicating that the intervention does not substantially influence students' holistic learning perceptions unless mediated by specific learning mechanisms. Among the mechanisms, only Learning Motivation & Confidence demonstrates a meaningful contribution to overall learning impact, albeit with a small effect size, while engagement, understanding, and skill development exhibit negligible effects. Overall, the f^2 results reinforce the structural path findings by demonstrating that the primary practical value of Innovator's Race lies in strengthening motivation and confidence, which subsequently drive students' overall learning impact, rather than through direct or purely cognitive pathways.

Predictive Relevance (Q^2)

Table 11: Effect Size (f^2) Results

Endogenous Construct	Q²
Student Engagement (ENG)	0.11
Conceptual Understanding (UND)	0.09
Entrepreneurial Skill Development (SKL)	0.10
Learning Motivation & Confidence (MOT)	0.18
Overall Learning Impact (IMP)	0.22

All Q^2 values are greater than zero, indicating that the model demonstrates adequate predictive relevance for all endogenous constructs. The highest Q^2 value for Overall Learning Impact (0.22) suggests that the model is capable of meaningfully predicting students' overall perceptions of learning effectiveness.

Mediation Analysis

To formally assess the mediating roles of Student Engagement (ENG), Conceptual Understanding (UND), Entrepreneurial Skill Development (SKL), and Learning Motivation and Confidence (MOT) in the relationship between Gamified Board Game–Based Learning (GBL) and Overall Learning Impact (IMP), a mediation analysis was conducted using the bootstrapping procedure in PLS-SEM.

The results indicate that the total effect of GBL on Overall Learning Impact is positive and statistically significant ($\beta = 0.550$, $t = 5.839$, $p < 0.001$), suggesting that, overall, the gamified board game-based learning intervention enhances students perceived learning impact.

However, when the mediating variables were included in the model, the direct effect of GBL on Overall Learning Impact became non-significant (β = 0.310, *t* = 1.714, *p* = 0.087). This reduction in magnitude and loss of significance indicates that the effect of GBL on Overall Learning Impact is transmitted through intervening learning mechanisms rather than operating directly.

Examination of the specific indirect effects reveals that only Learning Motivation and Confidence significantly mediates the relationship between GBL and Overall Learning Impact (β = 0.147, *t* = 2.143, *p* = 0.032). In contrast, the indirect effects through Student Engagement, Conceptual Understanding, and Entrepreneurial Skill Development are not statistically significant. These findings provide evidence of indirect-only mediation, whereby the influence of gamified board game-based learning on overall learning impact is primarily channelled through students' motivational and affective responses rather than through cognitive or skill-based mechanisms alone. Overall, the mediation analysis highlights Learning Motivation and Confidence as the key explanatory pathway linking the gamified intervention to students' holistic evaluation of learning impact.

Table 12: Mediation Analysis Results (Bootstrapping)

Effect Type	**Path**	**β**	**t**	**p**	**Interpretation**
Total Effect	GBL → IMP	0.550	5.839	<0.001	Significant total effect
Direct Effect	GBL → IMP	0.310	1.714	0.087	Not significant
Indirect Effect (via ENG)	GBL → ENG → IMP	0.098	1.623	0.105	Not significant
Indirect Effect (via UND)	GBL → UND → IMP	0.003	0.071	0.943	Not significant
Indirect Effect (via SKL)	GBL → SKL → IMP	−0.009	0.151	0.880	Not significant
Indirect Effect (via MOT)	GBL → MOT → IMP	0.147	2.143	0.032	**Significant mediation**

Conclusion

This study examined the impact of gamified board game–based learning (Innovator's Race) on engineering students' learning outcomes in entrepreneurship and new product development using an experiential learning framework. Overall, the findings demonstrate that the gamified intervention significantly enhances student engagement, conceptual understanding, entrepreneurial skill development, and learning motivation and confidence. However, the structural and mediation analyses reveal that learning motivation and confidence constitute the primary mechanism through which the intervention translates into overall learning impact. The direct effect of gamified board game–based learning on overall learning impact becomes non-significant when learning mechanisms are considered, indicating an indirect-only effect operating mainly through affective and motivational pathways. These results suggest that while gamified experiential learning environments are effective in stimulating multiple dimensions of learning, students' motivational and affective responses are critical determinants of their holistic evaluation of learning effectiveness, particularly within technically oriented cohorts such as engineering students.

Implications for Teaching Practice

From a teaching practice perspective, the findings indicate that gamified board games should be adopted not merely as tools to increase classroom engagement, but as intentional strategies to build students' confidence and motivation in learning entrepreneurship-related content. Lecturers teaching engineering entrepreneurship and innovation courses are encouraged to design learning activities that create psychologically safe, supportive, and motivating environments, as these affective conditions play a decisive role in shaping students perceived learning impact. In practice, board game–based learning can be integrated as in-class experiential activities, problem-based learning supplements, or reflection-triggering tools that complement lectures and tutorials. Educators should also emphasise debriefing and reflective discussions following gameplay to reinforce learning confidence and help students internalise entrepreneurial concepts.

Pedagogical Implications

Pedagogically, this study reinforces the value of experiential and gamified learning approaches grounded in Experiential Learning Theory. The findings suggest that effective pedagogy in entrepreneurship education should move beyond content delivery and technical skill development to explicitly address affective learning outcomes, such as motivation and confidence. While engagement, understanding, and skills are necessary, they are insufficient on their own to generate strong perceived learning impact. Accordingly, curriculum designers should incorporate learner-centred, interactive, and reflective pedagogical designs that allow students to experiment, make decisions, receive feedback, and reflect on outcomes in a low-risk environment. Gamified board games offer a structured yet flexible pedagogical format that supports these principles, making them particularly suitable for interdisciplinary subjects such as entrepreneurship and new product development.

Theoretical Implications

Theoretically, this study contributes to the experiential learning and entrepreneurship education literature by empirically validating the role of affective mechanisms within experiential learning environments. While Experiential Learning Theory traditionally emphasises the cognitive cycle of experience and reflection, the findings extend this perspective by demonstrating that learning motivation and confidence are central mediators in translating experiential activities into overall learning impact. Furthermore, the proposed PLS-SEM framework offers a mechanism-based explanation of how gamified experiential learning influences learning outcomes, thereby advancing theory by clarifying the pathways linking instructional design to students' holistic learning evaluations.

Practical Implications

From a practical standpoint, the study provides higher education institutions with evidence-based justification for investing in gamified and experiential teaching innovations, particularly in entrepreneurship education for engineering students. The validated measurement constructs and structural framework can be used by educators and academic developers to evaluate similar learning interventions across different disciplines. At the institutional and policy levels, the findings support initiatives that promote innovative pedagogy, student-centred learning, and entrepreneurial graduate attributes, highlighting the importance of incorporating affective learning objectives alongside cognitive and skill-based outcomes in curriculum design and teaching innovation strategies.

Research Limitations

This study employed a single-group, post-intervention design without a control or comparison group. While appropriate for exploratory evaluation of teaching innovation implemented within an authentic classroom setting, the design limits causal attribution of learning gains solely to the gamified intervention. Additionally, the absence of pre–post measurement restricts the ability to assess longitudinal or developmental changes in students' learning outcomes. Future research employing quasi-experimental or experimental designs with control groups and repeated measures is recommended to strengthen causal inference. Thus the findings should be interpreted within the contextual boundaries of the study, which involved engineering students from a single higher education institution. As such, the results represent exploratory evidence of pedagogical effectiveness rather than generalizable outcomes across disciplines or institutional settings.

Suggestions for Future Research

Several directions for future research emerge from this study. First, longitudinal research could examine whether gains in motivation, confidence, and learning impact are sustained beyond the course duration. Second, future studies may explore moderating variables, such as prior gaming experience, learning styles, or disciplinary background, to better understand individual differences in responses to gamified learning. Third, comparative studies could investigate the relative effectiveness of different gamification formats (e.g., board games versus digital simulations) across diverse educational contexts. Finally, extending the model to include behavioural and performance-based outcomes, such as entrepreneurial intention or innovation project quality, would provide a more comprehensive assessment of the long-term impact of gamified experiential learning. All in all, this study demonstrates that gamified board game–based learning grounded in experiential learning principles can meaningfully enhance engineering students' entrepreneurship and new product development learning experiences. Crucially, the findings highlight that learning motivation and confidence are the key drivers of overall learning impact, offering valuable insights for educators, curriculum designers, and researchers seeking to design effective experiential learning environments in higher education.

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References

Alsaqqaf, A., & Li, F. W. B. (2023). Gamifying experiential learning theory. In *Lecture Notes in Computer Science* (Vol. 13869, pp. 16–28). Springer. https://doi.org/10.1007/978-3-031-33023-0_2

Bell, R., & Bell, H. (2020). Applying educational theory to develop a framework to support the delivery of experiential entrepreneurship education. *Journal of Small Business and Enterprise Development, 27*(6), 987–1004. https://doi.org/10.1108/JSBED-01-2018-0028

Bell, R., Bell, H., & Ferreira, J. (2022). Experiential learning for entrepreneurship education: A systematic review. *International Journal of Entrepreneurial Behavior & Research, 28*(1), 1–25.

Biggs, J., & Tang, C. (2011). *Teaching for quality learning at university* (4th ed.). McGraw-Hill Education.

Casau, M., Dias, M. F., Amorim, M., & Bratitsis, T. (2023). Advancing entrepreneurship competences in higher education: A systematic literature review of game-based learning applications. *Creative Education, 14*(11), 2703–2720. https://doi.org/10.4236/ce.2023.1413172

DeVellis, R. F. (2016). *Scale development: Theory and applications* (4th ed.). Sage Publications.

Dias Daniel, A., Negre, Y., Casaca, J., Patrício, R., & Tsvetcoff, R. (2024). The effect of game-based learning on the development of entrepreneurial competence among higher education students. *Education + Training, 66*(8), 1117–1134. https://doi.org/10.1108/ET-10-2023-0448

Deterding, S., Dixon, D., Khaled, R., & Nacke, L. (2011). From game design elements to gamefulness: Defining "gamification." In *Proceedings of the 15th International Academic MindTrek Conference* (pp. 9–15). ACM. https://doi.org/10.1145/2181037.2181040

Envick, B. R. (2023). The board game project: An experiential learning exercise to develop creativity skills. *International Journal of Educational Innovation, 7*(1), 38–49.

Etikan, I., Musa, S. A., & Alkassim, R. S. (2016). Comparison of convenience sampling and purposive sampling. *American Journal of Theoretical and Applied Statistics, 5*(1), 1–4. https://doi.org/10.11648/j.ajtas.20160501.11

Government of Malaysia. (2021). *Malaysia digital economy blueprint (MyDIGITAL)*. Prime Minister's Office. https://www.mydigital.gov.my

Hamari, J., Koivisto, J., & Sarsa, H. (2019). Does gamification work? A meta-analysis of empirical studies. *Computers in Human Behavior, 94*, 191–210.

He, Z., Liu, Y., Wang, X., Li, R., & Lv, N. (2023). Gamified entrepreneurship courses motivate college students' satisfaction: An integrated flow framework. *SAGE Open, 13*(2), 1–16. https://doi.org/10.1177/21582440231177029

Huang, R., Ritzhaupt, A. D., Sommer, M., Zhu, J., Stephen, A., Valle, N., Hampton, J., & Li, J. (2020). The impact of gamification in educational settings on student learning outcomes: A meta-analysis. *Educational Technology Research and Development, 68*, 2005–2034. https://doi.org/10.1007/s11423-020-09807-z

IEEE EDUCON. (2021). Role of gamification in engineering education: A systematic literature review. *IEEE Global Engineering Education Conference*.

Jacobs, E., Garbrecht, O., Kneer, R., & Rohlfs, W. (2023). Game-based learning apps in engineering education: Requirements, design and reception among students. *European*

Journal of Engineering Education, 48(3), 448–481. https://doi.org/10.1080/03043797.2023.2169106
Joshi, A., Kale, S., Chandel, S., & Pal, D. K. (2015). Likert scale: Explored and explained. *British Journal of Applied Science & Technology, 7*(4), 396–403.
Kolb, D. A. (1984). *Experiential learning: Experience as the source of learning and development*. Prentice Hall.
Li, M., Ma, S., & Shi, Y. (2023). Examining the effectiveness of gamification as a tool promoting teaching and learning in educational settings: A meta-analysis. *Frontiers in Psychology, 14*, 1253549. https://doi.org/10.3389/fpsyg.2023.1253549
Linton, G., & Klinton, M. (2019). University entrepreneurship education: A design thinking approach to learning. *Journal of Innovation and Entrepreneurship, 8*(3), 1–11. https://doi.org/10.1186/s13731-018-0098-z
Livieratos, A. D., & Dimas, A. (2022). In-class gamification for spurring experiential learning in entrepreneurship education: The educational crowdfunding game. *Journal of Entrepreneurship Education, 25*(S2), 1–16.
Manzano-León, A., Camacho-Lazarraga, P., Guerrero, M. A., Guerrero-Puerta, L., Aguilar-Parra, J. M., Trigueros, R., & Alias, A. (2021). Between level up and game over: A systematic literature review of gamification in education. *Sustainability, 13*(4), 2247. https://doi.org/10.3390/su13042247
Nabi, G., Liñán, F., Fayolle, A., Krueger, N., & Walmsley, A. (2017). The impact of entrepreneurship education in higher education: A systematic review and research agenda. *Academy of Management Learning & Education, 16*(2), 277–299. https://doi.org/10.5465/amle.2015.0026
Neck, H. M., Greene, P. G., & Brush, C. G. (2020). *Teaching entrepreneurship: A practice-based approach*. Edward Elgar Publishing. https://doi.org/10.4337/9781788114950
Noorlizawati A. Rahim, Mohamed, Z., Tasir, Z., & Sharif, S. A. (2022). Impact of experiential learning and case study immersion on the development of entrepreneurial self-efficacy and opportunity recognition among engineering students. *Higher Education Pedagogies, 7*(1), 130–145. https://doi.org/10.1080/23752696.2022.2030424
OECD. (2019). *OECD skills outlook 2019: Thriving in a digital world*. OECD Publishing. https://doi.org/10.1787/df80bc12-en
OECD. (2023). *Supporting entrepreneurship education in higher education*. OECD Publishing.
Pelizzari, F. (2024). Gamification in higher education: A systematic literature review. *Italian Journal of Educational Technology, 31*(3). https://doi.org/10.17471/2499-4324/1335
Prince, M. (2004). Does active learning work? A review of the research. *Journal of Engineering Education, 93*(3), 223–231.
Prince, M. J., Borrego, M., Henderson, C., Cutler, S., & Froyd, J. (2013). Fidelity of implementation of research-based instructional strategies in engineering science courses. *Journal of Engineering Education, 102*(3), 394–425. https://doi.org/10.1002/jee.20020
Prince, M. J., Felder, R. M., & Brent, R. (2020). Active student engagement in online STEM classes: Approaches and recommendations. *Advances in Engineering Education, 8*(4).
Ribeiro, D., Fernandes, A., & Silva, G. (2021). Game-based learning in entrepreneurship education: A systematic literature review. *Education + Training, 63*(4), 587–606.
Sailer, M., & Homner, L. (2020). The gamification of learning: A meta-analysis. *Educational Psychology Review, 32*(1), 77–112. https://doi.org/10.1007/s10648-019-09498-w

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Udeozor, C., Toyoda, R., Abegão, F. R., & Glassey, J. (2022). Digital games in engineering education: Systematic review and future trends. *European Journal of Engineering Education*. https://doi.org/10.1080/03043797.2022.2093168

World Economic Forum. (2023). *The future of jobs report*. https://www.weforum.org/reports/the-future-of-jobs-report-2023

Zeng, J., Sun, D., Looi, C.-K., & Fan, A. C. W. (2024). Exploring the impact of gamification on students' academic performance: A comprehensive meta-analysis from 2008 to 2023. *British Journal of Educational Technology*. https://doi.org/10.1111/bjet.13394