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Developing Entrepreneurial Competence among University Students through Gamification-based Entrepreneurship Education

Juwita Sari[*)], **Vinza Hedi Satria, Fastha Aulia Pradhani**
Sekolah Tinggi Ilmu Ekonomi Indonesia, Surabaya, Indonesia

[*)]Corresponding Author: juwitasari@stiesia.ac.id

Abstract

This study examines the challenge of developing engaging and practical entrepreneurship education in the digital era. Using a causal research design, it examines the influence of entrepreneurship education on entrepreneurial competence, mediated by entrepreneurial attitude and mindset. In addition to identifying causal relationships between variables, this study examines the multivariate effects that result from integrating gamification into entrepreneurship learning. Data were collected from undergraduate students and analyzed using PLS-SEM to evaluate inter-variable relationships. The findings indicate that entrepreneurship education has a significant impact on students' attitudes and mindsets, ultimately influencing their entrepreneurial competence. However, no direct effect of education on competence was found, indicating that mentality and mindset completely mediate this relationship. Gamified learning methods significantly improved students' understanding of entrepreneurship content. This study presents a novel empirical framework that integrates gamification into a mediation model between education and competence, employing both structural and experimental analysis. Unlike prior studies focusing on direct effects or single-method designs, this research highlights the indirect impact of education. It comprehensively evaluates gamification's pedagogical value in higher education entrepreneurship programs.

Keywords: entrepreneurial attitude, entrepreneurial competence, entrepreneurial education, entrepreneurial mindset, gamification

INTRODUCTION

In this era of globalization and rapid technological development, the main challenge in entrepreneurship education is to create an engaging, dynamic learning process that is relevant to the real needs of students. Engaging learning goes beyond theoretical aspects and focuses on the practical application of concepts through business simulations, real projects, case studies, and creative methods such as gamification. The integration of technology and digital platforms can increase student engagement, strengthen the link between theory and practice, and help them understand the risks and challenges associated with entrepreneurship. Relevant learning connects teaching materials to global economic growth, market changes, and the latest business developments, so students can understand the direct link between what they learn in class and the real world (Isabelle, 2020; Wardana et al., 2020).

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This study applies specific definitions to describe its primary constructs. Entrepreneurial attitude refers to an individual's mental disposition as reflected in optimistic beliefs, feelings, and judgments toward entrepreneurial activities—including internal motivation, resilience, and self-confidence (Draghici, Albulescu, & Tamasila, 2014; Kusmintarti, Asdani, & Riwajanti, 2017). Entrepreneurial competence is the knowledge, skills, and attitudes needed to effectively recognize opportunities, manage resources, and achieve business goals (Sousa & Costa, 2022). Entrepreneurial mindset is the mental structure applied to overcome business challenges, such as initiative, opportunity identification, risk tolerance, and adaptability (Cui & Bell, 2021; Saptono et al., 2020). In this context, entrepreneurial attitude influences entrepreneurial behaviors, which in turn contribute to the growth of entrepreneurial competence. Meanwhile, entrepreneurial mindset forms the basis for strategic thinking and decision-making (Sultan, 2020; Al-Ghazali, Shah, & Sohail, 2022).

Previous studies have demonstrated that entrepreneurship education has a direct impact on entrepreneurial mindsets and attitudes (Bakar et al., 2022; Jena, 2020). An entrepreneurial mindset is an individual's perspective that involves proactive, innovative behavior and tolerance for risk. Entrepreneurship education can encourage students to think creatively and develop innovative solutions to existing problems. This mindset can be developed through entrepreneurial activities or business simulations that allow individuals to experience entrepreneurial thinking and entrepreneurship. Developing an entrepreneurial attitude also includes internal motivation, resilience, and self-confidence in running a business, which play an important role in creating an entrepreneurial attitude (Amofah & Saladrigues, 2022; Al-Ghazali, Shah, & Sohail, 2022).

Entrepreneurship education can shape students' attitudes to be similar to those of professionals in the business world, primarily through practical experiences such as internships, field work, or interacting with successful entrepreneurs (Avillanoza & Domingo, 2020). Students with a strong entrepreneurial attitude and mindset are better prepared to apply business skills in real-world situations. This enables them to recognize business opportunities, develop business plans, and improve their entrepreneurial abilities (Soomro & Shah, 2022). These competencies include technical and non-technical skills essential for managing a business. Therefore, well-planned entrepreneurship education can help develop key competencies, including technical skills—such as financial management, marketing, business operations, and understanding business law; and non-technical skills—such as leadership, communication, negotiation, and teamwork (Wardana et al., 2020; Lv et al., 2021).

In addition, implementing gamification methods is a promising option for improving the effectiveness of entrepreneurship education. Gamification, which refers to using game elements in contexts outside of games, has been recognized as a creative approach to increasing participation and motivation in many sectors, including education. By combining elements such as points, levels, challenges, and rewards, gamification can create a more engaging and interactive learning environment. Using gamification-based learning media can increase student engagement and enthusiasm by making the learning experience more active and exciting (Isabelle, 2020; Satria, Zuhroh, & Sari, 2024). This method will increase student participation in entrepreneurship education and support the

development of their entrepreneurial competencies.

This study is a causal study that aims to reveal how entrepreneurship education can improve entrepreneurial competence by exploring entrepreneurial mindset and entrepreneurial attitude as mediating variables. In addition, this study explores the one-way causal relationship between the two variables and attempts to identify the multivariate effects of various interrelated variables by integrating gamification methods into entrepreneurship education at the university level. Therefore, this study is expected to contribute meaningfully to creating a more innovative and effective entrepreneurship education model. This study provides practical guidance to educators in developing entrepreneurship programs that are more engaging and useful for students. This study also offers several key novelties. First, this study promotes a dual method approach by combining PLS-SEM and Wilcoxon analysis to investigate structural relationships and instructional effects. Second, this study emphasizes the full mediating effect of entrepreneurial attitudes and mindsets, which are rarely studied together. Third, this study uses gamification not only as a learning tool but also as a pedagogical intervention integrated into a causal learning model, which provides a new layer of understanding of how educational engagement affects entrepreneurial abilities in university students.

This study combines gamification in entrepreneurship education with systematic instructional design that includes game-based tasks, simulation modules, and real-world business challenges. The curriculum implements a system of points, rankings, and achievement badges that correspond to learning outcomes. For example, through competitive simulations, students must complete entrepreneurial tasks such as designing business models, presenting ideas, and conducting market validation. Each activity earns points and feedback, and students advance levels based on their performance. This mechanism allows students to increase their participation and enthusiasm.

In addition, peer assessment, challenge-based team collaboration, and mentor-guided feedback are implemented to illustrate core business dynamics while encouraging collaborative learning and self-improvement. The gamification process is integrated into the learning materials and applied in course assessment and student reflection, ensuring alignment between educational objectives and gamification practices. Entrepreneurship education also facilitates risk-taking tendencies, problem-solving skills, and creative ideas, which increase self-confidence and success. Entrepreneurial attitudes emerge as stronger behavior indicators than intentions (Isabelle, 2020; Wardana et al., 2020). This emphasizes the importance of entrepreneurship education in encouraging entrepreneurial behavior and economic growth.

H_1: Entrepreneurial education has a significant positive effect on entrepreneurial attitude

Entrepreneurship education in higher education institutions plays a crucial role in building entrepreneurial attitudes, behaviors, mindsets, and intentions among students. This educational strategy focuses on three main domains: cognitive, affective, and behavioral, with clear objectives to enhance understanding and entrepreneurial thinking. This entrepreneurial mindset consists of two distinct aspects: planning (elaboration) and implementation (action and evaluation). Learning methods that focus on experience and engagement have proven successful in developing both aspects while fostering constructive entrepreneurial attitudes and

perspectives (Alshebami, Al-Jubari, Alyoussef, & Raza, 2020; Alshebami, Al-Jubari, Alyoussef, & Raza, 2020).

H_2: Entrepreneurial education has a significant positive influence on the development of an entrepreneurial mindset.

A varied learning environment in higher education improves students' cognitive and creative abilities, especially in entrepreneurship education. Previous studies indicate that engaging in educational programs significantly improves students' entrepreneurial skills. Entrepreneurial competence encompasses understanding, attitudes, and skills directly related to job performance, which can be improved through specific training. Entrepreneurship education, business plan competitions, and practical support interventions have improved these competencies. Entrepreneurship education significantly improves entrepreneurial competencies and intentions among students (Chen, Tang, & Han, 2022; Glackin & Phelan, 2020; Lv et al., 2021).

H_3: Entrepreneurial education has a significant positive influence on the development of entrepreneurial competence

A person's attitude plays an important role in shaping entrepreneurial ability in various ways. First, attitude influences how opportunities and challenges are perceived, encouraging people to try new ideas. Secondly, a good attitude increases enthusiasm and resilience in achieving business targets. Third, attitudes relate to key entrepreneurial traits that strengthen business development capabilities, such as independence, innovation, and resilience. Fourth, an optimistic and proactive attitude improves the process of making bold and innovative decisions. Fifth, an open attitude towards learning and self-development encourages individuals to improve skills through training and experience. Finally, a favorable attitude towards cooperation and social networking strengthens relationships with business partners and investors. Previous research indicates that a proactive entrepreneurial attitude significantly increases competence and predicts business success (Wardana et al., 2020).

H_4: Entrepreneurial attitude has a significant positive influence on the development of entrepreneurial competence

A person's attitude plays an important role in shaping entrepreneurial ability in various ways. First, attitude influences how opportunities and challenges are perceived, encouraging people to try new ideas. Secondly, a good attitude increases enthusiasm and resilience in achieving business targets. Third, attitudes relate to key entrepreneurial traits that strengthen business development capabilities, such as independence, innovation, and resilience. Fourth, an optimistic and proactive attitude improves the process of making bold and innovative decisions. Fifth, an open attitude towards learning and self-development encourages individuals to improve skills through training and experience. Finally, a favorable attitude towards cooperation and social networking strengthens relationships with business partners and investors (Wardana et al., 2020). Previous research indicates that a proactive entrepreneurial attitude significantly increases competence and predicts business success.

H_5: Entrepreneurial mindset has a significant positive influence on the development of entrepreneurial competence

Entrepreneurship education provides understanding, skills, and experience in recognizing and applying entrepreneurial principles.

Empirical research shows that well-organized education improves entrepreneurial skills. A good entrepreneurial attitude must be developed first for the knowledge to be applied effectively. Entrepreneurial attitudes are characterized by views, beliefs, and risk-taking propensities that support opportunity exploration and innovation. When positive attitudes are instilled through entrepreneurship education, individuals are more likely to exhibit proactive behavior, confidence, and motivation in applying entrepreneurial skills. Entrepreneurial attitudes have been recognized as an important mediating role between educational interventions and student mindset formation (Wardana et al., 2020; Alshebami, Al-Jubari, Alyoussef, & Raza, 2020). The knowledge and skills acquired cannot be applied to business actions without appropriate attitude formation.

H6: The relationship between entrepreneurial education and entrepreneurial competence development is mediated by entrepreneurial attitude

Entrepreneurship education imparts theoretical knowledge of business concepts and practical skills such as market opportunity determination and risk reduction strategies. However, entrepreneurial competencies will not be enhanced unless this knowledge is applied in real situations. An entrepreneurial mindset serves as a driver to turn theory into practice. For example, a theoretical understanding of business risk becomes more efficient when one is willing to take action. Students with an entrepreneurial mindset tend to be more creative, able to overcome obstacles, and adapt to market changes. With this mindset, business acumen is honed, an optimistic attitude towards opportunities is strengthened, and continuous knowledge development is enhanced. Therefore, developing this mindset is crucial to ensure entrepreneurship education creates skilled individuals (Chang, Chang, & Chen, 2022; Al-Ghazali, Shah, & Sohail, 2022).

H7: The relationship between entrepreneurial education and entrepreneurial competence development is mediated by entrepreneurial mindset

Entrepreneurship programs encourage creative thinking and increase entrepreneurial motivation among students, which requires innovative pedagogical approaches (Lynch, Kamovich, Longva, & Steinert, 2021). Integrating gamification in entrepreneurship education provides an exciting yet challenging opportunity to improve learning outcomes. The current use of gamification in entrepreneurship education can be divided into two different approaches. First, game-based self-paced learning, where self-paced games with entrepreneurial content are used as the primary tool in the learning process (Isabelle, 2020). Second, integrated gamification, which combines game elements with conventional classroom teaching (Lyons, Fox, & Stephens, 2023; Pérez-Macías, Medina-Molina, & Gismera-Tierno, 2022).

H8: Significant impact of using gamification for entrepreneurship education

METHOD

This study utilizes primary data collected directly from research subjects through a structured questionnaire. To capture respondents' perceptions, the instrument employs closed-ended statements on a 5-point Likert scale, ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). The questionnaire was distributed electronically via an online questionnaire, with all items carefully designed to align with the

study's theoretical framework. The research examines four key variables: gamification in entrepreneurship education as the endogenous variable (Y), entrepreneurship education, entrepreneurial behavior, and entrepreneurial mindset as exogenous variables (X). Each variable is operationalized through multiple indicators, represented as specific statements in the questionnaire. The study population comprises all undergraduate students from Sekolah Tinggi Ilmu Ekonomi Indonesia or STIESIA (Accounting and Management study programs, cohorts 2022 and 2023) who have completed entrepreneurship courses, totaling 160 students.

A detailed explanation of the indicators used in this study is presented in Table 1. Preliminary questionnaire testing was conducted to assess the accuracy and reliability of the items. The selection of criteria in this study was since all students who had taken entrepreneurship courses in both classes had been given a trial of entrepreneurship gamification technol-

Table 1 Summary of Indicators for Questionnaire

Variables	Indicators	Measurement Scale
Exogenous Variable		
Entrepreneurial Education (Kusumojanto, Wibowo, Kustiandi, & Narmaditya, 2021; Saptono et al., 2020)	1. The ability to think as an entrepreneur 2. Increase understanding of entrepreneurship 3. Present knowledge related to entrepreneurship 4. Increasing opportunity identification capabilities 5. Forming students into entrepreneurs	Likert Scale: 1. Strongly disagree 2. Disagree 3. Neutral 4. Agree 5. Strongly Agree
Entrepreneurial Attitude (Draghici, Albulescu, & Tamasila, 2014; Kusmintarti, Asdani, & Riwajanti, 2017)	1. Entrepreneurship is the best career choice 2. Motivation to be your own business boss 3. Motivation to work with a flexible schedule 4. Motivation to participate in entrepreneurial activities 5. Willing to start a new business	
Entrepreneurial Mindset (Cui & Bell, 2021; Saptono et al., 2020)	1. Engage in entrepreneurial activities 2. Actively recognize business opportunities 3. Tend to take high risks in decision-making 4. Tolerance for uncertain situations 5. High optimism	
Entrepreneurial Competencies (Sousa & Costa, 2022)	1. Basic knowledge of entrepreneurship 2. Active learners, able to adapt and cope with uncertainty 3. The ability to research, assess, and market the market and persuade customers 4. The capacity to define, determine, and identify the causes of problems; identify, prioritize, and select alternatives 5. Knowledge to become an entrepreneur	
Endogenous Variable		
Entrepreneurial Gamification (Satria, Zuhroh, & Sari, 2024)	1. Pre-Test 2. Post-Test	Ratio scale

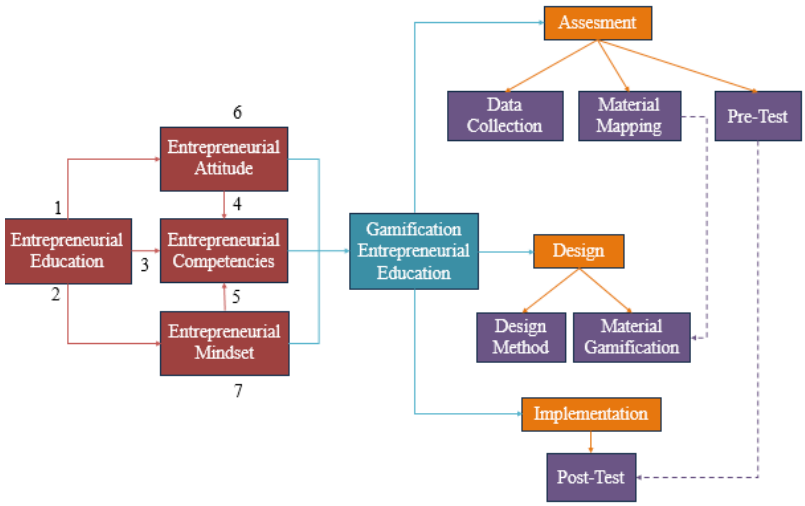

Figure 1 Structural Relationship between Variables

ogy. This research focuses on the effectiveness of gamification, so all students with these criteria are considered important to be included as samples to ensure the research results are more accurate (Sugiyono & Lestari, 2021). So, the method used in the sample is census sampling.

This study employs a three-stage analytical approach. The initial stage involves descriptive statistical analysis to summarize the collected data through several key steps: (1) generating pie charts or bar charts to visualize respondent characteristics (gender, age), (2) creating frequency tables for response distributions, and (3) computing measures of central tendency and dispersion for all scaled responses. The second stage examines intervariable relationships using Partial Least Squares Structural Equation Modeling (PLS-SEM), a robust alternative to Covariance-Based SEM (CB-SEM), particularly when analyzing smaller datasets or models with less established theoretical foundations (Haryono, 2017). It is used to get the answers from hypotheses 1–7. The final stage employs a paired t-test to determine the difference between the pre-gamification and post-gamification results, thereby proving the last hypothesis. First and third stages were conducted using SPSS 29, and the second stage was conducted using SmartPLS 4.0 software, with bootstrapping (5000 subsamples).

The PLS-SEM approach consists of two key modeling phases. The first phase is the outer Model Evaluation, which consists of validity and reliability tests for each latent variable's measurement model (Hair, Black, Babin, & Anderson, 2014). Next step is to evaluate model fit using two primary criteria: R-squared (substantial, if $R^2 = 0.67$ is substantial, moderate if $R^2 = 0.33$, and weak if $R^2 = 0.19$) and Q-squared (Q^2 value > 0 indicates the model possesses predictive relevance, while $Q^2 < 0$ suggests inadequate predictive capability). The next phase is inner model assessment to evaluate the structural relationships between variables as presented in Figure 1. A variable is said to influence another variable when the p-value is less than the specified alpha (5%–10%).

The final step is to test the significant effect on improving students' understanding of the material presented through the gamification created, by utilizing the pre-test and post-test method (Sudarmilah et al., 2020; Wang et al.,

Figure 2 Overview of Simulation for Gamification

2022). First, questions regarding what material needs to be gamified are created before the gamification process begins. The learning material is based on the Semester Learning Plan (SLP) for the Entrepreneurship Course at STIESIA. Due to the broad scope of the SLP covering all 14 meetings, one meeting will be selected for gamification purposes. This study will utilize the Break-Even Point as the topic. This material was chosen due to its quantitative character, which can be used as a game compared to other materials, and has the opportunity to be expanded, as it is related to other courses in the Department of Accounting and Management. In the simulation, students were asked to create a new type of bread, set the price, and calculate the BEP. Figure 2 shows a summary of the simulation. Students also needed to complete pre- and post-test questionnaires at this stage.

RESULT

This section discusses data processing results employing several statistical analysis methods. It consists of descriptive statistics, the PLS-SEM model, and test statistics. Table 2 shows the descriptive statistical results of the respondents' answers. On average, respondents answered in agreement, except for the Entrepreneurial Competence variable. Most respondents answered "doubtful" for all question indicators on this variable. Even respondents still gave "strongly disagree" answers to the five statements in this variable.

The testing uses the PLS-SEM analysis method. This method comprises two primary testing components, outer model evaluation and inner model assessment. The first step for the outer model is the convergent validity test. As shown in Table 3 below, all factor loadings exceed 0.5. This indicates that all indicators have met the

Table 2 Descriptive Statistics

Indicator	Mean	Median	Min	Max	SD	Indicator	Mean	Median	Min	Max	SD
Entrepreneurial Education						**Entrepreneurial Mindset**					
X_1	4.13	4	1	5	0.898	$Z_{2.1}$	3.98	4	2	5	1.016
X_2	4.17	4	1	5	**1.006**	$Z_{2.2}$	3.94	4	2	5	1.072
X_3	4.17	4	1	5	0.973	$Z_{2.3}$	4.18	5	1	5	1.032
X_4	4.22	5	2	5	0.964	$Z_{2.4}$	4.18	5	2	5	**1.122**
X_5	**4.36**	5	2	5	0.891	$Z_{2.5}$	**4.27**	5	2	5	1.063
Entrepreneurial Attitude						**Entrepreneurial Competence**					
$Z_{1.1}$	4.15	5	2	5	**1.119**	Y_1	**3.55**	4	1	5	1.364
$Z_{1.2}$	4.22	5	2	5	1.082	Y_2	3.49	4	1	5	1.329
$Z_{1.3}$	**4.24**	5	1	5	1.058	Y_3	3.43	4	1	5	1.409
$Z_{1.4}$	4.19	5	2	5	1.035	Y_4	3.38	4	1	5	1.255
$Z_{1.5}$	4.13	4	2	5	1.039	Y_5	3.17	4	1	5	**1.441**

convergent validity requirements, meaning each indicator accurately and representatively measures its respective research variable.

As evidenced in Table 4, the correlation values between the square root of AVE and its corresponding latent variable (displayed in the top row of each variable column) demonstrate the highest values compared to other variables. This indicates that each variable possesses unique and distinct indicators that differentiate it from the indicators of other variables. Next, Table 5 presents the summarized results of AVE and composite reliability values for each latent variable.

As presented in Table 5, all AVE values indicate that the indicators measuring each latent variable demonstrate both validity and reliability. The final step for the outer model is to check the model's goodness of fit. It was evaluated based on the R-Square/Adjusted R-Square criteria. The whole criteria were previewed in Table 6. All variables exhibit values greater than 0 regarding Q-Square values, indicating predictive relevance. All variables demonstrate large effect sizes except for entrepreneurial competence, which shows a comparatively lower value.

The following process is the inner model step, which tests a variable's influence based on the

Table 3 Factor Loading Value of Each Variable

Entrepreneurial Competence	Entrepreneurial Education	Entrepreneurial Mindset	Entrepreneurial Attitude
0.941	0.819	0.829	0.938
0.958	0.913	0.916	0.939
0.956	0.917	0.894	0.941
0.910	0.913	0.920	0.927
0.910	0.894	0.893	0.917

Table 4 AVE Root Value of Each Variable

	Competence	Education	Mindset	Attitude
Competence	0.935			
Education	-0.445	0.892		
Mindset	-0.553	0.643	0.891	
Attitude	-0.573	0.664	0.853	0.933

Table 5 AVE and Composite Reliability Values for Each Variable

Components	Entrepreneurial Competence	Entrepreneurial Education	Entrepreneurial Mindset	Entrepreneurial Attitude
AVE	0.874	0.796	0.794	0.87
Composite Reliability	0.972	0.951	0.951	0.971

Table 6 Goodness of Fit Criteria Value Model

	R Square	R Square Adjusted	Q Square
Entrepreneurial Competence	0.347	0.331	0.293
Entrepreneurial Mindset	0.414	0.409	0.320
Entrepreneurial Attitude	0.440	0.436	0.377

hypothesis. The complete results of the path analysis, including all p-values, are presented in Table 7. Table 7 demonstrates that all research hypotheses are supported, except the third hypothesis (H3). Both indirect effects through attitude and mindset variables exhibit statistically significant influences on competency. The mediation analysis reveals complete mediation for both mediating variables, indicating that prior to the inclusion of these mediators, education did not demonstrate a direct effect on competency.

Analysis of the Impact of Gamification on Entrepreneurial Education

The subsequent analysis in this subsection addresses the eighth research hypothesis (H8). Comparative results of the pre-test and post-test performance for all respondents are presented in Figure 4. It can be shown that post-test scores are higher than pre-test scores. The most substantial improvement was observed on Q4 (BEP computation), where correct responses increased from 124 (pre-test) to 149 (post-test), while incorrect responses decreased from 36 to 11 respondents. However, statistical testing needs to be carried out to determine whether there is a difference between the pre-post test and the statistical test.

Before conducting paired-sample analysis, normality testing was performed to examine the data distribution. The Kolmogorov-Smirnov test was employed for this assessment, which indi-

Table 7 Results of the Effect between Variables

Effect between Variables	Original Sample (O)	T Statistics (|O/STDEV|)	P Values
Education -> Attitude	0.664	9.532	0.000*
Education -> Mindset	0.643	10.203	0.000*
Education -> Competence	-0.086	1.242	0.107
Attitude -> Competence	0.334	2.684	0.004*
Mindset -> Competence	-0.213	1.5	0.067**
Education -> Attitude -> Competence	-0.222	2.601	0.005*
Education -> Mindset -> Competence	-0.137	1.52	0.065**

Note: *)Significance α=5%
**)Significance a=10%

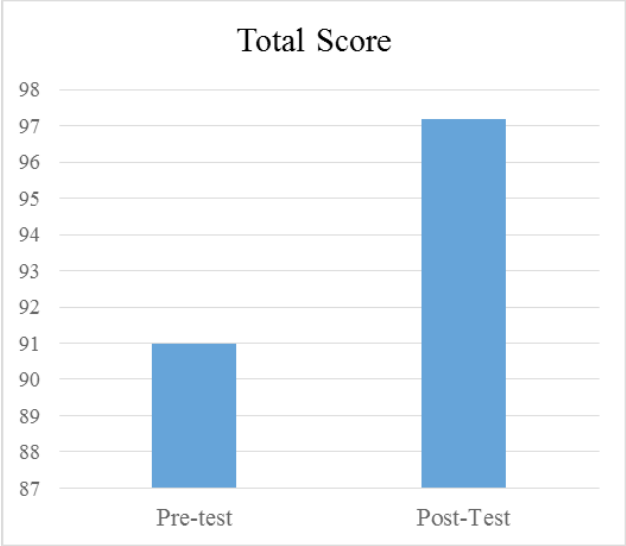

Figure 4 Result of Pre-Test and Post-Test Scores

Table 8 Normality Test

Variable	Statistic	df	P Values
Pre-Test	0.370	160	0.000
Post-Test	0.488	160	0.000

Table 9 Wilcoxon Test Result

Z	-4.986[b]
P Value	.000

cates non-normal data distributions (Table 8). Consequently, non-parametric difference testing was employed for subsequent analysis. Then, a comparative analysis was conducted between the pre-test (case-based assessment) and post-test (gamified assessment) using the Wilcoxon Signed-Rank Test. The results demonstrate a statistically significant difference between assessment conditions (Table 9). This finding leads to rejecting the null hypothesis and accepting the alternative hypothesis, confirming a significant performance difference between post-test (gamified) and pre-test (traditional) scores. Consequently, the eighth research hypothesis (H_8) is supported. This suggests that the implementation of gamification has a significant impact on entrepreneurship education outcomes.

DISCUSSION

The results of this study indicate that entrepreneurship education has a positive and significant effect on students' entrepreneurial attitudes. Through entrepreneurship education, students acquire foundational entrepreneurial knowledge, including risk management, marketing, and business planning, as well as practical skills that enhance their confidence and readiness to tackle business challenges. In addition, entrepreneurship education fosters an entrepre-

neurial mindset characterized by the ability to adapt to change, take calculated risks, and make informed decisions quickly and efficiently. These characteristics play a role in creating a proactive attitude when starting and managing business ventures (Alshebami, Al-Jubari, Alyoussef, & Raza, 2020; Al-Ghazali, Shah, & Sohail, 2022).

Previous research has shown that entrepreneurship education, which focuses on developing entrepreneurial knowledge, practical skills, and attitudes, effectively enhances positive attitudes towards entrepreneurship. Through the incorporation of theoretical knowledge, practical skills, and mindset development, entrepreneurship education shapes students' interest in entrepreneurial activities, encouraging them to act decisively and develop their ventures (Avillanoza & Domingo, 2020; Wardana et al., 2020).

Entrepreneurship education has a positive and statistically significant effect on forming an entrepreneurial mindset. This indicates that students who engage in entrepreneurship education experience a measurable improvement in their entrepreneurial mindset, as evidenced by their ability to identify opportunities, propensity to take quantifiable risks, and creative business attitude. This finding reinforces previous studies, which show that entrepreneurship education builds a thorough understanding of entrepreneurship by developing an entrepreneurial mindset in three important developmental areas: cognitive (knowledge acquisition and critical thinking), affective (motivation and attitude formation), and behavioral (practical skills and decision-making) (Bazkiaei et al., 2020; Jena, 2020; Al-Ghazali, Shah, & Sohail, 2022).

Entrepreneurship education has a limited effect on students' entrepreneurial competencies. This result contradicts the initial expectation that entrepreneurship education can directly improve students' entrepreneurial skills. One possible reason for this discrepancy is that entrepreneurship education in this study focused too much on the financial aspect. Gamification primarily involves calculating the Cost of Goods Sold (COGS), whereas entrepreneurship encompasses additional aspects, including marketing, human resources, logistics, and production. In addition, the entrepreneurship education students obtain is still theoretical and lacks practical experience in the field. As a result, students find their learning less relevant in the real business context (Mukhtar, Wardana, Wibowo, & Narmaditya, 2021; Lv et al., 2021).

Entrepreneurship education can positively impact entrepreneurial competence when supported by complementary elements, such as business plan competitions and entrepreneurial practice support (Lv et al., 2021). Entrepreneurship education without hands-on experience and business competitions may not be as effective for improving students' competencies. Moreover, entrepreneurial competence is a complex skill, influenced not only by education but also by experience, environment, and individual characteristics. Self-motivation, availability of mentors, and participation in entrepreneurial communities may improve entrepreneurial ability (Wardani & Nugraha, 2021; Herdiyana, Nuryani, & Miftahudin, 2024; Jassin & Dewi, 2023).

This study demonstrates that students' entrepreneurial attitude plays a significant role in enhancing their entrepreneurial ability. This research aligns with previous studies that suggest good entrepreneurial attitudes enhance various aspects of entrepreneurial competen-

cies. These attitudes enable individuals to improve their managerial skills, risk-taking ability, creativity, and resilience in facing business challenges. Thus, students with strong entrepreneurial attitudes tend to be more successful in running their own businesses as entrepreneurs (Wardana et al., 2020; Ramadani et al., 2022).

The entrepreneurial mindsets that enhance students' entrepreneurial skills include proactive and initiative-driven approaches, motivating students to recognize opportunities and respond quickly. Moreover, an openness to taking risks enhances both decision-making and financial management abilities. Creativity and innovation foster distinctive business solutions and boost competitiveness. At the same time, resilience and determination empower students to confront obstacles with increased assurance, whereas self-efficacy—belief in one's abilities—enhances communication skills and strategic thinking. Focused and disciplined mindsets also play a vital role in successful business management, while flexibility allows students to adapt to changes in the market and technology. Cultivating these attitudes enables students to enhance their entrepreneurial skills and become more proficient in managing business dynamics more effectively and sustainably (Wardana et al., 2020; Al-Ghazali, Shah, & Sohail, 2022).

Students believe their entrepreneurial mindset is crucial to developing business skills. This discovery aligns with earlier studies, which have shown that individuals with a robust entrepreneurial mindset have a strong foundation for developing extensive and sustainable entrepreneurial skills (Al-Ghazali, Shah, & Sohail, 2022; Mawson, Casulli, & Simmons, 2023). The entrepreneurial mindset is crucial in developing and enhancing students' entrepreneurial skills. People with a robust entrepreneurial mindset often exhibit opportunity-focused thinking, enabling them to recognize business potential even in uncertain circumstances. This perspective encourages creativity in generating extra value and discovering answers to market demands. Moreover, the entrepreneurial mindset fosters the bravery to take risks, which is essential for strategic choices about investments, marketing, and business growth (Wardana et al., 2020).

In addition to embracing risks, this attitude also enhances flexibility and toughness. Students with strong entrepreneurial mindsets adapt more easily to market trends, technological advances, and new business challenges. This flexibility is crucial for sustaining competitiveness in changing business landscapes. The entrepreneurial mindset enhances problem-solving abilities and data-driven decision-making, as students familiar with critical thinking are more inclined to pursue creative solutions to business issues (Al-Ghazali, Shah, & Sohail, 2022; Mawson, Casulli, & Simmons, 2023).

This strong mentality motivates students to pursue ongoing education and personal growth. Individuals with a growth mindset in entrepreneurship are more receptive to novel experiences, helpful criticism, and strategic adjustments when encountering setbacks. As a result, they advance their business skills more quickly, encompassing communication, negotiation, and resource management. Ultimately, the entrepreneurial mindset influences how students start businesses and guides their operations, expansion, and long-term maintenance of their enterprises (Al-Ghazali, Shah, & Sohail, 2022; Amofah & Saladrigues, 2022). The entrepreneurial attitude acts as a mediator between entrepreneurship education and entrepreneurial skills. The mediation effect implies complete

mediation, as entrepreneurship education does not directly influence entrepreneurial competence but exhibits substantial indirect effects when the entrepreneurial attitude acts as a mediating variable. In other words, entrepreneurship education does not directly improve students' entrepreneurial skills. Instead, it fosters a robust entrepreneurial mindset (Mukhtar, Wardana, Wibowo, & Narmaditya, 2021).

This discovery holds significant implications, indicating that students view an entrepreneurial mindset as a vital element that must be acknowledged in connecting the efficacy of entrepreneurship education to skill enhancement. Favorable entrepreneurial mindsets—such as willingness to take risks, inventive thinking, perseverance in overcoming obstacles, and focus on opportunities—act as critical components that convert the entrepreneurial knowledge acquired through education into practical business skills. Hence, methods of teaching entrepreneurship should not confine their emphasis to theoretical understanding and practical abilities. They should also focus on developing entrepreneurial mindsets through practical learning techniques, such as experiential learning, business simulations, and guidance from industry professionals (Al-Ghazali, Shah, & Sohail, 2022; Amofah & Saladrigues, 2022).

The entrepreneurial mindset completely mediates the connection between entrepreneurship education and entrepreneurial competence. Entrepreneurship education does not directly improve individuals' entrepreneurial skills but operates by creating an entrepreneurial mindset as an intermediary factor. Entrepreneurship education equips individuals with the knowledge, skills, and experiences necessary for becoming entrepreneurs. Nonetheless, the knowledge and skills gained from entrepreneurship education may not effectively convert into practical entrepreneurial competencies without a robust entrepreneurial mindset (Alshebami, Al-Jubari, Alyoussef, & Raza, 2020; Al-Ghazali, Shah, & Sohail, 2022).

This discovery aligns with entrepreneurial mindset theory, highlighting that an entrepreneurial mindset encompasses a willingness to take risks, creativity in seizing opportunities, and the ability to remain resilient in navigating business uncertainties. Additionally, these findings align with earlier studies suggesting that an entrepreneurial mindset connects entrepreneurship education with tangible outcomes in developing entrepreneurial competence. When people possess a robust entrepreneurial mindset, they demonstrate an increased willingness to apply knowledge acquired from entrepreneurship education to enhance their business management skills (Al-Ghazali, Shah, & Sohail, 2022; Amofah & Saladrigues, 2022). The results from the non-parametric test prompted the dismissal of the null hypothesis and the endorsement of the alternative hypothesis. As a result, Hypothesis 8 is validated. This verifies that gamification has a statistically significant impact on the results of entrepreneurship education. The analysis showed favorable outcomes from gamification, as post-test results surpassed those of the pre-test. The Wilcoxon Mean Rank test further supported these findings, yielding consistent results about the effectiveness of the intervention.

CONCLUSION

Entrepreneurship education demonstrates a significant positive influence on the development of entrepreneurial attitudes among students. Entrepreneurship education has a statis-

tically significant positive effect on cultivating an entrepreneurial mindset. The analysis reveals no significant direct relationship between entrepreneurship education and the development of entrepreneurial competencies. Entrepreneurial attitudes and entrepreneurial mindset significantly positively impact the formation of entrepreneurial competencies. The study confirms the full mediating role of entrepreneurial attitudes in the relationship between entrepreneurship education and competency development. The findings establish that the entrepreneurial mindset fully mediates the relationship between entrepreneurship education and competence. The implementation of gamification in entrepreneurship education yields statistically significant positive outcomes.

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