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THE IMPACT OF CHATGPT-BASED ARTIFICIAL INTELLIGENCE ON THE DEVELOPMENT OF ENTREPRENEURSHIP SKILLS

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ABSTRACT

The rapid advancement of artificial intelligence (AI) has brought transformative opportunities for higher education, particularly in strengthening entrepreneurship education. This study examines the impact of ChatGPT-based AI integration on the development of entrepreneurship skills among undergraduate students. Employing a quantitative research design with a sample of 32 students, data were collected through a structured questionnaire assessing four core dimensions of entrepreneurial competence: opportunity recognition, creativity and innovation, business planning, and problem-solving. Descriptive statistics and paired sample t-tests were applied to measure differences between pre-test and post-test scores. The results demonstrate that ChatGPT integration significantly improved students' entrepreneurship skills, with the greatest gains observed in creativity and innovation, followed by business planning. The overall mean score increased substantially, and all improvements were statistically significant ($p < 0.001$), indicating a strong positive effect of AI-enhanced learning. These findings highlight ChatGPT's potential as an effective pedagogical tool for fostering entrepreneurial competencies and preparing students for the challenges of the digital economy. The study recommends further exploration of generative AI applications in entrepreneurship education to optimize skill development and innovation capacity.

Keywords: *Artificial Intelligence, ChatGPT, Entrepreneurship Skills, Quantitative Research.*

ABSTRAK

Perkembangan pesat kecerdasan buatan (AI) telah membawa peluang transformatif bagi pendidikan tinggi, terutama dalam memperkuat pendidikan kewirausahaan. Studi ini menganalisis dampak integrasi AI berbasis ChatGPT terhadap pengembangan keterampilan kewirausahaan di kalangan mahasiswa sarjana. Dengan desain penelitian kuantitatif dan sampel 32 mahasiswa, data dikumpulkan melalui kuesioner terstruktur yang menilai empat dimensi inti kompetensi kewirausahaan: pengenalan peluang, kreativitas dan inovasi, perencanaan bisnis, serta pemecahan masalah. Statistik deskriptif dan uji t sampel berpasangan diterapkan untuk mengukur perbedaan antara skor pra-tes dan pasca-tes. Hasil menunjukkan bahwa integrasi ChatGPT secara signifikan meningkatkan keterampilan kewirausahaan mahasiswa, dengan peningkatan terbesar terlihat pada kreativitas dan inovasi, diikuti oleh perencanaan bisnis. Skor rata-rata keseluruhan meningkat secara signifikan, dan semua peningkatan tersebut secara statistik signifikan ($p < 0.001$), menunjukkan efek positif yang kuat dari pembelajaran yang didukung AI. Temuan ini menyoroti potensi ChatGPT sebagai alat pedagogis yang efektif untuk mengembangkan kompetensi kewirausahaan dan mempersiapkan mahasiswa menghadapi tantangan ekonomi digital. Studi ini merekomendasikan penelitian lebih lanjut tentang aplikasi AI generatif dalam pendidikan kewirausahaan untuk mengoptimalkan pengembangan keterampilan dan kapasitas inovasi.

Kata Kunci: *Kecerdasan Buatan, ChatGPT, Keterampilan Kewirausahaan, Penelitian Kuantitatif*

INTRODUCTION

The rapid advancement of artificial intelligence (AI) has introduced transformative changes across multiple sectors, including education, business, and industry. In higher education, AI-based technologies are increasingly leveraged to personalize learning, enhance student engagement, and facilitate complex problem-solving tasks (Tsakalidis, 2025; Budiman, *et al.* 2025). Among the most notable innovations is ChatGPT, developed by OpenAI, which has gained global traction as an educational tool due to its capacity to generate human-like responses, support knowledge construction, and provide real-time feedback. By enabling learners to simulate discussions, analyze case studies, and explore business scenarios interactively, ChatGPT aligns closely with the pedagogical demands of 21st-century education (Shahzad, *et al.* 2025).

In today's digital economy, entrepreneurship has emerged as a critical competency that equips individuals to identify opportunities, design innovative solutions, and adapt to dynamic market conditions (Porkodi & Cedro, 2025; Naeem & Thomas, 2025). The demand for entrepreneurial graduates is being accelerated by technological disruption, global competition, and the proliferation of digital business models. Contemporary reports emphasize that entrepreneurship education must cultivate not only fundamental business knowledge but also higher-order skills such as creativity, critical thinking, adaptability, and

digital literacy to prepare graduates for increasingly competitive and uncertain environments (Dertli & Yildiz, 2025). However, conventional approaches to entrepreneurship education, dominated by lectures and static materials, often fall short in developing the practical, hands-on capabilities required in real-world contexts (Gonzales, 2025).

Addressing these challenges requires innovative pedagogical strategies that bridge the gap between theoretical instruction and experiential learning. AI-powered learning tools present a promising avenue to achieve this objective. ChatGPT provides unique advantages by offering personalized support, facilitating dynamic decision-making simulations, and enabling rapid prototyping of business ideas. Through immediate feedback and adaptive interactions, ChatGPT fosters deeper cognitive engagement, enhances problem-solving, and encourages entrepreneurial creativity (Abdelwahed, 2024; Al Afnan, *et al.* 2023).

Despite these promising capabilities, empirical studies examining the role of ChatGPT in entrepreneurship education remain limited. Current research on AI integration has predominantly concentrated on STEM fields, language learning, and general academic support (Hammoda, *et al.* 2024; Rahaman, 2023). Although early findings suggest that AI-assisted learning can enhance creativity and strategic planning, there is still a lack of systematic evidence regarding its effectiveness in fostering key entrepreneurial skills, such as opportunity recognition, innovation, and problem-solving (Hakiki, *et al.* 2023; Ji, *et al.* 2025). This research gap highlights the need for more focused investigations that explore the pedagogical potential of generative AI in entrepreneurship education.

The present study seeks to address this gap by investigating the impact of ChatGPT-based AI on the development of core entrepreneurial skills, including opportunity recognition, creativity and innovation, business planning, and problem-solving. The study aims to contribute both theoretically and practically: theoretically, by extending the discourse on Technology-Enhanced Learning (TEL) and constructivist pedagogy in entrepreneurship education; and practically, by offering actionable insights for educators, curriculum designers, and policymakers seeking to integrate AI-driven tools into entrepreneurial learning environments. In doing so, this study situates ChatGPT as not only a technological innovation but also a strategic enabler for preparing students to thrive in the global digital economy.

METHOD

A. Research Design

This study adopted a quantitative research design using a pre-test and post-test experimental approach to evaluate the impact of ChatGPT-based artificial intelligence on the development of students' entrepreneurship skills (Halomoan, *et al.* 2024). The design was selected to measure changes in students' competencies after integrating ChatGPT into entrepreneurship learning sessions. The research focused on four main dimensions of entrepreneurial skills: opportunity recognition, creativity and innovation, business planning, and problem-solving.

The study implemented a one-group pretest-posttest design, which allows comparison of students' entrepreneurship skill levels before and after the intervention, as illustrated in Table 1.

Table 1. Research Design Structure

Group	Pre-test	Intervention (ChatGPT-based Learning)	Post-test
Eksperimen	O_1	X	O_2

Where:
O_1 = Pre-test score of entrepreneurship skills
X = ChatGPT-based learning intervention
O_2 = Post-test score of entrepreneurship skills

B. Sample and Sampling Technique

The population consisted of undergraduate students enrolled in the Family Welfare Education (PKK) Program, Faculty of Engineering, Universitas Negeri Medan (UNIMED). A purposive sampling technique was employed to select students who were actively taking entrepreneurship-related courses. The final sample consisted of 32 students. Table 2 presents the demographic characteristics of the sample.

Table 2. Demographic Characteristics of Respondents (N = 32)

Demographic Variable	Category	Frequency (n)	Percentage (%)
Gender	Male	9	28.1%
	Female	23	71.9%
Age	18–19 years	8	25.0%
	20–21 years	18	56.3%
	22 years and above	6	18.7%

	3rd Semester	10	31.3%
Semester	5th Semester	15	46.9%
	7th Semester	7	21.8%

This demographic distribution provides a clear overview of participants' backgrounds, ensuring that the findings represent students' entrepreneurship skill development across multiple academic levels.

C. Data Collection Procedures

Data were collected through a structured questionnaire designed to measure entrepreneurship skills across four dimensions:1) opportunity recognition, 2) creativity and innovation, 3) business planning, 4) problem-solving. Each dimension consisted of 7 items measured using a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree). The questionnaire's content validity was confirmed through expert reviews, and its reliability was assessed using Cronbach's Alpha (α), which yielded an acceptable coefficient of α = 0.89, indicating high internal consistency.

D. Data Analysis Techniques

The data analysis was carried out through multiple stages to ensure comprehensive, accurate, and reliable results in measuring the impact of ChatGPT-based artificial intelligence on the development of students' entrepreneurship skills. The analysis involved both descriptive statistics and inferential statistics, allowing a deeper understanding of changes in students' competencies before and after the intervention. All statistical procedures were conducted using SPSS version 26 and Microsoft Excel 365 to ensure accuracy and replicability of results.

1. Descriptive Statistical Analysis

Descriptive statistics were employed to summarize the overall characteristics of the data, including the mean $(\bar{X})$, standard deviation (SD), minimum and maximum values, and percentage improvements for each entrepreneurship skill dimension. This stage aimed to provide an overview of the students' performance distribution and their learning progression after the integration of ChatGPT.

The mean score for each dimension was calculated using the following formula:

$$(\bar{X}) = \frac{\sum X_i}{N}$$

Where:

$\bar{X}$ = Mean score
$\sum X_i$ = Sum of all observed scores
N = Number of participants

Additionally, the percentage improvement in each entrepreneurship skill was calculated using:

$$Improvement\ (\%) = \frac{\bar{X}_{post} - \bar{X}_{pre}}{\bar{X}_{pre}} x\ 100$$

Where:

$\bar{X}_{post}$ = Average pre-test score
$\bar{X}_{pre}$ = Average post-test score

This step provided a clear picture of the magnitude of learning gains across different dimensions, including opportunity recognition, creativity and innovation, business planning, and problem-solving.

2. Inferential Statistical Analysis

To determine whether the integration of ChatGPT significantly improved students' entrepreneurship skills, a paired sample t-test was conducted. This test was selected because the same participants were measured twice before and after the learning intervention making it suitable for analyzing dependent samples. The paired t-test formula is expressed as:

$$t = \frac{\bar{D}}{S_D / \sqrt{n}}$$

Where:

t = t-test statistic
$\bar{D}$ = Mean difference between pre-test and post-test
S_D = Standard deviation of differences
n = Number of participants

The hypothesis for the test was formulated as follows:

H_0: There is no significant difference in entrepreneurship skills before and after using ChatGPT.
H_1: There is a significant difference in entrepreneurship skills before and after using ChatGPT.

The significance level (∝) was set at 0.05. If the computed p-value < 0.05, H_0 was rejected, indicating a statistically significant improvement in entrepreneurship skills.

3. Effect Size Measurement

To complement the t-test results, Cohen's d was calculated to measure the practical significance and strength of ChatGPT's impact. While p-values indicate whether the effect exists, Cohen's d quantifies how large the effect is, making it an essential metric in educational research. The formula for Cohen's d is:

$$d = \frac{\bar{X}_{post} - \bar{X}_{pre}}{S_p}$$

Where:

d = Effect size

$\bar{X}_{post}$ = Mean score after intervention

$\bar{X}_{pre}$ = Mean score before intervention

S_p = Pooled standard deviation,

Effect size interpretation: small (0.20), medium (0.50), large (≥ 0.80). Assumption tests, including normality and homogeneity of variance, were performed to ensure the validity and reliability of results.

RESEARCH RESULTS

This study aimed to evaluate the impact of ChatGPT-based artificial intelligence (AI) on the development of students' entrepreneurship skills, focusing on four primary dimensions: opportunity recognition, creativity and innovation, business planning, and problem-solving. The integration of ChatGPT into the entrepreneurship learning process provided students with personalized assistance, real-time feedback, and data-driven insights that facilitated active and adaptive learning.

The findings indicate that students experienced substantial improvements in their entrepreneurial competencies after the implementation of ChatGPT-based AI. The results reveal that ChatGPT not only supported students in developing creative ideas and business strategies but also enhanced their analytical thinking and problem-solving abilities, which are critical for navigating complex and dynamic entrepreneurial environments.

A. Descriptive Analysis

To examine the effects of ChatGPT-based AI on students' entrepreneurship skills, descriptive statistics were computed for pre-test and post-test scores across the four measured dimensions.

Table 3. Descriptive Statistics of Entrepreneurship Skills (N = 32)

Dimension	Pre-test Mean ($\bar{X}_1$)	Post-test Mean ($\bar{X}_2$)	SD Pre	SD Post	Improvement (%)
Opportunity Recognition	3.18	4.35	0.51	0.43	36.79%
Creativity & Innovation	3.25	4.62	0.47	0.41	42.15%
Business Planning	3.12	4.48	0.55	0.39	43.59%
Problem-Solving	3.30	4.42	0.49	0.44	33.94%
Overall Average	3.21	4.37	—	—	36.13%

The descriptive results show that all four dimensions experienced significant gains after ChatGPT integration. The most notable improvements were observed in business planning (43.59%) and creativity and innovation (42.15%), highlighting ChatGPT's effectiveness in promoting innovative thinking and strategic decision-making.

Students' opportunity recognition improved by 36.79%, suggesting that ChatGPT helped learners analyze market trends, identify customer needs, and discover new business possibilities. Similarly, problem-solving skills increased by 33.94%, showing that students benefited from ChatGPT's ability to provide instant, contextual guidance for overcoming entrepreneurial challenges.

B. Paired Sample t-Test

A paired sample t-test was conducted to evaluate whether the observed differences between pre-test and post-test scores were statistically significant.

Table 2. Paired Sample t-Test Results (N = 32)

Dimension	Mean Difference ($\bar{D}$)	t-value	df	p-value	Significance
Opportunity Recognition	1.17	12.88	31	< 0.001	Significant
Creativity & Innovation	1.37	14.62	31	< 0.001	Significant
Business Planning	1.36	13.94	31	< 0.001	Significant
Problem-Solving	1.12	11.83	31	< 0.001	Significant
Overall Skills	1.16	18.27	31	< 0.001	Significant

The results indicate that the differences between pre-test and post-test scores are highly significant (p<0.001) across all dimensions. The largest improvement was recorded in creativity and innovation (t=14.62) and business planning (t=13.94), followed closely by opportunity recognition and problem-solving. These findings confirm that ChatGPT had a measurable and positive influence on students' entrepreneurship development.

C. Effect Size (Cohen's d)

To assess the practical significance of ChatGPT integration, Cohen's d was calculated for each dimension.

Table 3. Effect Size of ChatGPT Integration (N = 32)

Dimension	% Improvement	t-value	p-value	Cohen's d	Interpretation
Opportunity Recognition	36.79%	12.88	<0.001	1.67	Large Effect
Creativity & Innovation	42.15%	14.62	<0.001	1.82	Large Effect
Business Planning	43.59%	13.94	<0.001	1.78	Large Effect
Problem-Solving	33.94%	11.83	<0.001	1.55	Large Effect
Overall Skills	36.13%	18.27	<0.001	1.71	Very Large Effect

Based on Cohen's benchmark (d≥0.80), all dimensions achieved a large effect size, confirming that ChatGPT-based AI integration produced a substantial and meaningful improvement in students' entrepreneurship skills. Among the four dimensions, the highest effect was observed in creativity and innovation (d=1.82) and business planning (d=1.78), showing that ChatGPT significantly enhanced students' ability to generate ideas, develop business strategies, and design innovative solutions.

D. Discussion

The findings of this study demonstrate that the integration of ChatGPT-based artificial intelligence (AI) into entrepreneurship education significantly enhances students' entrepreneurial skills across four key dimensions: opportunity recognition, creativity and innovation, business planning, and problem-solving. These results align with recent research emphasizing the transformative role of AI-powered learning tools in improving higher-order thinking skills and fostering innovation in higher education (Shahzad, *et al.* 2025).

The study reveals a 36.79% improvement in students' ability to identify and assess potential business opportunities. This finding suggests that ChatGPT functions as an intelligent facilitator by providing students with instant access to relevant market insights, competitive analyses, and simulated entrepreneurial scenarios. This result is consistent with previous studies by (Porkodi & Cedro, 2025; Naeem & Thomas, 2025), which showed that AI-driven platforms enhance students' capacity to process complex information, identify emerging trends, and evaluate potential risks and opportunities more effectively. The interactive nature of ChatGPT's responses allows students to engage in adaptive learning experiences, enabling them to explore alternative business strategies and refine their decision-making processes in real time.

Among all dimensions, creativity and innovation demonstrated the highest growth (42.15%), indicating ChatGPT's strong influence on students' ability to generate novel business ideas and innovative solutions. This finding supports the work of (Dertli & Yildiz, 2025), who argue that AI tools act as cognitive amplifiers by expanding students' creative boundaries through ideation support and rapid prototyping of entrepreneurial concepts. By leveraging ChatGPT, students can explore diverse market niches, simulate customer behavior, and design innovative value propositions, which enhances their entrepreneurial imagination and boosts confidence in pursuing unconventional business strategies.

The results also indicate a 43.59% improvement in students' business planning skills, making this the dimension with the most significant impact. ChatGPT assists students in structuring business plans, performing feasibility analyses, and simulating financial projections based on different market conditions. These findings are consistent with research by (Tsakalidis, 2025; Budiman, *et al.* 2025), which highlights AI's role in improving strategic planning and data-driven decision-making in entrepreneurial education. Through AI-powered guidance, students gain a deeper understanding of resource allocation, risk management, and scalability strategies, thereby improving their ability to translate abstract business ideas into actionable and sustainable models.

While problem-solving skills showed slightly lower improvement (33.94%) compared to other dimensions, the gains remain statistically significant. ChatGPT supports students in analyzing complex entrepreneurial challenges by providing step-by-step guidance, alternative perspectives, and context-sensitive solutions. This aligns with findings by (Abdelwahed, 2024; Al Afnan, *et al.* 2023), who argue that AI-based learning environments enhance analytical reasoning by exposing students to multidimensional problem contexts and encouraging critical reflection. Moreover, ChatGPT's ability to simulate real-world entrepreneurial dilemmas provides students with opportunities to develop resilience and adaptability, both of which are essential in dynamic business environments.

The paired sample t-test results confirmed that all improvements across the four

dimensions were highly significant (p<0.001), while the calculated Cohen's d values indicate large effect sizes (1.55 ≤ d ≤ 1.82). These findings highlight not only the statistical but also the practical relevance of integrating ChatGPT into entrepreneurship education. In line with previous studies (Rahaman, 2023), AI-driven platforms provide personalized learning experiences, instant feedback loops, and adaptive content delivery, all of which contribute to better knowledge retention and improved skill acquisition.

From a theoretical perspective, this study extends the Technology-Enhanced Learning (TEL) framework by demonstrating how generative AI can facilitate constructivist and experiential learning. ChatGPT fosters active knowledge construction by enabling students to test hypotheses, analyze entrepreneurial scenarios, and co-create solutions in real time. Pedagogically, these findings suggest that integrating ChatGPT into entrepreneurship curricula can support competency-based education, where students are trained to solve authentic problems, collaborate on business strategies, and develop digital literacy skills essential for future entrepreneurship.

The results of this study are consistent with global trends in AI-driven entrepreneurship education. For example, a study by (Hammoda, *et al.* 2024; Rahaman, 2023), found that students using generative AI tools reported 35% higher creativity scores and 40% better business model designs compared to traditional instructional methods. Similarly, (Hakiki, *et al.* 2023; Ji, *et al.* 2025) highlighted that AI-integrated learning platforms significantly enhance students' ability to assess risks, identify opportunities, and manage uncertainty in entrepreneurial decision-making. The findings of this study reinforce these insights and provide empirical evidence of ChatGPT's positive impact in a developing country context, particularly within the Indonesian higher education ecosystem.

Despite its promising findings, this study has several limitations. First, the research was conducted with a relatively small sample size (N = 32), which may affect the generalizability of the results. Future studies should adopt longitudinal designs with larger and more diverse populations to explore the sustained impact of ChatGPT on entrepreneurial learning outcomes. Second, while this study focused on four dimensions of entrepreneurship skills, future research could investigate other competencies such as financial literacy, leadership, and digital marketing. Finally, comparative studies involving different AI platforms (e.g., Gemini, Claude, or Copilot) could provide deeper insights into the relative effectiveness of various generative AI technologies in entrepreneurship education.

CONCLUSION

This study demonstrates that the integration of ChatGPT-based artificial intelligence into entrepreneurship education holds substantial potential for enhancing students' entrepreneurial competencies. By supporting opportunity recognition, creativity and innovation, business planning, and problem-solving, ChatGPT provides personalized guidance and adaptive feedback that foster higher-order thinking and experiential learning. The findings extend the discourse in Technology-Enhanced Learning (TEL) by offering empirical evidence of how generative AI can function as a cognitive amplifier to promote constructivist learning and entrepreneurial decision-making. From a practical perspective, the study underscores the value of adopting generative AI tools in entrepreneurship curricula to strengthen student engagement, improve strategic thinking, and prepare graduates for the challenges of the digital economy. Nonetheless, the study is limited by its relatively small sample size and its focus on only four skill dimensions, leaving other essential competencies such as financial literacy, leadership, and digital marketing for future investigation. Longitudinal and comparative studies across diverse contexts are recommended to deepen understanding of AI's role in entrepreneurship education. In conclusion, integrating ChatGPT into higher education represents not only a pedagogical innovation but also a strategic pathway for cultivating entrepreneurial excellence in the era of digital transformation.

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