

The Influence Of The Challenges Of Applying Artificial Intelligence On Students Business Creativity In The Entrepreneurship Study Program

Pengaruh Tantangan Penerapan Artificial Intelligence Terhadap Kreativitas Berbisnis Mahasiswa Di Program Studi Kewirausahaan

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ABSTRACT

This study examines the influence of Artificial Intelligence (AI) usage challenges namely elaboration fluency, effectiveness, and ethical concerns on students' creativity exploration in entrepreneurship education. A quantitative approach with a cross-sectional design was employed through a survey of 344 students from the Entrepreneurship Study Program at Universitas Pembangunan Nasional “Veteran” Jawa Timur. The data were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) to simultaneously assess the relationships among constructs. The findings reveal that ethical challenges of AI have a positive and significant effect on students' creativity exploration, while effectiveness and elaboration fluency challenges do not show significant effects. These results indicate that ethical dimensions play a more prominent role than technical aspects in shaping technology-based creative exploration processes. Theoretically, this study extends the understanding of human–AI interaction in the context of creativity and knowledge-driven innovation. Practically, the findings provide insights for educational institutions to integrate AI ethics literacy into entrepreneurship education in order to support responsible and sustainable creativity exploration. This study contributes empirically by highlighting the multidimensional role of AI challenges in shaping students' creativity and innovation processes.

Keywords: *entrepreneurship education, knowledge creation, innovation learning, artificial intelligence.*

ABSTRAK

Penelitian ini bertujuan untuk mengkaji pengaruh tantangan penggunaan Artificial Intelligence (AI), yaitu elaboration fluency, efektivitas, dan aspek etika, terhadap eksplorasi kreativitas mahasiswa dalam pendidikan kewirausahaan. Penelitian ini menggunakan pendekatan kuantitatif dengan desain cross-sectional melalui survei terhadap 344 mahasiswa Program Studi Kewirausahaan di Universitas Pembangunan Nasional “Veteran” Jawa Timur. Data dianalisis menggunakan Partial Least Squares Structural Equation Modeling (PLS-SEM) untuk menguji hubungan antar konstruk secara simultan. Hasil penelitian menunjukkan bahwa tantangan etika AI memiliki pengaruh positif dan signifikan terhadap eksplorasi kreativitas mahasiswa, sementara tantangan efektivitas dan elaboration fluency tidak menunjukkan pengaruh yang signifikan. Temuan ini mengindikasikan bahwa dimensi etika memiliki peran yang lebih dominan dibandingkan aspek teknis dalam membentuk proses eksplorasi kreativitas berbasis teknologi. Secara teoretis, penelitian ini memperluas pemahaman mengenai interaksi manusia–AI dalam konteks kreativitas dan inovasi berbasis pengetahuan. Secara praktis, hasil penelitian memberikan implikasi bagi institusi pendidikan untuk mengintegrasikan literasi etika AI dalam pendidikan kewirausahaan guna mendukung eksplorasi kreativitas yang bertanggung jawab dan berkelanjutan. Penelitian ini juga memberikan kontribusi empiris dengan menyoroti peran multidimensi tantangan AI dalam membentuk proses kreativitas dan inovasi mahasiswa.

Kata Kunci: Pendidikan kewirausahaan, penciptaan pengetahuan, pembelajaran inovasi, kecerdasan buatan.

1. Introduction

The development of digital technology in recent years has brought fundamental changes in higher education, not only in the administrative and infrastructural aspects, but also in the way knowledge is produced, distributed, and utilized. One of the rapidly growing innovations is the use of artificial intelligence (AI), especially *generative AI*, which is able to produce text, ideas, and analysis quickly and adaptively. This technology allows for more dynamic interactions in supporting thought processes, problem-solving, and idea development (Dwivedi et al., 2023; Kasneci et al., 2023).

In entrepreneurship education, this development becomes relevant because creativity is a core competency of students. Entrepreneurship education focuses not only on business knowledge, but also on the ability to explore opportunities and come up with innovative solutions. Creativity is understood as the ability to generate new, valuable, and relevant ideas (Amabile, 1996), so AI integration has the potential to affect the process of exploring ideas and students' creativity.

Along with digital transformation, student creativity develops in the concept of *digital creativity*, which is the ability to generate ideas through innovative technology integration (Cojocariu & Boghian, 2024). In this perspective, AI does not only serve as a tool, but as part of a socio-technical ecosystem that shapes the mindset and process of exploring ideas.

Various studies show that AI has the potential to support creativity by expanding the space for ideas, accelerating exploration, and improving the efficiency of iteration of ideas (Hwang & Wu, 2024). In the context of entrepreneurship, *generative AI* is even positioned as a *cognitive partner* that can increase students' *self-efficacy* in developing business ideas (Ashkinaze et al., 2025; Park et al., 2025).

However, the use of AI also faces various challenges. Institutionally, the use of AI requires policies related to literacy, ethics, and academic integrity (Jin et al., 2025). At the individual level, challenges arise in the elaboration fluency of ideas, i.e. the ability to formulate effective *prompts*. Many students have difficulty in drafting *prompts*, interpreting outputs, and developing ideas in an ongoing manner (Park et al., 2025; Syam et al., 2025).

In addition, the effectiveness of AI is also a concern because not all outputs have high relevance and accuracy. AI sometimes generates ideas that are general or not contextual, thus increasing the cognitive load of students in the evaluation and refinement process (Baklaga, 2025; Park et al., 2025). On the other hand, ethical aspects such as the authenticity of ideas, plagiarism, and limits on the use of AI also cause confusion and anxiety among students (Chan & Hu, 2023; Qadhi et al., 2024).

These three challenges fluency, effectiveness, and ethics reflect the quality of human-AI interaction in creative learning. Optimal interaction can support the exploration of ideas, but obstacles in these aspects have the potential to disrupt students' creative processes.

Although various studies have addressed the potential and risks of AI, studies that simultaneously examine the influence of various challenges of using AI on students' creativity exploration are still limited (Batista et al., 2024). Therefore, this study aims to analyze the influence of the challenges of elaboration fluency, the effectiveness of AI, and ethical aspects on the exploration of student creativity in the Entrepreneurship Study Program. This research is expected to make a theoretical contribution to the development of the literature as well as practical implications in designing learning strategies and policies for the use of AI that supports creativity in an innovative and ethical manner.

2. Literature Review

Artificial Intelligence in the Context of Student Entrepreneurship

Various studies show that *Artificial Intelligence* (AI) in entrepreneurship has transformed from an automation tool to a *cognitive partner* that supports value creation. In

early-stage student entrepreneurship, *generative AI* is used for ideation, opportunity exploration, concept development, and market validation. (Chan & Hu, 2023) assert that AI helps decision-making through data analysis and simulation, while (Ali et al., 2024) shows increased creativity, precision, and innovation efficiency.

In entrepreneurship education, AI functions as a learning tool as well as a cognitive partner. Studies (Chan & Hu, 2023; Kasneci et al., 2023) show that AI helps with the understanding and elaboration of ideas, despite ethical challenges. (Park et al., 2025) affirm the contribution of AI in strengthening *the entrepreneurial mindset* when used as a support. In addition, (Solórzano Solórzano et al., 2024) found that *intention to use AI* has a significant effect on *entrepreneurial intention*. Thus, AI is not only a tool, but also shapes the way students think, create, and make decisions.

Exploration of Creativity in the Entrepreneurial Process

Exploration of creativity in entrepreneurship is understood as a dynamic behavior that emphasizes the search for ideas, the incorporation of knowledge across domains, and continuous experimentation, rather than just the end result. This perspective sees creativity as *exploratory behavior*, which is important for students because they are still in the learning and entrepreneurial identity formation stages (Marrone et al., 2022). In addition, creativity develops through repetitive interaction, reflection, and exploration, with a combination of knowledge as the basis of innovation (Rumanti et al., 2023).

The development of AI has also expanded the space for exploring creativity by providing a variety of ideas, alternative perspectives, and accelerating conceptual experimentation. (Ashkinaze et al., 2025) showed that AI increases the diversity and evolution of ideas, while (Sánchez Díaz, 2024) finds that *the use of generative AI* results in more quality, fast, and diverse ideas. In higher education, AI also helps students develop and combine cross-disciplinary ideas, although it still requires critical control (Chan & Hu, 2023; Park et al., 2025). Thus, the exploration of creativity is an ever-evolving cognitive process, with AI as an enabler that expands possibilities without replacing the active role of the individual.

Artificial Intelligence as an Enabler and Constraint in Creativity Exploration

The literature on *Artificial Intelligence* (AI) and creativity shows two main perspectives, namely AI as *an enabler* and as a *constraint*. As *an enabler*, AI is able to accelerate ideas, expand knowledge, and provide a variety of ideas that encourage creative exploration. Studies (Al-Mamary, 2025; Ali et al., 2024) show an increase in creativity and decision quality, while (Ashkinaze et al., 2025) affirm that AI encourages diversity of ideas. At the organizational level, AI also increases analytical capabilities and *organizational innovativeness* (Lin et al., 2025).

However, AI also has the potential to be a *constraint*. Overdependence can lead to the homogenization of ideas, decreased critical reflection, and weakened cognitive autonomy (Baklaga, 2025; Mukhtar et al., 2024) suggest that users can shift to passive evaluators, while (Chan & Hu, 2023; Kasneci et al., 2023) find a risk of decreased depth of thinking in college students. Thus, AI is ambivalent as an *enabler* as well as a *constraint* in the exploration of student creativity.

The Challenges of Using AI in Creativity Exploration

The literature places the ethical challenge of AI as an important issue in the exploration of student creativity, especially related to plagiarism, ownership of ideas, and academic integrity. The use of *generative AI* creates ambiguity between human and AI contributions, thus demanding a higher ethical awareness. (Mukhtar et al., 2024) and (Mabirizi et al., 2025) assert that ethical issues affect individuals' interactions with AI, while (Kofinas et al., 2025) and (Qadhi et al., 2024) point out that concern for academic integrity encourages a

more reflective use of AI. In fact, ethical awareness can encourage more critical and original exploration.

In addition, the effectiveness of AI and elaboration fluency are also major challenges. AI does not always produce contextual and relevant outputs, thus affecting the level of dependency and quality of idea exploration (Chan & Hu, 2023; Park et al., 2025). (Kasneji et al., 2023) suggest that repetitive or less contextual responses can inhibit further exploration, even though AI is effective in the early stages. Thus, ethical challenges, effectiveness, and elaboration have a direct effect on the process of exploring students' creativity.

The Simultaneous Influence of AI Challenges on Creativity Exploration

The latest literature emphasizes the importance of looking at the challenges of using *Artificial Intelligence* (AI) holistically, because the ethical aspects, effectiveness, and elaboration fluency interact with each other in shaping students' creative experiences. The *socio-technical system perspective* shows that the impact of AI is not linear, but rather is influenced by the relationship between technology, individuals, and the context of use (Dwivedi et al., 2023; Topham et al., 2025). In this case, the issues of ethics, perception of effectiveness, and quality of human–AI interaction collectively affect the exploration of creativity (Mabirizi et al., 2025; Mukhtar et al., 2024).

In addition, the way students interpret the limitations of AI is a key factor. When understood critically, AI serves as a reflective tool that deepens ideas (Chan & Hu, 2023; Park et al., 2025). Conversely, overconfidence can increase dependency and decrease critical reflection (Gerlich, 2023). Thus, the impact of AI challenges on the exploration of creativity is contextual and influenced by the integration of ethical, technical, and cognitive factors.

Hypothesis Development

H1: The challenge of AI elaboration fluency has a significant impact on the exploration of students' creativity.

The use of *Artificial Intelligence* (AI) in higher education is becoming more widespread, but it does not always guarantee optimal exploration of creativity. The quality of human-AI interaction, especially in the process of elaborating ideas, is a key factor. (X. Liu & Zhong, 2025) show that constraints such as inaccurate output, *less effective prompts*, and unclear direction can limit students' ability to develop and modify ideas. In line with that, (Habib et al., 2025) emphasized that the effectiveness of AI in the creative process is collaborative and depends on the quality of interaction, not just the existence of technology.

In addition, the use of non-optimal AI can trigger *cognitive offloading*, which is the tendency of students to rely on AI to reduce the involvement of creative thinking. Conversely, (Chen & Xiao, 2025) show that effective interaction with AI can improve *cognitive flexibility*, which is important in the exploration of ideas.

H2: The challenge of AI effectiveness has a significant impact on the exploration of students' creativity.

The perception of the effectiveness of *Artificial Intelligence* (AI) is an important factor in encouraging the exploration of creativity. When AI is able to generate novel and useful ideas, users tend to be more motivated to experiment (Y. Liu et al., 2025). In general, AI can support creative processes, problem-solving, and idea development if it produces relevant and accurate outputs (Doris M. & Brennan, 2018; Dwivedi et al., 2023).

However, the effectiveness of AI is not always optimal. (Wei et al., 2025) show that there are challenges such as *cognitive offloading*, overdependence, and output mismatches, which actually hinder the creative process. In creativity theory, the effectiveness of tools greatly affects the quality of ideas, and ineffectiveness can trigger *creative interruption* and increase cognitive load (Amabile, 1996).

Furthermore, challenges such as irrelevant or inconsistent outputs can decrease students' ability to explore creativity. (Alshamy et al., 2025) showed that the effectiveness of AI had an effect on divergent thinking skills, while (Zhang et al., 2024) found that the ineffectiveness of AI encourages *excessive verification* which reduces the focus on creative activities.

H3: The ethical challenges of AI have a significant impact on the exploration of student creativity.

The use of *Artificial Intelligence* (AI) in the academic context raises ethical issues such as the authenticity of ideas, plagiarism, and academic integrity (Kasneci et al., 2023). Concerns about this ethical aspect can affect students' courage in exploring ideas using AI. (Kasneci et al., 2023; Wei et al., 2025) show that the risk of ethical violations makes college students more likely to limit the use of AI, despite the potential to support creative processes.

In creativity theory, moral anxiety and fear of breaking rules can lower *creative confidence* and hinder the exploration of ideas (Bianchi et al., 2025). In addition, creativity in the context of AI is also influenced by the perception of authenticity and human involvement (Bianchi et al., 2025), so ethical doubt can have an impact on the process of evaluation and development of ideas.

Furthermore, (Mabirizi et al., 2025) showed that ethical concerns create a *psychological restraint* that limits creative exploration, while (Kofinas et al., 2025) found that the perception of ethical risk decreases students' *creative confidence*.

H4: The challenge of AI elaboration fluency, the challenge of AI effectiveness, and the challenge of AI ethics simultaneously have a significant effect on the exploration of student creativity.

The use of *Artificial Intelligence* (AI) in entrepreneurship education has the potential to support creative processes, from ideation to the development of innovative solutions (Dwivedi et al., 2023). However, its success is greatly influenced by the conditions of use and the ability of the user (Amabile, 1996). Studies show that elaboration challenges, such as *prompting difficulties* and inaccuracies of outputs, can hinder the development of ideas (Kim & Maher, 2023). while inconsistent AI effectiveness degrades the quality of exploration due to the need for repeated corrections (Park et al., 2025).

On the other hand, ethical issues such as the authenticity of ideas and academic integrity also limit the exploration of student creativity (Kasneci et al., 2023). Ethical concerns make students more cautious about using AI, even though the technology has the potential to support creativity.

3. Research Methods

This study uses a quantitative approach to examine the relationship and influence between variables related to the challenges of using *Artificial Intelligence* (AI) on student creativity exploration. This approach was chosen because it is able to systematically measure user perception and experience and test the relationship between constructs through statistical analysis (Chan & Hu, 2023; Kasneci et al., 2023).

The type of research used is explanatory, which aims to explain the cause-and-effect relationship between variables based on a conceptual framework. This approach is relevant to understand the influence of the use of AI on students' cognitive processes and creative behavior (Dwivedi et al., 2023; Hwang & Wu, 2024).

This study uses a *cross-sectional* design, with data collected over a period of time to capture students' perceptions of the use of AI in learning. This design is commonly used in the study of technology adoption and higher education (Chan & Hu, 2023; Qadhi et al., 2024).

Data analysis was carried out using Structural Equation Modeling–Partial Least Squares (SEM-PLS), which is able to analyze complex relationships between latent variables

simultaneously. This method is suitable for research that is predictive and involves multidimensional constructs such as creativity, technological effectiveness, and ethics (Babina et al., 2024) (Ali et al., 2024) In addition, SEM-PLS enables a more comprehensive understanding of structural relationships in the context of AI and innovation (Ashkinaze et al., 2025) (Syam et al., 2025).

Sampling And Data Collection

The population of this study is all students of the Entrepreneurship Study Program of the "Veteran" National Development University of East Java who have known or used *Artificial Intelligence* (AI) in academic activities and business idea development. This population was chosen because entrepreneurship students are required to have creative, innovative, and adaptive skills to digital technology.

The sampling technique uses *saturated sampling (census approach)*, where all members of the population have the opportunity to become respondents. This method was chosen to obtain a comprehensive empirical picture.

Data collection was carried out through a theory-based structured questionnaire that was distributed online using Google Form. The instrument has been expertly reviewed to ensure clarity and relevance. Filling is done with *informed consent*, and only complete and consistent data is used in the analysis.

Measurements

The measurement of variables in this study was conducted using questionnaire instruments adapted from previous studies and adjusted to the context of Artificial Intelligence use in entrepreneurship learning. These instruments were selected due to their established validity and reliability in measuring research constructs (Chan & Hu, 2023; Dwivedi et al., 2023).

All items were measured using a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree), which effectively captures respondents' perceptions and attitudes. This scale is widely used in studies related to technology adoption, creativity, and user behavior in higher education (Kasneci et al., 2023).

The measurement indicators were adapted without altering their conceptual meaning to ensure relevance to students as AI users in academic and creative contexts, while maintaining theoretical consistency (Park et al., 2025). This perception-based approach is appropriate as the study focuses on students' subjective experiences in facing AI usage challenges and their impact on cognitive processes and creativity (Syam et al., 2025).

Operational Definitions Of Variables

The challenge of AI elaboration fluency

The challenges of elaboration fluency of AI are measured using several indicators that represent students' obstacles in developing, expanding, and modifying creative ideas when utilizing Artificial Intelligence as a thinking tool.

The challenge of AI effectiveness

The challenges of AI effectiveness are measured through indicators that describe students' perceptions of the level of accuracy, relevance, and usefulness of AI outputs in supporting creative and innovative processes.

The ethical challenges of AI

The ethical challenges of AI are measured using indicators that reflect students' perceptions of the issue of the authenticity of the work, the potential for plagiarism, and the ethical limits of the use of AI in academic and entrepreneurial contexts.

Cretivity Exploration Students

The exploration of student creativity is measured using indicators that represent students' ability to find, develop, and realize new ideas creatively and innovatively.

Figure 1 illustrates The structural model illustrates the associations among the study's constructs. The present study employs four main variables: AI elaboration fluency challenge, AI effectiveness challenge, AI ethical challenge, and creativity exploration. The three dimensions of AI challenges are assumed to directly influence students' creativity exploration, which is positioned as the outcome variable in this study.

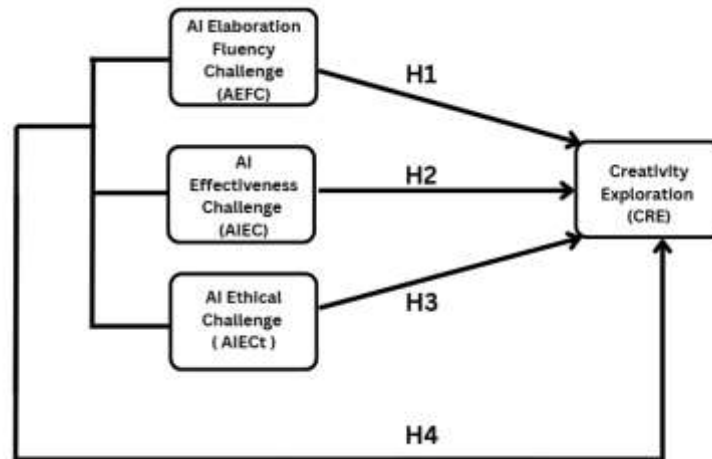


Figure 1. Structural model results

Data Analysis Techniques

The data that has been collected is analyzed using the Structural Equation Modeling–Partial Least Squares (SEM-PLS) approach. This method was chosen because it is able to analyze the relationship between latent variables simultaneously and is suitable for research with predictive models and a relatively limited number of samples.

4. Results and Discussions

Results

Participants

The demographic characteristics of the respondents in this study are presented in the table 1, table 2, and table 3 describes the distribution of respondents.

Table 1. Respondent By Gender.

GENDER	Frequency	Percentage
Male	188	54.7%
Female	151	43.8%
Other / Don't want to mention	5	1.5%
Total	344	100%

Table 2. Respondent By Age.

Age	Frequency	Percentage
<18 years	54	16 %
19 – 20 years	201	59.2 %
21- 22 Years	83	23.7 %
>23 Years	6	1.2 %

Total	344	100%
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Table 3. Respondent By Semester

Semester	Frequency	Percentage
Semester 1 – 2	125	37 %
Semester 3 – 4	92	26.9 %
Semester 5 - 6	89	25.7 %
Semester 7 Above	38	10.4 %
Total	344	100%

Confirmatory Factor Analysis

Confirmatory Factor Analysis (CFA) was conducted using the PLS-SEM approach to evaluate the measurement model, including outer loadings, Cronbach's Alpha, Composite Reliability, and Average Variance Extracted (AVE). The analysis aims to ensure that each indicator validly and reliably represents its respective latent construct, namely Creativity Exploration, AI Ethics Challenge, AI Effectiveness Challenge, and AI Elaboration Fluency Challenge.

The results indicate that most indicators have outer loading values above 0.70, reflecting good construct validity. The constructs of Creativity Exploration, AI Ethics Challenge, and AI Effectiveness Challenge show strong and consistent indicator loadings. However, several indicators in the AI Elaboration Fluency Challenge (AEFC1, AEFC2, and AEFC5) fall below the recommended threshold, suggesting the need for further evaluation.

In terms of reliability, all constructs demonstrate Cronbach's Alpha and Composite Reliability values above 0.70, indicating adequate internal consistency. Overall, the measurement model is considered reliable, although some indicators require refinement. Detailed outer loading results are presented in Table 4.

Discriminant And Convergent Validity

Convergent Validity

Convergent validity in this study was evaluated using outer loading, Composite Reliability (CR), and Average Variance Extracted (AVE) within the PLS-SEM framework. The results show that the constructs of Creativity Exploration, AI Ethics Challenge, and AI Effectiveness Challenge have AVE values of 0.744, 0.666, and 0.640, respectively, all exceeding the recommended threshold of 0.50, indicating adequate convergent validity. However, the AI Elaboration Fluency Challenge has an AVE value of 0.459, which is below the threshold, suggesting insufficient explanatory power. This result is consistent with the outer loading evaluation, where several indicators show low contributions. Therefore, further refinement of the measurement items, including possible indicator elimination, is recommended to improve construct validity.

Discriminant Validity

Discriminant validity ensures that each construct is empirically distinct and measures different concepts without overlap. In this study, it was assessed using the Fornell–Larcker criterion and the Heterotrait–Monotrait Ratio (HTMT) within the PLS-SEM framework. These approaches confirm that each construct has a higher correlation with its own indicators than with other constructs, indicating adequate discriminant validity. Furthermore, Table 5 shows that all constructs meet the recommended thresholds for Cronbach's Alpha and Composite Reliability, supporting the reliability of the measurement model.

Table 4. Outer Loadings

	Creativity Exploration (CRE)	AI Ethical Challenge(AIEct)	AI Effectiveness Challenge (AIEC)	AI Elaboration Fluency Challenge (AEFC)
AEFC1				0.36
AEFC2				0.66
AEFC3				0.919
AEFC4				0.739
AEFC5				0.58
AIEC1			0.819	
AIEC2			0.829	
AIEC3			0.699	
AIEC4			0.843	
AIEct1		0.742		
AIEct2		0.831		
AIEct3		0.81		
AIEct4		0.875		
CRE1	0.841			
CRE2	0.871			
CRE3	0.84			
CRE4	0.871			
CRE5	0.889			

Table 5. Construct Reliability & Validity

	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
Creativity Exploration (CRE)	0.915	0.935	0.936	0.744
AI Ethical Challenge (AIEct)	0.841	0.942	0.888	0.666
AI Effectiveness Challenge (AIEC)	0.826	0.895	0.876	0.64
AI Elaboration Fluency Challenge (AEFC)	0.805	1.212	0.797	0.459

Correlation

Correlation analysis was conducted to examine the direction and strength of relationships among latent constructs using a PLS-SEM correlation matrix. As shown in Table 6, Creativity Exploration has positive but weak correlations with AI Ethical Challenge (0.270), AI Effectiveness Challenge (0.179), and AI Elaboration Fluency Challenge (0.263), indicating limited associations.

In contrast, stronger relationships are observed among AI challenge constructs, with correlations of 0.622 between AI Ethical and AI Effectiveness Challenges, 0.460 between AI Ethical and AI Elaboration Fluency Challenges, and 0.499 between AI Effectiveness and AI Elaboration Fluency Challenges, reflecting moderate interrelationships. Furthermore, no

correlation value exceeds the threshold of 0.90, indicating the absence of multicollinearity. Therefore, the structural model is suitable for further hypothesis testing.

Table 6. Latent Variable Correlations

	Creativity Exploration (CRE)	AI Ethical Challenge (AIECt)	AI Effectiveness Challenge (AIEC)	AI Elaboration Fluency Challenge (AEFC)
Creativity Exploration (CRE)	1.000	0.270	0.179	0.263
AI Ethical Challenge (AIECt)	0.270	1.000	0.622	0.460
AI Effectiveness Challenge (AIEC)	0.179	0.622	1.000	0.499
AI Elaboration Fluency Challenge (AEFC)	0.263	0.460	0.499	1.000

Hypothesis Testing

Hypothesis testing in this study was conducted using the Partial Least Squares Structural Equation Modeling (PLS-SEM) approach with a bootstrapping procedure to evaluate the influence of each AI challenge construct on Creativity Exploration. The evaluation criteria included path coefficients (original sample), t-statistics, and p-values, with a significance level of 5% ($\alpha = 0.05$).

As presented in Table 7, the results show that the AI Ethical Challenge has a positive and significant effect on Creativity Exploration, with a path coefficient of 0.212, a t-statistics value of 2.884, and a p-value of 0.004. Since the t-statistics exceeds 1.96 and the p-value is below 0.05, this hypothesis is accepted.

In contrast, the AI Effectiveness Challenge shows a negative and non-significant effect on Creativity Exploration, with a path coefficient of -0.047 , a t-statistics value of 0.645, and a p-value of 0.519, indicating that the hypothesis is rejected. Similarly, the AI Elaboration Fluency Challenge shows a positive but non-significant effect, with a path coefficient of 0.189, a t-statistics value of 1.545, and a p-value of 0.122; thus, this hypothesis is also not supported.

Overall, the findings indicate that only the AI Ethical Challenge has a significant influence on Creativity Exploration. This suggests that ethical aspects play a more dominant role compared to technical challenges, such as AI effectiveness and elaboration fluency, in shaping students' creativity exploration.

Table 6. Path Coefficients

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (O/STDEV)	P values
AI Ethical Challenge (AIECt) > Creativity Exploration (CRE)	0.212	0.209	0.074	2.884	0.004
AI Effectiveness Challenge (AIEC) > Creativity Exploration (CRE)	-0.047	-0.023	0.074	0.645	0.519
AI Elaboration Fluency Challenge (AEFC) > Creativity Exploration (CRE)	0.189	0.191	0.123	1.545	0.122

Discussion

This study aims to analyze the influence of various challenges of using artificial intelligence (AI) on the exploration of creativity. The results show that not all dimensions of AI challenges have the same role in influencing creativity exploration. Specifically, only the AI Ethics Challenge was shown to have a significant effect, while the AI Effectiveness Challenge and the AI Elaboration Fluency Challenge did not show a significant impact. These findings provide additional insight into how AI interacts with human creative processes and underscore the importance of ethical aspects in the context of AI-based creativity.

a) AI Ethics Challenges to Creativity Exploration

The finding that the AI Ethical Challenge has a significant effect on the exploration of creativity shows that ethical issues are not solely barriers, but can serve as a trigger for cognitive reflection that drives the creative process. When individuals are faced with ethical questions such as the originality of the work, the ownership of ideas, the potential for algorithmic bias, as well as the responsibility of using AI, they tend to engage in more in-depth and reflective thought processes. This process can expand the space for exploring ideas and encourage more meaningful creativity. These results are in line with (Mukhtar et al., 2024) which states that ethical challenges in AI-based creativity often trigger a re-evaluation of the role of humans in the creative process, thus encouraging the emergence of new ideas. In addition, (Dwivedi et al., 2023) emphasize that ethical awareness in the use of AI, particularly in academic and research contexts, encourages users not to rely entirely on AI, but rather to position it as a cognitive partner that needs to be critically monitored.

In the context of education and creativity development, these findings are also supported by (Chan & Hu, 2023) and (Kasneji et al., 2023) who found that ethical concerns related to the use of generative AI actually increase students' reflective awareness of the learning process and idea creation. Thus, the AI Ethical Challenge can be understood as a factor that enriches the exploration of creativity through increased individual awareness, responsibility, and reflection.

b) The Challenges of AI's Effectiveness to Creativity Exploration

The results showed that the AI Effectiveness Challenge did not have a significant influence on the exploration of creativity. These findings indicate that AI's limitations in terms of accuracy, reliability, or relevance of output do not directly hinder the process of exploring ideas. One possible explanation is that users have developed adaptive abilities in utilizing AI as an aid, so that the limitations of AI effectiveness can be compensated for through human judgment and modification. These findings are in line with (Ali et al., 2024) and (Babina et al., 2024) who state that while AI plays a role in increasing efficiency and innovation, human creativity remains highly dependent on individual interpretive and decision-making abilities. In the context of entrepreneurship and innovation, (Sammet et al., 2024) also showed that AI is more often positioned as an operational supporter than a key determinant of creativity.

In addition, research (Ashkinaze et al., 2025) confirms that the limitations of AI-generated ideas do not necessarily reduce human creativity, as individuals tend to use AI output as a starting point, rather than a final solution. Therefore, the insignificance of the AI Effectiveness Challenge in this study reflects that exploratory creativity is more determined by the active role of humans than by the technical performance of AI itself.

c) The Challenges of Elaboration Fluency of AI to Creativity Exploration

Another interesting finding is the insignificance of the influence of the AI Elaboration Fluency Challenge on creativity exploration. This suggests that AI's difficulty in developing or

expanding ideas in depth does not directly limit users' creative exploration. One possible explanation is that the exploration of creativity has more to do with the early stages of the search and development of ideas, which are still heavily controlled by human intuition and experience. (Hwang & Wu, 2024) show that while AI can influence creative cognition, psychological factors such as self-efficacy and anxiety have a more dominant role in determining the extent to which individuals explore new ideas. These findings are also in line with (Baklaga, 2025) which states that AI tends to be more effective in supporting the structure and refinement of ideas, while the exploration of creativity remains dependent on human reflective and imaginative capacity.

In the context of entrepreneurship and design education, (Park et al., 2025) affirm that AI plays a role as a facilitator, not a substitute, in the creative process. Therefore, challenges in the elaboration fluency of AI do not necessarily hinder the exploration of creativity, as long as users have the ability to reflect and control over the creative process.

5. Conclusion

This study shows that the challenges of using Artificial Intelligence (AI) do not have a uniform impact on students' exploration of creativity. Of the three challenge dimensions tested, only the AI Ethics Challenge showed a significant influence, while the AI Effectiveness Challenge and the AI Elaboration Fluency Challenge did not show a significant influence partially. These findings indicate that students' exploration of creativity is likely not solely influenced by the technical limitations or performance of AI systems, but also related to the normative and reflective dimensions inherent in the user's ethical awareness. Further, ethical challenges can serve as reflective mechanisms that encourage prudence and intellectual responsibility in the process of exploring ideas (Dwivedi et al., 2023; Qadhi et al., 2024). Thus, the results of this study suggest that AI in the context of student entrepreneurship can be understood as part of a socio-technical system that shapes creativity through the interaction between technology, values, and human consciousness, not just through its technical capabilities. Simultaneously, while all three AI challenges have the potential to impact the exploration of creativity, the impact appears to be contextual and depends on how students interpret and manage the limitations of AI in practice. The partial insignificance of the technical dimension suggests that students may be able to adapt to the limitations of the effectiveness and fluency of AI elaboration through their own reflective capacity and cognitive control. These findings are in line with the literature that views exploratory creativity as the active domain of humans, while AI plays a role as a facilitator whose effectiveness is influenced by users' ethical attitudes and awareness (Park et al., 2025; Xie & Wang, 2025).

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