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Enhancing Students' Innovative Competence through Academic Creativity: An Analysis of The Role of Learning Innovation and Digital Literacy from The Perspective of Educational Management Based on the Componential Theory of Creativity

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Abstract: This study investigates the role of learning innovation and digital literacy in enhancing students' academic creativity and innovative competence in higher education, using Amabile's Componential Theory of Creativity as the theoretical lens. A quantitative survey design was employed, using a Likert-scale questionnaire as the main research instrument to measure learning innovation, digital literacy, academic creativity, and innovative competence. Data were collected from 100 undergraduate students in Karawang, West Java Province, selected through purposive sampling based on their experience with project-based and technology-integrated learning. This sample size is considered adequate because it fulfills the minimum requirement for SEM-PLS analysis, which allows reliable estimation even with relatively small samples. Structural Equation Modeling using SmartPLS was applied to examine causal relationships among variables. The findings reveal that learning innovation significantly influences academic creativity, while digital literacy enhances innovative competence both directly and indirectly through academic creativity. Academic creativity is confirmed as a strong predictor of innovative competence, although it does not mediate the effect of learning innovation. These results underscore digital literacy as a foundational driver of creativity-based innovation, aligning with the needs of the digital era. The study contributes theoretically by extending the application of creativity theory within the Indonesian higher education context and provides practical implications for universities to strengthen digital-based innovative learning and curriculum development.

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Introduction

In the era of ongoing digital disruption, higher education institutions are required to cultivate creativity and innovation as essential skills to face global challenges. The paradigm of education has shifted from a mere transfer of knowledge to strengthening critical thinking, problem-solving, collaboration, and digital literacy, which demands the presence of adaptive and innovative learning models. Higher education is no longer sufficient if it only focuses on curriculum achievement; instead, it must also encourage students to explore new ideas, integrate technology into learning, and transform their academic creativity into innovative competence that is relevant to the needs of the labor market and an increasingly competitive society (Ovbiagbonhia et al., 2019).

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On a global scale, innovative competence has become a key determinant of national competitiveness. Recent global analyses show that countries with strong innovation capabilities tend to achieve higher economic resilience and human-capital productivity (OECD, 2021). The 2023 UNESCO Global Education Monitoring Report likewise emphasizes that educational innovation supported by digital literacy is essential for preparing creative and adaptive learners in the era of the Fourth Industrial Revolution and Society 5.0 (UNESCO, 2023). These findings are reinforced by recent academic studies, which highlight that the integration of digital literacy into learning environments significantly improves students' creativity, problem-solving, and readiness for innovation-driven economies (Mahmud & Wong, 2022; Wu et al., 2025). In developed countries such as Finland, Japan, and South Korea, project-based learning, the utilization of digital technology, and cross-disciplinary collaboration have successfully enhanced students' ability to innovate in both academic and practical domains (Fujii et al., 2025; Nummela, 2021). Conversely, developing countries face challenges such as digital literacy gaps, limited facilities, and conventional teaching methods, which often result in students becoming passive recipients of knowledge rather than creators of new ideas (Ndibalema, 2025).

Within the national context, Indonesia continues to face significant challenges in improving students' innovative competence. World Bank data in 2022 revealed that Indonesia's innovation index still lags behind other ASEAN countries, particularly in the development of human resources based on creativity (World Bank, 2022). In many universities, learning is still heavily focused on cognitive aspects rather than stimulating creativity, preventing students from fully developing innovative ideas. Digital literacy issues also remain prominent; although internet access is expanding, its use to support learning innovation and academic development is still limited. As a result, students often use technology primarily for entertainment rather than as a medium to strengthen academic creativity.

This phenomenon is also evident at the provincial level, particularly in West Java, which is recognized as one of Indonesia's hubs for both industry and higher education. West Java holds significant potential in producing innovative human resources due to the large number of universities and the support of its creative industry ecosystem. However, a 2023 report by the West Java Education Office revealed that the integration of digital literacy into learning practices in most universities remains low (Winarto, 2023). While the majority of students are familiar with digital technology, they are not yet accustomed to utilizing it for academic innovation, such as creative research, digital scientific publications, or technology-based projects. This situation creates a gap between the needs of industries, which demand creative and innovative graduates, and the outcomes of higher education, which still lean toward conventional approaches.

In a more specific scope, this phenomenon is also evident in higher education institutions in Karawang Regency. As the largest industrial area in Indonesia, Karawang requires graduates who not only possess technical skills but also innovative competence to address the challenges of the manufacturing, technology, and creative sectors. However, the reality shows that students in several universities in Karawang still face limitations in developing academic creativity (Raka, 2024). The learning models implemented are often one-directional and lack digital exploration, while the available digital literacy facilities have not been fully optimized. As a result, students are less encouraged to develop innovative ideas that can be applied in the workforce or entrepreneurship.

To address this issue, this study employs the Componential Theory of Creativity proposed by Amabile (1983), which posits that creativity results from the interaction of three

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components: domain-relevant skills, creativity-relevant skills, and intrinsic motivation. In the context of higher education, learning innovation primarily strengthens creativity-relevant skills—such as flexible thinking, experimentation, and collaborative problem-solving—while digital literacy contributes to the development of domain-relevant skills that enable students to access, analyze, and transform information using digital technologies. Previous studies have examined parts of this process. Arifatin (2023) demonstrated that project-based learning enhances students' creative thinking, and Heilporn et al. (2021) found that blended learning increases student engagement. However, these studies treat learning innovation as an independent pedagogical factor and do not incorporate digital literacy as a complementary capability that enables students to fully actualize their creativity in technology-rich environments. As a result, they overlook the role of technological competence in amplifying or enabling the creative processes triggered by innovative learning.

Conversely, studies focusing on digital literacy, such as Jaya & Nurqamarani (2023) and Mahmud & Wong (2022), show that digital proficiency improves students' ability to complete technology-based academic tasks and prepares them for 21st-century learning demands. Yet these studies do not examine how digital literacy interacts with pedagogical innovation or contributes to the formation of academic creativity itself. They treat digital literacy mainly as a functional skill rather than a factor that can stimulate creative thinking when paired with innovative learning environments. These limitations collectively reveal a clear research gap: existing literature tends to isolate learning innovation and digital literacy rather than examine how the two jointly contribute to creativity. Integrating both variables within Amabile's theoretical framework is therefore significant theoretically, because creativity emerges from the interplay of multiple skill components, and practically, because modern higher education increasingly requires students to navigate innovative learning designs through digital tools. Understanding this interaction provides a more comprehensive explanation of how academic creativity develops and how it transforms into innovative competence.

Based on this discussion, the objective of this research is to analyze how learning innovation and digital literacy contribute to the enhancement of students' academic creativity and, consequently, to their innovative competence, using the Componential Theory of Creativity as the underlying framework. Within this framework, learning innovation is operationalized as an instructional condition that develops creativity-relevant skills, such as divergent thinking, experimentation, and collaborative problem-solving. Digital literacy is conceptualized as a form of domain-relevant skills, equipping students with the technological knowledge and information-processing abilities necessary to generate and refine creative ideas. Academic creativity, in turn, reflects the interaction of these components, while intrinsic motivation is embedded in students' engagement with project-based and technology-integrated learning environments. By focusing on university students in Karawang, this study is expected to offer empirical evidence that enriches the literature on creativity and innovation in higher education. Practically, the findings provide direction for developing educational management policies that integrate pedagogical innovation and digital competence, enabling universities to better respond to the demands of the digital era and the evolving needs of both local and global industries.

Research Method

This study employed a quantitative approach to objectively and systematically assess the relationships among variables using numerical data that are empirical, rational, and statistically testable. This approach was selected to examine the influence of learning

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innovation and digital literacy on students' innovative competence, with academic creativity functioning as a mediating variable within the Componential Theory of Creativity. Data were collected using an online Likert-scale questionnaire. The instrument was developed by adapting and modifying indicators from previously validated scales, including learning innovation items based on Heilporn et al. (2021), digital literacy indicators adapted from Mahmud & Wong (2022), academic creativity items modified from Amabile's (1983) creativity components, and innovative competence measures adapted from Ovbiagbonhia et al. (2019). All items were adjusted to suit the higher education context in Karawang. To ensure content validity, the instrument underwent expert review by three specialists in educational management, instructional technology, and psychometrics, who evaluated the clarity, relevance, and alignment of each item with its construct. Revisions were made based on their feedback. Additionally, a pilot test was conducted with 30 students who met the inclusion criteria, and the results confirmed that all items met preliminary validity and reliability thresholds, making the instrument appropriate for full-scale data collection.

The population of this study consisted of undergraduate students enrolled in higher education institutions in Karawang between 2022 and 2025 who were actively involved in technology-integrated academic activities and exposed to various innovative learning practices. The sample was selected using purposive sampling based on the following inclusion criteria: (1) active enrollment in undergraduate programs in Karawang; (2) experience with innovative learning methods such as project-based learning, blended learning, or other creativity-oriented instructional practices; (3) active use of digital technology to support academic or research-related activities; and (4) engagement in creativity-driven assignments or academic projects. Out of 133 students who completed the questionnaire, 100 respondents who met all inclusion criteria were retained as the final research sample. The final sample size is methodologically adequate for PLS-SEM. According to Hair et al. (2021), PLS-SEM is appropriate for studies with relatively small samples, and minimum sample adequacy can be assessed using the 10-times rule, which requires at least ten times the largest number of structural paths directed at a single endogenous construct. In this model, the maximum number of predictors for any endogenous variable is two, indicating a minimum requirement of 20 cases. Additionally, power-analysis guidelines recommend between 50–100 observations to achieve stable parameter estimates in PLS-SEM. Thus, a sample of 100 respondents satisfies both criteria and ensures sufficient statistical power.

The data were analyzed using Structural Equation Modeling with the Partial Least Squares (SEM-PLS) technique through SmartPLS 4.0, selected for its effectiveness in handling complex models and its robustness with limited sample sizes. The analysis included both the measurement (outer) and structural (inner) models. In the outer model, validity and reliability were assessed through convergent validity—using factor loadings (> 0.70) and Average Variance Extracted (AVE > 0.50)—discriminant validity based on the Fornell–Larcker criteria and cross-loadings, and construct reliability through Composite Reliability (CR > 0.70) and Cronbach's Alpha (CA > 0.70) as recommended by Hair et al. (2021). All constructs met these thresholds, indicating satisfactory validity and reliability. The inner model evaluation involved calculating R-square values to determine explanatory power and Q-square values to assess predictive relevance, followed by hypothesis testing to examine the significance of direct and indirect relationships among learning innovation, digital literacy, academic creativity, and innovative competence within the proposed conceptual framework.

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Table 1. Characteristics of the Respondents

Respondents' Characteristics	Category	Number (n=100)	Percentage (%)
Gender	Male	45	45%
	Female	55	55%
Age	18–19 years	20	20%
	20–21 years	50	50%
	22–23 years	25	25%
	≥ 24 years	5	5%
Institution	Universitas Singaperbangsa	62	62%
	Universitas Pelita Bangsa	30	30%
	Universitas BSI	8	8%
Study Program	Education	30	30%
	Engineering/Informatics	25	25%
	Economics/Management	20	20%
	Social Sciences & Humanities	25	25%
Experience with Learning Innovation	Experienced project-based learning / blended learning	70	70%
	Have not experienced intensively	30	30%
Level of Digital Literacy (Self-Assessment)	High (able to optimize digital technology for academic purposes)	40	40%
	Medium (able to use technology with guidance)	45	45%
	Low (mostly using technology for entertainment)	15	15%
Engagement in Academic Creativity	Active in research, innovation competitions, publications, or creative projects	35	35%
	Fairly active (coursework based on creativity)	50	50%
	Less active	15	15%
Location	Karawang	100	100%

Based on respondents' characteristics, the majority of students in this study were female (55%), with the largest age group being 20–21 years old (50%), indicating that most respondents were in the middle phase of their undergraduate studies. In terms of institution, the highest number of respondents came from Universitas Singaperbangsa Karawang (62%), which is the largest and most dominant higher education institution in the Karawang region. By study program, the largest proportion came from the Education field (30%), showing that students in educational disciplines were more involved compared to other study areas. Experience with learning innovation was dominated by students who had engaged in project-based or blended learning (70%), suggesting significant exposure to modern teaching methods that foster creativity. Regarding digital literacy, most respondents assessed themselves at a medium level (45%), indicating that they were capable of using digital technology effectively, although still requiring some guidance. Academic creativity engagement was highest at the fairly active category (50%), meaning that students frequently engaged in creativity-based coursework, even if not all participated in competitions or publications. All respondents were located in Karawang (100%), aligning with the local context focus of this research.

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Results and Discussion

Outer Model

The first stage in SEM-PLS analysis is to evaluate the outer model to ensure that each construct in the study meets the criteria of validity and reliability. This evaluation is essential to guarantee that the data obtained is consistently and accurately measured, thereby providing a valid foundation for the subsequent structural analysis stage.

Convergent Validity

Convergent validity aims to assess the extent to which the indicators within a construct are strongly correlated with one another. The criterion used is that the loading factor value must be greater than 0.70. If an indicator exceeds this threshold, it can be concluded that the indicator consistently represents its construct. Based on the results of the analysis using SmartPLS 4.0, all indicators in the constructs of Learning Innovation, Digital Literacy, Academic Creativity, and Innovative Competence show loading factor values above 0.70. This indicates that the criterion for convergent validity has been satisfactorily met (see Table 2).

Discriminant Validity

Discriminant validity is tested by comparing the square root of the Average Variance Extracted (AVE) for each construct with the correlations between constructs. If the square root of AVE is higher than the inter-construct correlation values, it can be concluded that the construct possesses conceptual uniqueness and does not overlap with other constructs. The calculation results show that all constructs in this study have square root AVE values greater than their inter-construct correlations. Therefore, discriminant validity is fulfilled, and each construct demonstrates clear conceptual differentiation (see Table 3).

Reliability Test

The reliability test is conducted by examining the values of Cronbach's Alpha and Composite Reliability. The minimum required threshold is 0.60 to state that a construct is reliable. The analysis results indicate that all constructs in this study have Cronbach's Alpha and Composite Reliability values above 0.60. This means that the research instrument meets the criteria of internal consistency and can be considered a stable and reliable measurement tool for assessing the indicators of each construct (see Table 2).

Table 2. Measurement Model Analysis

Construct	Indicator	Loading Factor	AVE	Cronbach's Alpha	Composite Reliability
Learning Innovation	LI.1	0.82	0.68	0.83	0.87
	LI.2	0.85			
	LI.3	0.79			
Digital Literacy	DL.1	0.84	0.70	0.85	0.89
	DL.2	0.87			
	DL.3	0.81			
Academic Creativity	AC.1	0.86	0.72	0.88	0.91
	AC.2	0.83			
	AC.3	0.85			
Innovative Competence	IC.1	0.88	0.74	0.89	0.92
	IC.2	0.84			
	IC.3	0.87			

Table 3. Discriminant Validity

Construct	Learning Innovation	Digital Literacy	Academic Creativity	Innovative Competence
Learning Innovation	**0.824**			

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Digital Literacy	0.652	**0.836**		
Academic Creativity	0.688	0.701	**0.849**	
Innovative Competence	0.674	0.721	0.745	**0.860**

Inner Model

In the next stage of SEM-PLS analysis, the evaluation focuses on the inner model to assess the predictive power and causal relationships among variables. Several key indicators are used, including R-Square, Q-Square Predictive Relevance, and hypothesis testing of the formed path coefficients. This evaluation aims to ensure the extent to which Learning Innovation and Digital Literacy influence students' Academic Creativity, which in turn drives the enhancement of Innovative Competence in accordance with the framework of the Componential Theory of Creativity.

R-Square

The R-Square value is used to indicate the proportion of variance in the endogenous variable that can be explained by the exogenous variables. Referring to the results in Table 4, the R-Square for Academic Creativity is 0.612, meaning that 61.2% of the variation in students' Academic Creativity can be explained by Learning Innovation and Digital Literacy, while the remaining 38.8% is influenced by other factors outside the model. Meanwhile, the R-Square for Innovative Competence is 0.587, which indicates that 58.7% of the variance in Innovative Competence can be explained by Learning Innovation, Digital Literacy, and Academic Creativity. These values suggest that the model has a good explanatory power and is capable of capturing causal relationships among variables with an adequate level of predictability (see Table 4).

Q^2 Predictive Relevance

To assess the predictive relevance of the model, the Q^2 value is calculated using the following formula:

$$Q2 = 1 – (1 – R12) \times (1–R22)$$
$$Q2 = 1 – (1 – 0.612) \times (1–0.587)$$
$$Q2 = 1– (0.388 \times 0.413)$$
$$Q2 = 1 – 0.160$$
$$Q2 = 0.840$$

The Q^2 value of 0.840 (> 0) indicates that this research model possesses very strong predictive relevance, making it reliable for explaining the influence of Learning Innovation and Digital Literacy on students' Academic Creativity and Innovative Competence.

Hypothesis Testing

Hypothesis testing is conducted through the analysis of the significance of path coefficients, considering p-values (< 0.05) and t-values (> 1.96). The test results, summarized in Table 5, show that all primary paths are significant, except for one mediating path that is not significant. This reinforces the validity of the conceptual framework based on the Componential Theory of Creativity, which posits that students' innovative competence is formed through a combination of internal factors (academic creativity) and external factors (learning innovation and digital literacy).

Table 4. R-Square Test

No	Endogenous Variable	R-Square
1	Academic Creativity (AC)	0.612
2	Innovative Competence (IC)	0.587

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Table 5. Hypothesis Testing Results

Hypothesis	Path Relationship	Path Coefficient	T Value	P Values	Decision
H1	Learning Innovation → Academic Creativity	0.284	4.379	0.002	**Accepted**
H2	Digital Literacy → Academic Creativity	0.267	3.927	0.004	**Accepted**
H3	Academic Creativity → Innovative Competence	0.417	5.842	0.000	**Accepted**
H4	Learning Innovation → Academic Creativity → Innovative Competence	0.093	1.624	0.105	**Rejected**
H5	Digital Literacy → Academic Creativity → Innovative Competence	0.163	3.211	0.001	**Accepted**

Based on the hypothesis test results presented in Table 5, the path from Learning Innovation to Academic Creativity shows a path coefficient of 0.284, a T Value of 4.379, and a P Value of 0.002, indicating that hypothesis H1 is supported. This finding confirms that learning innovation has a positive and significant effect on enhancing students' academic creativity. Examined through its indicators, learning innovation, manifested through the implementation of new methods (such as project-based learning and blended learning), the utilization of learning technologies (such as interactive digital platforms), and the strengthening of collaboration in the academic process effectively encourages students to generate new ideas, develop interdisciplinary concepts, and create applicable innovations. This is further supported by respondent demographic data, where 70% of students have previously participated in project-based or blended learning, meaning that the majority of respondents have had direct experience with innovative learning methods, thereby stimulating their academic creativity more than those without such experience.

These findings align with the Componential Theory of Creativity, which posits that creativity emerges from the interaction of domain-relevant skills, creativity-relevant skills, and intrinsic motivation shaped by environmental conditions (Amabile, 1983). The significant positive effect of learning innovation on academic creativity empirically demonstrates the activation of creativity-relevant skills, as innovative learning methods expose students to challenging tasks, collaborative problem-solving, and opportunities for divergent thinking. At the same time, the availability of technology-enhanced learning environments reflects an environmental support component that fosters intrinsic motivation by encouraging exploration and creative risk-taking. This direct relationship observed in the statistical model confirms that learning innovation functions not merely as a pedagogical strategy but as a structured stimulus that cultivates the cognitive and motivational prerequisites for creativity. Furthermore, these results extend Amabile's framework by showing how technology-integrated instructional practices, such as project-based learning and blended learning, create conditions under which students' creativity-relevant skills translate into measurable academic creativity outcomes. This reinforces findings from previous studies showing that technology-enhanced collaboration increases student engagement in generating academically valuable creative products (Shadiev et al., 2022). Theoretically, the study contributes by empirically demonstrating that innovative learning environments can serve as a catalyst that strengthens the synergy between domain knowledge, creative skills, and intrinsic motivation, thereby enabling students to reach higher levels of academic creativity relevant to the digital era.

Based on the hypothesis test results in Table 5, the path from Digital Literacy to Academic Creativity shows a path coefficient of 0.267, a T Value of 3.927, and a P Value of

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0.004, indicating that hypothesis H2 is supported. These results confirm that digital literacy has a positive and significant effect on students' academic creativity. When examined through its indicators, digital literacy reflected in digital access skills (such as using online references and academic platforms), utilization of academic applications (e.g., Google Scholar, Moodle, or ResearchGate), and awareness of digital ethics (such as academic honesty and responsible data usage) effectively enables students to generate new ideas, develop cross-disciplinary concepts, and create applicable innovations relevant to both academic and social needs. This is supported by respondent demographic data showing that most students have moderate (45%) and high (40%) digital literacy levels, indicating that the majority are capable of using digital technology not only for entertainment but also to optimize academic activities that directly impact creativity.

These findings are in line with the Componential Theory of Creativity, which explains that creativity develops when individuals possess domain-relevant skills and creative thinking abilities supported by intrinsic motivation and a conducive environment (Amabile, 1983). In this context, digital literacy serves as a source of domain-relevant skills, enabling students to access knowledge, process information, and integrate it into innovative new concepts. Previous research also demonstrates that digital literacy stimulates creative thinking processes because students have broader access to cross-disciplinary ideas, facilitating the creation of applicable innovations (Wu et al., 2025). Therefore, digital literacy can be considered a strategic foundation linking technology with academic creativity, preparing students to better face academic and professional challenges in the digital era.

Based on the hypothesis test results in Table 5, the path from Academic Creativity to Innovative Competence shows a path coefficient of 0.417, a T Value of 5.842, and a P Value of 0.000, indicating that hypothesis H3 is supported. This finding demonstrates that academic creativity has a positive and significant effect on students' innovative competence. Examined through its indicators, academic creativity, manifested through the ability to generate new ideas, develop interdisciplinary concepts, and create applicable innovations, effectively encourages students to develop innovative products, adapt knowledge according to needs, and produce more sustainable projects. Respondent demographic data also supports this finding, with 35% of students actively engaged in research, innovation competitions, publications, or creative projects, and 50% moderately active through creativity-based coursework, indicating that the majority of respondents have practical experience in honing creativity, which directly strengthens their innovative competence.

This finding aligns with the Componential Theory of Creativity, which emphasizes that creativity leads to innovation when domain-relevant skills, creativity-relevant skills, and motivation are supported by the environment (Amabile, 1983). In this context, academic creativity serves as a cognitive process that enables students to transform creative ideas into innovative competence in the form of products, projects, or adaptations with sustainability. Previous studies also indicate that a high level of academic creativity enhances individuals' innovative capabilities to produce new solutions applicable in both educational and industrial contexts (Kim et al., 2017). Therefore, academic creativity can be considered a crucial foundation for the development of innovative competence, essential for meeting the demands of a dynamic era and workforce.

Based on the hypothesis test results in Table 5, the mediating path from Learning Innovation → Academic Creativity → Innovative Competence shows a path coefficient of 0.093, a T value of 1.624, and a P value of 0.105, indicating that hypothesis H4 is rejected. This suggests that although learning innovation significantly enhances academic creativity, this improvement is not strong enough to translate into students' innovative competence. In

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other words, students' exposure to new instructional methods, technology-supported learning activities, and collaborative environments does not automatically enhance their ability to transform creative ideas into innovative products, knowledge applications, or sustainable projects.

A deeper examination reveals several contextual and methodological factors that may explain why academic creativity fails to mediate this relationship. Within the Componential Theory of Creativity, creativity emerges from the interaction of domain-relevant skills, creativity-relevant skills, and intrinsic motivation (Amabile, 1983). While learning innovation may successfully stimulate creativity-relevant skills, the development of innovative competence requires stronger domain knowledge and motivational drive than creativity alone can provide. In the Indonesian higher-education context, particularly in regions like Karawang, students often face limited institutional support, restricted access to innovation facilities, and assessment systems that prioritize task completion over experimentation, which may weaken the intrinsic motivation component necessary for moving from idea generation to innovation.

Cultural dynamics may also contribute. In collectivist environments, students may be less inclined to take creative risks or challenge established norms, which can inhibit the translation of creativity into innovation. Methodologically, the measurement of academic creativity relied on self-reported perceptions, which may capture students' confidence in generating ideas but not their actual ability to implement or refine them. This aligns with research that argues that creativity does not automatically yield innovation without the support of deep knowledge integration, applied experience, and opportunities for real-world implementation (Baer et al., 2023; del-Corte et al., 2016). Thus, in this study, academic creativity operates as a weak mediator, indicating that the relationship between learning innovation and innovative competence may be more effectively explained through the direct pathway rather than through the indirect effect of academic creativity.

Based on the hypothesis test results in Table 5, the mediating path from Digital Literacy → Academic Creativity → Innovative Competence shows a path coefficient of 0.163, a T Value of 3.211, and a P Value of 0.001, indicating that hypothesis H5 is supported. This finding demonstrates that academic creativity positively and significantly mediates the effect of digital literacy on students' innovative competence. In other words, students with higher digital literacy—which includes digital access to learning resources, optimal use of academic applications, and awareness of digital ethics—are more likely to generate new ideas, develop interdisciplinary concepts, and create applicable innovations, which in turn contribute to the development of innovative competence in the form of innovative products, knowledge adaptations, and sustainable projects. This is further supported by respondent demographic data, showing that the majority of students have moderate (45%) to high (40%) digital literacy levels, indicating that they are capable of leveraging digital technology to enhance their academic creativity before further developing more mature, innovative competence.

These findings align with the Componential Theory of Creativity, which explains that creativity functions as a bridging mechanism between domain-relevant skills represented here by students' digital literacy and innovative achievement (Amabile, 1983). Digital literacy equips students with domain-relevant knowledge that allows them to access, process, and utilize information effectively, while academic creativity serves as the transformative capacity through which this knowledge is converted into novel and applicable solutions. Previous research also highlights that high digital literacy enhances academic performance and, when paired with strong creative abilities, produces more sustainable innovative

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competence (Wu et al., 2025) and (Atrup et al., 2023). Given that learning innovation alone does not automatically lead to innovative competence unless it is supported by creativity, these findings underscore a critical implication for universities. Institutions must not only implement innovative learning models but also intentionally cultivate the creative processes that enable students to transform these learning experiences into meaningful innovation. This includes designing learning environments that strengthen divergent thinking, providing structured opportunities for experimentation and risk-taking, integrating digital tools that promote creative problem-solving, and offering mentorship or project-based platforms where creative ideas can be developed into tangible outputs. By strategically aligning digital literacy development with creativity-enhancing pedagogies, universities can more effectively prepare students to achieve higher levels of innovative competence and meet the evolving demands of the digital era.

Conclusion

This study demonstrates that learning innovation and digital literacy play a crucial role in enhancing students' academic creativity, which in turn strengthens their innovative competence. SEM-PLS results indicate that learning innovation significantly influences academic creativity, while digital literacy not only has a direct effect but is also positively mediated by academic creativity to produce higher levels of innovative competence. Academic creativity serves as a key factor linking digital-based cognitive abilities with applicable innovative competence. The mediating path from learning innovation to innovative competence through academic creativity was not significant, suggesting that innovative learning experiences are not fully internalized without intrinsic motivation and additional practical skills. Theoretically, these findings extend the application of Amabile's Componential Theory of Creativity (1983) in the context of Indonesian higher education, emphasizing digital literacy as domain-relevant skills that form an epistemological foundation for academic creativity and sustainable innovation. Practically, higher education institutions are encouraged to integrate digital literacy into the curriculum as a medium for generating creative academic ideas. Instructors should implement interactive learning innovations such as project-based learning and blended learning, and policymakers can expand student access to digital literacy to better align with labor market demands and the creative industry.

Recommendation

Future research is recommended to expand the sample across different regions and types of higher education institutions, adopt a mixed-methods approach such as interviews, FGDs, or case studies to gain deeper insight into how academic creativity is transformed into innovative competence, and incorporate additional variables, including intrinsic motivation, instructor support, cross-disciplinary collaboration, and the broader academic ecosystem. For educational practice, higher education institutions should strengthen digital-based innovative learning, develop continuous digital literacy programs that emphasize digital ethics, research collaboration, and technology-supported scholarly production, and increase industry involvement in student projects to ensure that academic creativity is directly linked to workplace-relevant innovative competence. For lecturers, these findings imply the need to design learning activities that intentionally stimulate creativity through authentic problem-solving, iterative feedback, and opportunities for experimentation, as well as to integrate digital tools that support creative knowledge construction. For curriculum developers, the results highlight the importance of embedding creativity and innovation outcomes explicitly

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into course learning objectives, aligning curricula with digital literacy competencies, and ensuring that assessment systems evaluate not only content mastery but also creative processes and innovation capacity. Such strategic alignment can better equip students to translate digital literacy and learning innovation experiences into meaningful and applicable innovative competence.

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