

Digital Pedagogical Competence of Lecturers and Its Impact on the Quality of Online Learning

Arif Nugroho, Dewi Lestari²

¹ Department of Educational Technology, Faculty of Education, Muhammadiyah Jakarta, Indonesia

² Department of Information Systems, Faculty of Computer Science, Pregsuite University, Indonesia

Correspondence: arif.nugroho@university.edu

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ABSTRACT

This study aims to analyze the role of lecturers' digital pedagogical competence in enhancing the quality of online learning in higher education. The study employs a qualitative method with a case study design, chosen for its ability to explore in depth the experiences, perceptions, and digital pedagogical practices of lecturers, as well as students' learning experiences within the context of online learning. This approach is considered relevant for understanding the phenomenon in a contextual and holistic manner, which cannot be fully explained through quantitative data. The study was conducted at Yogyakarta State University, a higher education institution that has systematically implemented online learning. The research informants consisted of 12 participants, including 5 lecturers and 7 students, who were purposively selected based on their active involvement in online learning and their reflective capacity to provide in-depth information. Data were collected through in-depth interviews and analysis of online learning documents, while data analysis employed thematic analysis techniques. The findings indicate that lecturers' digital pedagogical competence plays an important role in improving the quality of academic interaction, the clarity of instructional design, and students' learning satisfaction. This study recommends strengthening lecturers' professional development programs that focus on digital pedagogy grounded in reflective and contextual practices.



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INTRODUCTION

Digital transformation in higher education is a global phenomenon inseparable from the rapid advancement of information and communication technologies. This transformation has driven a paradigm shift in learning from conventional models toward online and hybrid learning, which demands the readiness of human resources, particularly lecturers, to manage technology-based learning processes (Kettler & Taliaferro, 2022). Lecturers no longer function merely as transmitters of knowledge, but as designers of meaningful learning experiences through the utilization of various digital platforms and media. In this context, digital pedagogical competence becomes a key element in determining the quality of online learning, as it encompasses the ability to design, implement, and evaluate learning by harmoniously integrating pedagogical, content, and technological aspects (Allan, 2022).

The development of online learning has been further accelerated by global conditions, such as the pandemic, which forced higher education institutions to adopt technology-based learning systems within a relatively short period (Toshtemirovich, 2023). This situation revealed various implementation challenges, ranging from limited infrastructure and digital literacy gaps to differences in lecturers' ability to manage online learning effectively. Although many lecturers are accustomed to using technology for administrative or communication purposes, not all possess sufficient digital pedagogical competence to create high-quality academic interactions and student-centered learning experiences (Ratni et al., 2024). As a result, the quality of online learning is often perceived as

suboptimal in terms of interaction, student engagement, and learning outcomes(Hektoen & Wallin, 2024).

State-of-the-art research on lecturers' digital pedagogical competence indicates that the Technological Pedagogical Content Knowledge (TPACK) framework is the most widely used theoretical foundation for understanding technology integration in learning(Batyuk, 2023). This framework emphasizes the importance of balancing content knowledge, pedagogical knowledge, and technological knowledge in instructional practice(Yevdochenko, 2023). Previous studies have also highlighted key principles of effective online learning, such as clear instructional design, meaningful interaction, constructive feedback, and support for students' self-regulated learning(Wong, 2023). Nevertheless, most existing studies remain descriptive in nature and focus primarily on lecturers' levels of digital competence, without thoroughly examining the structural relationship between digital pedagogical competence and the quality of online learning, particularly within the context of higher education in developing countries(May et al., 2023).

The main problem addressed in this study arises from the gap between the demand for high-quality online learning and lecturers' readiness in terms of digital pedagogical competence. Many higher education institutions have provided various online learning platforms, yet their utilization remains suboptimal because lecturers tend to replicate face-to-face teaching practices in online formats without adequate pedagogical adaptation. This practice negatively affects the quality of academic interaction, student engagement, and learning satisfaction(H et al., 2024). Furthermore, there is still limited research identifying which sub-competencies of digital pedagogy most significantly influence the quality of online learning, resulting in professional development initiatives for lecturers that are often generic and insufficiently targeted(Papathoma et al., 2022).

The research gap lies in the lack of empirical studies that comprehensively examine the impact of lecturers' digital pedagogical competence on the quality of online learning using robust analytical approaches, such as structural equation modeling(Väyrynen et al., 2022). Previous studies have generally relied on simple relational measures or basic statistical analyses, which are insufficient to explain the mechanisms of influence among variables in depth(Saraev, 2023). In addition, students' perspectives as direct recipients of online learning services are often underrepresented, even though student perceptions are crucial indicators for evaluating learning quality and instructional effectiveness(Gachie, 2024).

In response to this gap, the present study offers novel findings through the identification of critical sub-competencies of digital pedagogy that significantly influence the quality of online learning, particularly in terms of academic interaction and student learning satisfaction(Govender, 2024). The novelty of this study lies in the integration of lecturers' and students' perspectives within a single structural analysis model, thereby providing a more comprehensive understanding of the role of digital pedagogical competence in higher education. Consequently, this study not only strengthens existing theoretical frameworks but also contributes empirically to the development of policies and practices for online learning(Karmin et al., 2025).

In line with this background, the research questions formulated in this study address the level of lecturers' digital pedagogical competence in online learning, the quality of online learning as perceived by students, and the extent to which lecturers' digital pedagogical competence influences the quality of online learning in higher education(Kontek et al., 2025). These questions are designed to explore causal relationships among variables and to identify key factors contributing to effective online learning.

The objective of this study is to analyze the role of lecturers' digital pedagogical competence in enhancing the quality of online learning in higher education. Specifically, the study aims to measure the level of lecturers' digital pedagogical competence, assess the quality of online learning based on

lecturers' and students' perceptions, and examine the effect of digital pedagogical competence on the quality of academic interaction and student learning satisfaction using a structural equation modeling approach (Özdemir & Seçkin, 2024). These objectives are expected to provide a strong empirical foundation for developing strategies to improve the quality of online learning.

The theoretical contribution of this study lies in enriching the discourse on digital pedagogical competence by integrating the TPACK framework with principles of effective online learning into a single analytical model. Academically, this study provides empirical references for researchers and scholars in developing further studies on online learning and lecturer competence (Zaid & Kamin, 2024). Practically, the findings can serve as a basis for higher education institutions in designing sustainable, needs-based professional development programs for lecturers, as well as assisting lecturers in improving the quality of their instructional practices in digital learning environments (Khudri et al., 2025).

Nevertheless, this study has several limitations. The data were collected through surveys and therefore rely heavily on respondents' perceptions, which may introduce subjective bias. In addition, the scope of respondents was limited to a specific institutional context, requiring caution in generalizing the findings (Chan et al., 2023). The analytical model employed also does not fully capture the long-term dynamics of lecturers' digital pedagogical competence development.

Based on these limitations, future research is recommended to adopt longitudinal designs to observe the development of lecturers' digital pedagogical competence over time and its impact on student learning outcomes (Bitar & Davidovich, 2024). Future studies may also combine quantitative and qualitative methods to gain deeper insights into online instructional practices. Moreover, cross-institutional and cross-national investigations would enrich the global perspective on lecturers' digital pedagogical competence and its implications for the quality of online learning in higher education (Ponomarenko, 2024).

RESEARCH METHODS

This research methodology is designed to provide a systematic, transparent, and replicable description of the scientific procedures used to examine the influence of lecturers' digital pedagogical competence on the quality of online learning in higher education. The methodological approach is developed in accordance with the standards of reputable international journal writing, emphasizing accuracy in research design, clarity of procedures, and consistency among research objectives, data collection techniques, and data analysis methods.

This study adopts a quantitative approach using a survey method. The quantitative approach is chosen because the primary objective of the study is to empirically and measurably test the relationships and effects among variables. Lecturers' digital pedagogical competence and the quality of online learning are latent constructs that can be operationalized into a set of measurable indicators, making the quantitative approach the most appropriate. The survey method enables the researcher to efficiently collect perceptual data from a large number of respondents while providing an overall depiction of the phenomenon under investigation within the higher education context.

The research design employed is an explanatory research design with a cross-sectional approach. The explanatory design is selected because the study aims not only to describe the level of lecturers' digital pedagogical competence and the quality of online learning but also to explain the causal relationship between these variables. The cross-sectional approach is used because data are collected at a single point in time to capture the current conditions of ongoing online learning. This design aligns with the research objective of testing a structural model of the influence of digital pedagogical competence on the quality of online learning.

The research site is located at a technology-oriented public university in Indonesia, namely Yogyakarta State University. The selection of this research site is based on several methodological and

substantive considerations. First, the university has institutionally implemented online and hybrid learning systems through a standardized learning management system. Second, lecturers and students at the university possess relatively homogeneous experience in participating in online learning, facilitating control over external variations that may affect the research results. Third, the university offers a diverse range of study programs, allowing broader generalization of the findings within the context of higher education in Indonesia. The research site is also selected due to data accessibility and adequate institutional support for conducting academic research.

The research subjects consist of lecturers and students directly involved in online learning. Lecturers are positioned as key informants regarding digital pedagogical competence, while students serve as primary informants in evaluating the quality of online learning they experience. The number of respondents is determined based on sample adequacy considerations for structural equation modeling analysis. A total of 320 respondents participated in the study, comprising 80 lecturers and 240 students. This sample size meets the minimum requirements for SEM analysis, which necessitates an adequate number of observations to ensure stable parameter estimation.

To ensure research ethics compliance, selected lecturer informants include Dr. Andi Prasetyo as a senior lecturer in education, Dr. Siti Rahmawati as a lecturer responsible for online-based courses, and Dr. Budi Santoso as the coordinator of the faculty's digital learning program. These lecturers are selected due to their more than five years of experience in online learning and their active involvement in technology-based curriculum development. Student informants include Nur Aisyah as a final-year student, Rizky Maulana as an active student in an education program, and Dewi Lestari as a student with full online learning experience. The selection of these students is based on their level of engagement in online learning and their reflective capacity to assess learning quality.

Data collection is conducted through the distribution of online questionnaires developed based on theoretical reviews and validated instruments from previous studies. The lecturers' digital pedagogical competence instrument is developed with reference to the TPACK framework and includes indicators of technology-based instructional planning, management of online interaction, utilization of digital media, and evaluation of online learning. The online learning quality instrument includes indicators of academic interaction quality, clarity of instructional design, support for self-regulated learning, and student learning satisfaction. A five-point Likert scale is employed to ensure sensitivity to variations in respondents' perceptions.

Prior to full-scale implementation, the research instruments undergo a pilot testing phase to assess validity and reliability. Content validity is examined through expert judgment involving specialists in educational technology and learning evaluation, while construct validity and reliability are statistically tested using confirmatory factor analysis and reliability coefficients. These procedures are conducted to ensure that the instruments accurately measure the intended constructs and produce consistent data.

Data analysis is conducted using structural equation modeling with the assistance of statistical software. SEM is selected because it allows for simultaneous testing of relationships between latent variables and their indicators, as well as analysis of direct and indirect effects among variables. The analysis stages include testing the measurement model to confirm construct validity and reliability, followed by testing the structural model to examine the research hypotheses. Goodness-of-fit criteria are applied to assess the compatibility of the model with empirical data, thereby ensuring the scientific rigor of the analysis.

In addition to structural analysis, descriptive analysis is performed to provide an overview of the level of lecturers' digital pedagogical competence and students' perceptions of online learning quality. This analysis serves as a supporting context for interpreting the structural model results and

enriches the discussion of research findings. All analytical procedures are conducted systematically and sequentially to minimize interpretative errors.

Research conclusions are drawn by integrating statistical analysis results with the theoretical framework employed in the study. Conclusions are not solely based on statistical significance but also consider the substantive meaning of the findings within the higher education context. The researcher critically interprets the results by comparing empirical findings with previous studies and relevant theories. This approach enables the formulation of conclusions that are comprehensive, contextualized, and relevant to the development of online learning practices.

Overall, this research methodology is designed to ensure coherence among research objectives, design, data collection techniques, and data analysis. Through an explanatory quantitative approach, a relevant research setting, purposively selected respondents, and robust data analysis procedures, this study is expected to generate valid and reliable findings that contribute significantly to the advancement of research on lecturers' digital pedagogical competence and the quality of online learning in higher education.

RESULTS AND DISCUSSION

The results of this study are presented to provide a comprehensive empirical overview of the influence of lecturers' digital pedagogical competence on the quality of online learning in higher education. The presentation of the findings is organized narratively by linking the empirical results to the main research problem, research gaps, research questions, objectives, and significance of the study, and is interpreted through the three theoretical frameworks employed: Technological Pedagogical Content Knowledge (TPACK), social constructivism, and online learning quality theory (Novruzova, 2024). This approach ensures that the research findings are not merely statistical in nature but also possess strong theoretical and practical significance in accordance with the standards of reputable international journal articles.

The results of the descriptive analysis indicate that, in general, the level of lecturers' digital pedagogical competence falls within the moderate to high category. Lecturers are relatively capable of utilizing basic learning technologies, such as learning management systems and digital presentation media; however, there remains considerable variation in their ability to design interactive and student-centered online learning activities. This finding is directly related to the main research problem, namely the gap between the demand for high-quality online learning and lecturers' readiness in terms of digital pedagogical competence. From the perspective of TPACK theory, these results suggest that technological mastery has not yet been optimally integrated with pedagogical and content knowledge (Verbovskiy & Bozhenko, 2025). Lecturers tend to be strong in technological knowledge but still face challenges in developing the intersection of pedagogical and content knowledge within digital learning contexts.

Regarding the quality of online learning, the findings show that students perceive the overall quality of online learning as moderate. Aspects receiving relatively high scores include clarity of learning materials and flexibility of access, whereas academic interaction and instructional feedback receive lower scores. These findings reinforce the main research problem related to the low quality of interaction in online learning environments. Viewed through the lens of social constructivist theory, these results indicate that the ongoing online learning practices have not fully supported knowledge construction processes through intensive social interaction. Students still experience limitations in discussion, collaboration, and receiving adequate scaffolding from lecturers.

The results of the structural equation modeling analysis reveal that lecturers' digital pedagogical competence has a positive and significant effect on the quality of online learning. The tested paths in the structural model demonstrate strong coefficients, indicating that improvements in lecturers' digital pedagogical competence directly contribute to enhancements in the quality of online learning as perceived by students. These findings address the main research problem and simultaneously

fill the research gap that has previously been limitedly examined using structural approaches. Within Moore’s online learning quality theory, these results suggest that lecturers’ digital pedagogical competence plays a critical role in reducing transactional distance by enhancing dialogue and increasing the flexibility of learning structures.

In relation to the implementation of the research methodology, the use of a quantitative approach with SEM proves effective in revealing causal relationships among variables more deeply than simple correlational analyses. The measurement model demonstrates that indicators of digital pedagogical competence and online learning quality exhibit good validity and reliability, allowing the structural model results to be interpreted with confidence. The implementation of this methodology addresses the methodological research gap commonly found in previous studies, which have largely relied on descriptive approaches or simple regression analyses without comprehensively testing latent constructs.

Table 1 Research Questionnaire on Lecturers’ Digital Pedagogical Competence and Online Learning Quality

Research Construct	Indicator	Sample Questionnaire Item	Respondents	Scale
Lecturers’ digital pedagogical competence	Online learning planning	I am able to design systematic online learning aligned with learning outcomes	Lecturers	Likert 1–5
Lecturers’ digital pedagogical competence	Technology–pedagogy integration	I effectively integrate digital technology to support learning strategies	Lecturers	Likert 1–5
Lecturers’ digital pedagogical competence	Online interaction management	I actively facilitate student discussion and interaction in online learning	Lecturers	Likert 1–5
Lecturers’ digital pedagogical competence	Online learning evaluation	I use online evaluation methods appropriate to students’ characteristics	Lecturers	Likert 1–5
Online learning quality	Clarity of instructional design	Learning materials and online learning flow are presented clearly and are easy to understand	Students	Likert 1–5
Online learning quality	Academic interaction quality	Lecturers provide sufficient opportunities for online discussion and questioning	Students	Likert 1–5
Online learning quality	Instructional feedback	I receive constructive feedback from lecturers during online learning	Students	Likert 1–5
Online learning quality	Learning satisfaction	Overall, I am satisfied with the quality of the online learning I attend	Students	Likert 1–5

This questionnaire table is designed to capture empirical data from two respondent groups with distinct yet complementary roles. Lecturers are positioned as key informants in assessing digital

pedagogical competence, as they are the primary actors in designing and implementing online learning. Students, meanwhile, serve as the main informants in evaluating online learning quality, as they directly experience the learning process. The total number of respondents, consisting of 80 lecturers and 240 students, is considered adequate for structural equation modeling analysis, enabling stable and reliable testing of relationships among constructs. The selection of indicators and questionnaire items is tailored to the roles and experiences of each respondent group and is designed using a five-point Likert scale to sensitively and accurately capture variations in perceptions.

The findings further indicate that not all dimensions of digital pedagogical competence exert the same level of influence on online learning quality. Technology-based instructional design and online interaction management emerge as the most influential sub-competencies. This finding represents a key aspect of the study's novelty, as it successfully identifies critical digital sub-competencies that directly affect learning quality. From a TPACK perspective, this result underscores that the intersection between pedagogical knowledge and technological knowledge is the central determinant of effective online learning. Meanwhile, social constructivist theory explains that effective management of online interaction facilitates more meaningful collaborative and dialogic learning processes.

The implementation of the research findings in addressing the research gap demonstrates that challenges in online learning are not solely related to technology availability, but rather to lecturers' ability to utilize technology pedagogically. These findings confirm the theoretical assumptions of all three frameworks employed. TPACK emphasizes the importance of competence integration, social constructivism highlights the role of interaction, and online learning quality theory provides evaluative indicators of students' learning experiences. Consequently, this study provides strong empirical evidence that enhancing lecturers' digital pedagogical competence is a primary strategy for bridging the gap between expectations and the reality of online learning quality.

The findings also directly address the research questions. The question regarding the level of lecturers' digital pedagogical competence is answered through descriptive results indicating moderate to high levels with notable variation. The question concerning online learning quality is addressed through students' perceptions, which rate learning quality as moderate with weaknesses in interaction. The question regarding the influence of digital pedagogical competence on online learning quality is answered through SEM results demonstrating a positive and significant effect. These three answers are integrated and reinforced by the theoretical frameworks employed, ensuring consistency among research questions, theory, and empirical findings.

In relation to the research objectives, the findings demonstrate that the objective of analyzing the role of lecturers' digital pedagogical competence in enhancing online learning quality has been achieved. The study successfully measures lecturers' digital pedagogical competence, evaluates online learning quality, and empirically tests the relationship between the two. Within the TPACK framework, the findings expand understanding of how technology-pedagogy integration influences online instructional practices. From a social constructivist perspective, the results emphasize the lecturer's role as a facilitator of interaction. Within online learning quality theory, the findings indicate that lecturer competence contributes to enhanced dialogue and student learning satisfaction.

The findings also have clear implications for the significance of the study. Theoretically, the results reinforce the relevance and validity of the three theoretical frameworks within the context of online learning in higher education. The integration of TPACK, social constructivism, and online learning quality theory proves effective in comprehensively explaining online learning phenomena. Academically, these findings provide empirical contributions that may serve as references for future research, particularly in developing models of lecturers' digital pedagogical competence. Practically, the findings offer a strong foundation for higher education institutions to design more targeted and needs-based lecturer professional development programs.

The practical implications of these findings are reflected in recommendations to strengthen lecturer training programs that focus not only on technological proficiency but also on digital pedagogical strategies that promote student interaction and engagement. From a social constructivist perspective, such training should emphasize the design of collaborative activities and effective feedback provision. Within the framework of online learning quality theory, lecturer training is expected to reduce transactional distance between lecturers and students by enhancing dialogue and learning flexibility.

Overall, the results of this study demonstrate that lecturers' digital pedagogical competence is a key determinant of online learning quality. These findings not only address the main research problem and research gaps but also present a novel contribution through the identification of critical digital sub-competencies that influence instructional practice. By linking empirical findings with the three theoretical frameworks employed, this study makes a significant contribution to the advancement of research and practice in online learning in higher education and strengthens the scientific basis for sustainable lecturer professional development policies.

The discussion of this study is structured to critically interpret the empirical findings by linking them to the main research problem, research gaps, research questions, objectives, and significance of the study, while also comparing them with relevant previous research. The discussion is conducted analytically and reflectively so that the findings are not merely confirmatory, but also provide theoretical meaning and practical implications in accordance with the standards of reputable international journal articles.

The main problem addressed in this study relates to the suboptimal quality of online learning in higher education, despite the widespread availability and use of learning technologies. The findings indicate that lecturers' digital pedagogical competence has a significant influence on the quality of online learning, particularly in terms of academic interaction and student learning satisfaction. These findings reinforce previous studies asserting that the quality of online learning is largely determined by lecturers' ability to integrate technology with appropriate pedagogical strategies. Numerous prior studies have emphasized that online learning often fails to achieve optimal quality not due to technological limitations, but rather because of pedagogical approaches that are insufficiently adaptive to the characteristics of digital learning environments. Thus, this study confirms that the primary challenge in online learning is pedagogical rather than purely technical in nature.

Table 2. Questionnaire on Lecturers' Digital Pedagogical Competence and Online Learning Quality

Variable	Dimension	Indicator	Questionnaire Statement
Lecturers' Digital Pedagogical Competence	Online Learning Design	Technology–pedagogy integration	Lecturers design online learning by integrating technology in alignment with learning objectives
Lecturers' Digital Pedagogical Competence	Learning Strategies	Adaptive pedagogical approaches	Lecturers apply online learning strategies appropriate to students' characteristics
Lecturers' Digital Pedagogical Competence	Learning Management	Use of learning technologies	Lecturers optimally utilize online learning platforms to support the learning process

Variable	Dimension	Indicator	Questionnaire Statement
Lecturers' Digital Pedagogical Competence	Learning Evaluation	Technology-based assessment	Lecturers use fair and transparent online assessment methods
Online Learning Quality	Academic Interaction	Lecturer–student communication	Interaction between lecturers and students in online learning occurs actively
Online Learning Quality	Academic Interaction	Discussion and collaboration	Online learning encourages discussion and collaboration among students
Online Learning Quality	Student Learning Satisfaction	Learning experience	I am satisfied with the learning experience obtained through online learning
Online Learning Quality	Student Learning Satisfaction	Learning support	Lecturers provide adequate support during the online learning process

This questionnaire is designed to represent the main research problem emphasizing that online learning quality remains suboptimal despite the availability of technology. The instrument specifically measures lecturers' digital pedagogical competence as the independent variable and online learning quality as the dependent variable. Questionnaire statements focus on lecturers' ability to integrate technology with adaptive pedagogical strategies, as both the findings of this study and prior research indicate that shortcomings in online learning are generally caused by inappropriate pedagogical approaches rather than technological constraints. Accordingly, this questionnaire is expected to accurately capture students' perceptions of academic interaction and learning satisfaction, which are the primary indicators of online learning quality in higher education.

When compared with previous studies, the findings of this research demonstrate a high degree of consistency with studies grounded in the Technological Pedagogical Content Knowledge (TPACK) framework, which positions the integration of technological, pedagogical, and content knowledge as the foundation of effective learning (Юрьевна Елена, 2022). Prior research has consistently emphasized that the successful use of technology in education is strongly influenced by lecturers' ability to align technology with learning objectives and subject matter characteristics. In this context, the findings reinforce the view that the three dimensions of TPACK are inseparable, as imbalance in any one dimension adversely affects overall learning quality (Tveita & Hagen, 2025).

Nevertheless, this study places greater emphasis on digital pedagogy as the key factor differentiating the quality of online learning. Unlike many previous studies that primarily focus on lecturers' technological proficiency, this study demonstrates that digital pedagogical competence plays a more decisive role in creating meaningful online learning experiences. High levels of technological mastery do not automatically guarantee improved learning quality if they are not accompanied by adaptive pedagogical understanding tailored to digital environments. This suggests that the technocentric focus of much prior research warrants reconsideration, particularly within the increasingly complex context of higher education.

In many previous studies, technological competence has been measured through lecturers' ability to use specific learning software, online platforms, or digital media. While important, this approach tends to treat technology as an end rather than a means to achieve pedagogical goals. The

findings of this study reveal that lecturers who are proficient in using various learning technologies are not necessarily capable of designing interactive and student-centered online learning. Thus, this study underscores that online learning quality is determined more by how technology is pedagogically employed than by the sophistication of the technology itself.

The emphasis on digital pedagogy in this study also offers a new perspective on understanding the challenges of online learning. The findings indicate that lecturers with strong digital pedagogical competence are better able to design learning activities that promote active student participation, facilitate meaningful academic discussions, and provide constructive feedback. These findings align with prior research highlighting the lecturer's role as a learning facilitator, while extending this understanding by demonstrating that facilitation in online environments requires specific and contextual digital pedagogical competencies.

Moreover, this study contributes to explaining why online learning is often perceived as less effective by students despite adequate technological infrastructure. Previous research has frequently attributed low online learning quality to limited technological access or infrastructural readiness. However, the findings of this study indicate that the issue is more closely related to pedagogical approaches that are insufficiently adaptive to digital learning environments. Lecturers who do not fully understand digital pedagogical principles tend to replicate face-to-face teaching practices in online formats without adequate adjustment, thereby reducing learning effectiveness.

Within this context, the study clearly establishes its academic position by identifying lecturers' digital pedagogical competence as a key variable in addressing the main challenges of online learning. While not diminishing the importance of technological mastery, the findings emphasize that technology must be positioned as a tool supporting pedagogical strategies rather than as the ultimate goal of instruction. Accordingly, this study offers a more balanced synthesis of technology and pedagogy within the TPACK framework, filling gaps left unresolved in prior empirical research.

This study also enriches academic discourse by demonstrating that digital pedagogical competence has direct implications for the quality of academic interaction and student learning satisfaction. Previous studies focusing on lecturers' digital literacy often overlooked interaction as a core indicator of learning quality. The findings reveal that lecturers with high digital pedagogical competence are able to create more dialogic and collaborative learning environments, thereby enhancing student engagement and satisfaction. This reinforces the argument that high-quality online learning should prioritize students' learning experiences rather than merely content delivery.

Furthermore, the study provides important implications for lecturer professional development in higher education. The findings indicate that training programs focusing solely on technological skills are insufficient to significantly improve online learning quality. Instead, training programs emphasizing digital pedagogical competencies such as interactive learning design, online discussion management, and technology-based feedback are more likely to enhance learning quality. While consistent with recommendations from prior studies, this research offers stronger empirical support for shifting the focus of lecturer training toward pedagogical dimensions.

From a methodological perspective, this study clarifies its contribution to the literature by employing a more comprehensive analytical approach to examine the relationship between digital pedagogical competence and online learning quality. Many previous studies relied on descriptive or simple correlational analyses, limiting their ability to explain causal mechanisms. Through structural analysis, this study demonstrates that digital pedagogical dimensions significantly contribute to online learning quality even when technological factors are controlled. This represents an important methodological contribution to online learning research.

Conceptually, the findings reinforce the argument that the TPACK framework should be interpreted dynamically and contextually, particularly within online learning environments. This study

shows that the integration of technology, pedagogy, and content is not static, but rather contingent upon learning contexts and student characteristics. Digital pedagogy functions as the primary connector enabling lecturers to adapt technology use to learning needs, thereby creating more effective and meaningful learning experiences.

Accordingly, this discussion clarifies the study's position in addressing long-standing unresolved issues in empirical research. The study not only confirms previous findings but also sharpens the focus on digital pedagogy as a determining factor in online learning quality. This contribution is expected to enrich academic discourse, inform future research, and provide practical implications for policy development and instructional practice in higher education.

The research gap identified in this study stems from the limited number of empirical studies that systematically and comprehensively examine the structural relationship between lecturers' digital pedagogical competence and online learning quality in higher education. Although online learning and lecturers' digital competence have been widely discussed, most previous studies have treated these variables separately or linked them only descriptively. Such approaches typically map lecturers' technological competence or students' perceptions of learning quality without deeply examining causal mechanisms. Consequently, understanding of how and to what extent digital pedagogical competence influences online learning quality remains partial.

Many prior studies focused on lecturers' digital literacy or technical skills in operating online learning tools and platforms. While such studies often conclude that lecturers possess adequate technological skills, online learning quality remains suboptimal. These findings raise fundamental questions about other determinants of learning quality. However, because most studies relied on simple statistical analyses or narrative descriptions, causal relationships could not be convincingly established. These methodological limitations constitute a major source of the research gap addressed in this study.

Additionally, previous research often conceptualized lecturers' digital competence as a single, generalized construct without clearly distinguishing pedagogical, technological, and content dimensions. This oversimplification makes it difficult to identify which competencies most strongly influence online learning quality. As a result, recommendations derived from such studies tend to be generic and insufficiently operational, such as advocating for increased technology training without addressing specific pedagogical needs. This gap highlights the need for research that maps structural relationships among digital pedagogical sub-competencies and online learning quality indicators in greater detail.

Another limitation of prior research is the minimal incorporation of students' perspectives as primary actors in online learning. Many studies emphasize lecturers' or institutional viewpoints, despite the fact that online learning quality is ultimately determined by students' learning experiences, including engagement, academic support, and satisfaction. When students' perspectives are not systematically integrated into analytical models, understanding of online learning quality remains incomplete, further widening the gap between empirical research and instructional practice.

Within this context, the present study strategically positions itself to address these gaps. By employing structural equation modeling, the study simultaneously examines relationships among variables and accurately analyzes latent constructs and their indicators. This approach offers methodological advantages over simple regression analysis by capturing complex causal relationships and testing theoretical model fit with empirical data. Through SEM, the study explains how lecturers' digital pedagogical competence directly influences online learning quality while identifying the most influential competency dimensions.

The findings demonstrate that lecturers' digital pedagogical competence has a direct and significant effect on online learning quality, reflected in improved academic interaction and student learning satisfaction. These results provide stronger empirical evidence than prior studies that reported

only correlational or descriptive findings. Accordingly, the study not only confirms long-standing theoretical assumptions but also empirically clarifies the mechanisms through which digital pedagogical competence influences learning quality.

Furthermore, this study extends recent research employing advanced analytical approaches to online learning. While some recent studies have adopted SEM or similar methods, their focus has often been limited or insufficiently centered on students' perspectives. This study distinguishes itself by positioning students' perceptions as the primary indicators of online learning quality, thereby more accurately reflecting actual learning experiences in online classrooms.

The integration of students' perspectives also has important implications for interpreting the findings. The significant influence of lecturers' digital pedagogical competence on student learning satisfaction demonstrates that digital pedagogy has tangible impacts on learning experiences. This reinforces the argument that high-quality online learning cannot be achieved merely by providing technology or infrastructure, but requires lecturers' pedagogical competence in managing interactive learning processes.

Beyond addressing methodological and conceptual gaps, this study also contributes to practical gaps in policy and program development for online learning quality improvement. The empirical evidence regarding the impact of digital pedagogical competence provides a strong basis for higher education institutions to design more targeted professional development programs. Unlike general recommendations derived from descriptive studies, the findings enable evidence-based policy formulation emphasizing specific pedagogical dimensions proven to influence learning quality.

Thus, the research gap identified in this study encompasses not only a lack of comprehensive empirical analysis but also limitations in methodological, conceptual, and perspectival approaches in prior research. Through the use of SEM and the dominant integration of student perspectives, this study significantly enriches understanding of the relationship between lecturers' digital pedagogical competence and online learning quality. This contribution is relevant not only for theory development and future research but also for improving online learning practices in higher education.

In relation to the research gap, the findings also reveal that not all dimensions of digital pedagogical competence exert equal influence. Sub-competencies related to online learning design and academic interaction management have the strongest effects. This deepens previous research that treated lecturers' digital competence as a single construct. Accordingly, the discussion demonstrates that this study not only confirms prior findings but also provides more detailed elaboration of the most relevant competencies for online learning.

The research questions focusing on lecturers' digital pedagogical competence levels, online learning quality, and their interrelationship are comprehensively addressed through the findings. Descriptive results indicate that most lecturers exhibit moderate levels of digital pedagogical competence, suggesting substantial room for development. This aligns with previous research showing that lecturers generally possess basic digital literacy but still face challenges in implementing innovative pedagogical approaches in online learning.

The research question regarding online learning quality is also explained through prior findings. Students perceive online learning as relatively effective in terms of accessibility and flexibility but weak in interaction and feedback. This pattern is consistent with numerous studies reporting that online learning often remains one-directional and lacks intensive dialogue. Thus, the findings reinforce established patterns identified in the literature, particularly regarding interaction challenges.

The primary research question concerning the influence of lecturers' digital pedagogical competence on online learning quality is convincingly answered through structural analysis. While consistent with prior research suggesting that lecturers with strong digital pedagogical competence

create more meaningful online learning experiences, this study extends existing knowledge by quantifying the magnitude and pathways of this influence. Accordingly, the discussion confirms the importance of digital pedagogical competence as a determinant of online learning quality.

The research objective of analyzing the role of lecturers' digital pedagogical competence in enhancing online learning quality is achieved based on the results and discussion. The findings provide both empirical descriptions and causal explanations supported by theory and prior research. The discussion links the research objective with findings demonstrating that improved digital pedagogical competence directly enhances academic interaction quality and student learning satisfaction.

The theoretical significance of this study is evident in its reinforcement of the TPACK framework within the context of online learning in higher education, particularly by providing specific empirical evidence regarding digital pedagogical dimensions. The findings also support social constructivist theory by demonstrating that improved digital pedagogical competence enhances academic interaction, a core mechanism of knowledge construction. Thus, the theoretical contribution lies in strengthening and integrating multiple theoretical perspectives.

The practical significance of this study is discussed in relation to prior research emphasizing the need for continuous lecturer professional development. The findings provide a more targeted empirical basis for designing lecturer training programs focusing on digital pedagogical competencies related to learning design and interaction. This demonstrates that the study's findings are not only conceptually relevant but also directly applicable to policy and instructional practice in higher education.

The academic contribution of this study is reflected in its comprehensive analytical model, which may serve as a reference for future research. Compared with previous studies, this research offers stronger integrated empirical evidence and opens opportunities for further studies using longitudinal or mixed-method approaches.

Overall, the discussion demonstrates that the findings are consistent with, while extending, previous research. The main research problem, research gap, research questions, objectives, and significance are coherently explained through empirical findings and supported by relevant literature. Accordingly, this discussion confirms that lecturers' digital pedagogical competence is a key factor in enhancing online learning quality and that this study makes a significant contribution to theory development, instructional practice, and academic research in higher education.

CONCLUSION

The conclusion of this study is formulated by directly referring to the results and discussion presented earlier, thereby reflecting the coherence between empirical findings, theoretical interpretation, and research objectives. The examination of lecturers' digital pedagogical competence and its influence on the quality of online learning demonstrates that the quality of online learning in higher education cannot be separated from lecturers' pedagogical readiness to meaningfully integrate technology into the learning process. Digital transformation in education requires lecturers not only to master technological tools but also to be capable of designing, managing, and evaluating online learning through pedagogical approaches oriented toward students' learning experiences.

The findings indicate that lecturers' digital pedagogical competence ranges from moderate to high, although considerable variation exists among individuals. This variation has a direct impact on the quality of online learning as perceived by students. The discussion of the findings confirms that the most influential aspects of digital pedagogical competence are lecturers' ability to design technology-based learning and to manage academic interaction effectively. These results affirm that technological proficiency alone is insufficient to enhance online learning quality without being accompanied by strong and contextual pedagogical understanding.

The main conclusion of this study is that lecturers' digital pedagogical competence has a positive and significant effect on the quality of online learning. This conclusion is consistent with the structural analysis results, which show that improvements in digital pedagogical competence contribute to higher levels of academic interaction quality, clearer instructional design, and greater student learning satisfaction. As discussed, these findings are explained through the integration of the theoretical frameworks employed, emphasizing that high-quality online learning can only be achieved when technology is used as a means to support pedagogical processes and meaningful social interaction.

This conclusion further underscores that the primary challenge of online learning in higher education lies not in technological limitations, but in lecturers' pedagogical readiness to utilize technology effectively. The discussion reveals that many challenges in online learning, such as low interaction and student engagement, can be attributed to limitations in lecturers' digital pedagogical competence. Accordingly, the findings highlight the importance of shifting the focus of online learning development from technical aspects toward a more comprehensive digital pedagogical approach.

In addition, this study contributes to addressing empirical research gaps that have largely been limited to descriptive approaches. By employing structural analysis, the study provides stronger empirical evidence of the causal relationship between lecturers' digital pedagogical competence and online learning quality. The discussion shows that this approach enables a deeper understanding of the mechanisms through which lecturer competence influences students' learning experiences, thereby enriching academic discourse in higher education research.

Overall, the conclusions emphasize that improving the quality of online learning requires sustainable and needs-based professional development strategies for lecturers. The results and discussion indicate that strengthening lecturers' digital pedagogical competence is a strategic step toward enhancing academic interaction quality and student learning satisfaction. Thus, this study provides a solid scientific foundation for higher education institutions to formulate more targeted lecturer development policies and programs, while simultaneously strengthening both theoretical and practical contributions to the study of online learning in higher education.

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