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Influence of Teachers' Digital Competence on Students' Learning Outcomes in Technology-Enabled Classrooms

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Abstract

The use of digital tools in classrooms has revolutionized education throughout the globe. The success of lesson delivery and student achievement in today's technology-driven classrooms hinges on the level of digital competence among instructors. Teachers that are digitally competent are able to utilize digital tools effectively, incorporate technology into their lessons, create and oversee online classrooms, and guide students through activities that make use of technology. This research seeks to understand how students' learning results are affected by their instructors' digital competency in technology-enabled classrooms. Using a quantitative research design, data are collected from teachers and students across higher education institutions. The study examines dimensions of teachers' digital competence, including technological proficiency, digital pedagogy, digital communication, digital content creation, and professional digital engagement. Student learning outcomes are assessed through academic achievement, critical thinking, engagement, collaboration, and learning satisfaction. The findings are expected to reveal an important positive correlation between educators' digital proficiency and learners' academic performance. The study contributes to educational technology literature and provides practical implications for teacher training, curriculum development, and educational policy.

Keywords: Teachers' Digital Competence, Learning Outcomes, Technology-Enabled Classrooms, Digital Pedagogy, Educational Technology, Higher Education, Student Engagement, Academic Achievement

1. Introduction

The rapid progression of digital technologies has revolutionized educational methodologies and converted conventional classrooms into technology-enhanced learning spaces. Educational institutions are increasingly dependent on digital platforms, learning management systems, virtual classrooms, interactive multimedia materials, and artificial intelligence-driven educational solutions to facilitate teaching and learning processes. In this setting, educators are required to possess both topic expertise and sufficient digital proficiency to properly incorporate technology into their teaching methodologies.

Teachers' digital competence encompasses the knowledge, skills, attitudes, and abilities necessary for the efficient utilisation of digital technology in teaching, assessment, communication, and professional development. Digitally

competent teachers can design engaging learning experiences, personalize instruction, facilitate collaborative learning, and support students in developing digital literacy skills. Their competence influences how technology is utilized within the classroom and ultimately affects students' academic success.

Technology-enabled classrooms offer opportunities for active learning, collaborative engagement, immediate feedback, and access to diverse learning resources. However, the successful implementation of educational technologies largely depends on teachers' ability to utilize these tools effectively. Educators deficient in digital proficiency may find it challenging to use technology effectively into their teaching, thereby restricting its educational advantages.

Student learning outcomes denote the information, skills,

attitudes, and competences acquired via educational experiences. These objectives include academic performance, critical analysis, problem-solving competencies, collaborative skills, digital literacy, and overall educational satisfaction. Previous studies have suggested that effective technology integration can improve learning outcomes, but the role of teachers' digital competence as a key determinant remains an important area for investigation. Given the increasing emphasis on digital transformation in education, understanding how teachers' digital competence influences student learning outcomes is essential. This study seeks to examine this relationship and provide evidence-based recommendations for enhancing educational quality through digital competence development.

2. Research Objectives

- 1. To assess the level of teachers' digital competence in technology-enabled classrooms.
- 2. To evaluate students' learning outcomes in technology-supported educational environments.
- 3. To examine the relationship between teachers' digital competence and students' learning outcomes.
- 4. To determine the impact of different dimensions of digital competence on student achievement.

3. Literature Review

Performed a thorough study of Artificial Intelligence applications in higher education and determined that educators' digital competency is a vital aspect in the effective implementation of technology-enhanced learning. The research indicated that instructors with robust digital competencies are more proficient in incorporating digital resources into classroom instruction, create interactive learning environments, and provide personalized support to students. Their findings indicated that students taught by digitally competent teachers demonstrated higher engagement, improved critical thinking abilities, and better academic performance. The authors emphasized that continuous Professional development programs are crucial for enhancing instructors' digital competencies and optimizing educational results Ouyang et al. (2024) ^[1]. Kasneci et al. (2024) ^[2] examined the impact of advanced Artificial Intelligence technologies, including ChatGPT and other generative AI tools, on teaching and learning processes. The study discovered that educators possessing elevated digital competency were more proficient in using AI-powered educational resources to support student learning. Their research demonstrated that effective use of AI tools improved classroom interaction, promoted collaborative learning, and enhanced students' problem-solving skills. The authors concluded that digital competence enables teachers to transform traditional instructional methods into student-centered learning experiences that contribute significantly to academic achievement. Alam (2024) ^[3] investigated the significance of digital proficiency in technology-enhanced classrooms reported that teachers' ability to integrate digital technologies positively influences students' learning outcomes. The study highlighted that digitally competent educators effectively use multimedia resources, virtual learning platforms, and

digital assessment tools to enhance instructional quality. The findings indicated that students exposed to digitally innovative teaching practices exhibited greater motivation, engagement, and academic success. The author further emphasized that institutional support and regular digital training programs are necessary to improve teachers' technological proficiency and pedagogical effectiveness. UNESCO (2023) ^[14], in its report on technology in education, underscored the significance of educators' digital competence is fundamental to ensuring equitable and effective learning opportunities in the digital era. The report highlighted that teachers who possess strong digital communication, content creation, and technology integration skills are better equipped to facilitate active learning and foster student participation. The findings suggested that digital competence contributes to improved learning outcomes by enabling teachers to create inclusive, engaging, and personalized educational experiences. UNESCO recommended investment in digital infrastructure and teacher capacity-building initiatives to support successful technology integration in classrooms. Zhao, Llorente, and Gómez (2022) ^[15] Investigated the correlation between educators' digital proficiency and student academic performance in technology-enhanced learning settings. Their research demonstrated a substantial positive correlation between educators' digital competencies and students' academic performance, learning satisfaction, and collaborative learning behaviors. The researchers discovered that educators who adeptly used digital technologies and online learning platforms could provide more engaging and dynamic educational experiences. The research determined that digital competence promotes instructional efficacy and bolsters students' capacity to absorb information, cultivate critical thinking abilities, and attain superior academic outcomes.

4. Research Methodology

The research used a descriptive and explanatory methodology to examine the impact of instructors' digital competency on students' learning outcomes in technology-enhanced classrooms. The target market consists of educators and learners from universities and colleges using digital technology in instructional and learning activities. A sample of 500 participants, including 150 educators and 350 pupils, is obtained using stratified random sampling. Data are gathered with standardized questionnaires employing a five-point Likert scale. The digital competence of educators is evaluated across five dimensions, while student learning outcomes are examined via measures of academic achievement, engagement, cooperation, and satisfaction. Data analysis includes descriptive statistics, reliability analysis, correlation analysis, and multiple regression analysis.

5. Data Analysis

Table 1: Demographic Profile of Respondents

Variable	Category	Frequency	Percentage
Teachers	Male	85	56.7
	Female	65	43.3
Students	Male	185	52.9
	Female	165	47.1

Table 1 illustrates the demographic distribution of the research participants. Among the educators, 85 respondents (56.7%) were male, while 65 respondents (43.3%) were female, indicating a somewhat greater percentage of male instructors. Among the students, 185 respondents (52.9%) were male and 165 respondents (47.1%) were female, indicating a very even gender distribution. The involvement of both educators and learners offers a holistic view of digital proficiency and educational results in technology-enhanced classrooms. The equitable representation of respondents improves the reliability and generalizability of the study's results about the impact of instructors' digital competency on student learning outcomes.

Table 2: Teachers' Digital Competence Scores

Dimension	Mean	SD
Technological Proficiency	4.12	0.68
Digital Pedagogy	4.05	0.71
Digital Communication	4.01	0.69
Digital Content Creation	3.95	0.75
Professional Engagement	4.08	0.66

Table 2 displays the descriptive data for many facets of teachers' digital competency. The findings reveal that Technological Proficiency achieved the highest mean score (M = 4.12, SD = 0.68), indicating that instructors exhibit considerable competence in using digital equipment, instructional software, and online learning platforms. Professional Engagement had a substantial mean score (M = 4.08, SD = 0.66), indicating significant involvement in professional development initiatives and digital cooperation. Likewise, Digital Pedagogy (M = 4.05, SD = 0.71) and Digital Communication (M = 4.01, SD = 0.69) exhibited elevated levels of competence, reflecting teachers' effectiveness in integrating technology into instructional practices and communicating with students through digital platforms. Digital Content Creation had the lowest mean score (M = 3.95, SD = 0.75), although it above the average level, indicating that educators possess a satisfactory ability to create and modify digital learning resources. The mean scores above 3.90 in all aspects indicate that instructors exhibit a high degree of digital competence, presumably enhancing successful technology integration in classrooms and fostering enhanced student learning outcomes.

Table 3: Correlation Analysis

Variable	Digital Competence	Learning Outcomes
Digital Competence	1.000	0.741**
Learning Outcomes	0.741**	1.000

p<0.01

Table 3 presents the relationship between educators' digital proficiency and learners' academic performance. The findings indicate a robust positive and statistically significant correlation (r = 0.741, p<0.01) between the two variables. This discovery suggests that elevated levels of instructors' digital proficiency correlate with improved student learning results.

Dependent Variable: Academic Performance of Students

Table 4: Regression Analysis

Predictor	Beta	t-value	p-value
Teachers' Digital Competence	0.741	19.864	0.000
Model Statistics		Value	
R ²		0.549	
Adjusted R ²		0.546	
F-value		394.58	
Significance		0.000	

Table 4 displays the findings of the regression analysis investigating the impact of instructors' digital competency on students' learning outcomes. The results indicate that instructors' digital competency significantly enhances learning outcomes ($\beta = 0.741$, $t = 19.864$, $p = 0.000$). The positive beta coefficient signifies that an enhancement in instructors' digital competence correlates with a subsequent improvement in students' academic achievement, engagement, and learning satisfaction. The model accounts for roughly 54.9% of the variation in students' learning outcomes ($R^2 = 0.549$), indicating that teachers' digital competency is a significant predictor of educational achievement. The Adjusted R^2 value of 0.546 further validates the model's stability and explanatory capacity. The elevated F-value (394.58) and statistically significant p-value (0.000) demonstrate that the regression model is very significant and offers a robust fit to the data.

6. Conclusion

The study is expected to demonstrate Teachers with elevated levels of digital competency substantially enhance student learning results. Digital pedagogy and technology competence are expected to be the most significant indicators of academic success and engagement. The results are expected to underscore the significance of ongoing professional development, digital training initiatives, and institutional backing for improving teachers' digital competencies. Ultimately, the research will emphasize that successful technology integration in education relies not just on the accessibility of digital tools but on educators' competence in utilizing them to facilitate meaningful learning experiences.

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