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The Relationship Between Teachers' Digital Literacy Levels and Their Instructional Effectiveness in Public Elementary Schools in Manila

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ABSTRACT

This study examined the relationship between teachers' digital literacy levels and instructional effectiveness in selected public elementary schools in District VI, Manila, Philippines. Anchored on the Technological Pedagogical Content Knowledge (TPACK) framework and the Input-Process-Output (IPO) model, the study employed a descriptive-correlational research design involving 150 purposively selected teachers. Data were collected using a validated researcher-made questionnaire consisting of 50 Likert-scale items and an open-ended question, with an overall reliability coefficient of 0.95. Means, standard deviations, Pearson's product-moment correlation, and thematic analysis were employed. Findings revealed very high levels of digital literacy (M = 3.432) and instructional effectiveness (M = 3.444). Professional development and training obtained the highest digital literacy rating (M = 3.528), while continuous adaptation and innovation ranked highest in instructional effectiveness (M = 3.525). Conversely, access to ICT resources (M = 3.195) and ICT-supported assessment and feedback (M = 3.253) received comparatively lower ratings. Significant positive correlations were established between digital literacy and instructional effectiveness ($r = .398–.622$, $p < .05$). Major challenges included unreliable internet connectivity, insufficient digital devices, inadequate instructional resources, and limited institutional funding. The study concludes that stronger digital competencies are associated with greater instructional effectiveness, although infrastructural limitations constrain technology integration. Accordingly, Project DIGI-LEAP was proposed to strengthen digital assessment competencies, ICT accessibility, professional development, and institutional support. The study supports Sustainable Development Goals 4 (Quality Education), 9 (Industry, Innovation and Infrastructure), and 10 (Reduced Inequalities). Its sustainability contribution lies in promoting equitable educational technology access, continuous teacher capacity-building, and long-term institutional improvement in digital instruction.

Keywords: *Digital Literacy, ICT Resources, Instructional Effectiveness, Professional Development, Project DIGI-LEAP, Public Elementary School Teachers, Technology Integration*

1. INTRODUCTION

The integration of digital technologies into education has transformed instructional planning, teaching strategies, classroom management, assessment, and communication. As educational institutions increasingly adopt technology-supported learning approaches, teachers are expected to develop digital competencies that enable them to use technological resources effectively. However, the availability of digital tools does not automatically ensure quality instruction, as effective technology integration requires appropriate technical knowledge, pedagogical skills, and institutional support. Orakova et al. (2024) identified connections among teachers' technological competence, pedagogical competence, and digital literacy, underscoring the need to align technical proficiency with classroom practice. The importance of teachers' technological competence became more evident following the COVID-19 pandemic, which accelerated the adoption of remote and blended learning approaches. Mailizar et al. (2022) examined digital literacy in relation to teachers' acceptance of online professional development, while Demir et al. (2022) investigated its relationship with lifelong learning tendencies. Chama and Subaveerapandiyan (2023) also explored teachers' digital literacy skills and purposes for using ICT. These findings suggest that effective digital integration requires continuous professional development and the meaningful application of technology to instructional practices. In the Philippine public elementary education system, teachers encounter varying levels of access to ICT resources, internet connectivity, technical assistance, and professional development opportunities. These conditions may influence their ability to integrate digital technologies into lesson planning, instructional delivery, classroom management, and assessment. In District VI, Manila, large class sizes, diverse learner needs, and differences in technological infrastructure present additional challenges to effective digital instruction. Although existing studies have examined teachers' digital literacy and technology integration, localized evidence concerning the relationship between digital competencies and multidimensional instructional effectiveness remains limited. Addressing this research gap, the present study examines the relationship between teachers' digital literacy levels and their instructional effectiveness among 150 public elementary school teachers in selected schools in District VI, Manila. Digital literacy is examined through technological skills, information and communication literacy, critical and creative use of digital tools, professional development and training, and access to ICT resources. Instructional effectiveness is assessed through digital lesson planning, technology-enhanced instructional delivery, classroom management, ICT-supported assessment and feedback, and continuous adaptation and innovation. The study also identifies challenges encountered in digital integration and provides an empirical basis for developing a professional enhancement program aimed at strengthening teachers' technological competencies and instructional practices. Its findings may contribute to educational sustainability by informing teacher capacity-building, equitable ICT resource allocation, and continuous instructional improvement in public elementary schools. International guidance further emphasizes that educational technology should be appropriate to learning needs and supported by equitable access and teacher preparation (UNESCO, 2023). The OECD (2023) likewise identifies digital infrastructure, governance, and teacher capabilities as interconnected components of an effective digital education ecosystem. Beyond individual competence, equitable financing and school-level conditions shape educational opportunities (OECD, 2024). The UNESCO and International Task Force on Teachers for Education 2030 (2024) highlight sustained professional support and collaborative teacher development, while the World Bank et al. (2022) emphasize the urgency of improving foundational learning and reducing disparities in access to quality instruction.

Research Problem

The increasing integration of digital technologies into classroom instruction requires teachers to possess adequate digital literacy competencies to support effective teaching and learning. However, variations in technological proficiency, access to ICT resources, professional development opportunities, and institutional support continue to affect teachers' ability to integrate digital tools into their instructional practices. In public elementary schools in District VI, Manila, these challenges are particularly relevant because of diverse learner needs, large class sizes, and differences in technological infrastructure. Although previous studies have examined teachers' digital literacy and technology integration, limited localized evidence establishes how digital literacy relates to instructional effectiveness across multiple pedagogical dimensions. This study addresses this gap by assessing teachers' digital literacy in terms of technological skills, information and communication literacy, critical and creative use of digital tools and platforms, professional development and training, and access to ICT resources. It also examines instructional effectiveness in lesson planning, technology-enhanced instructional delivery, digital classroom management, ICT-supported assessment and feedback, and continuous adaptation and innovation. Furthermore, the investigation determines whether a statistically significant relationship exists between these variables, identifies challenges encountered by teachers in integrating digital technologies, and provides a basis for developing an enhancement program to strengthen digital competencies and instructional effectiveness in public elementary schools in District VI, Manila.

Assumptions of the Study

The study assumes that teachers' digital literacy levels are associated with their instructional effectiveness in public elementary schools in District VI, Manila. Teachers with higher digital literacy competencies are expected to demonstrate greater proficiency in integrating technology into lesson planning, instructional delivery, classroom management, assessment, and continuous instructional improvement. However, effective technology integration also depends on pedagogical knowledge, access to ICT resources, institutional support, and professional development opportunities. The study further assumes that teachers' digital literacy and instructional effectiveness can be systematically assessed through the established indicators using a structured questionnaire. It recognizes that differences in technological skills, digital resource availability, and training opportunities may influence instructional practices. Nevertheless, the existence and statistical significance of the relationship between digital literacy and instructional effectiveness remain subject to empirical examination. Accordingly, the study tests the null hypothesis that there is no significant relationship between teachers' digital literacy levels and their instructional effectiveness in public elementary schools in District VI, Manila.

Objectives of the Study

The primary objective of this study is to determine the relationship between teachers' digital literacy levels and their instructional effectiveness in selected public elementary schools in District VI, Manila. Specifically, it aims to assess teachers' digital literacy in terms of technological skills, information and communication literacy, critical and creative use of digital tools and platforms, professional development and training, and access to ICT resources. It also seeks to evaluate instructional effectiveness based on lesson planning using digital tools, technology-enhanced instructional delivery, digital classroom management, ICT-supported assessment and feedback, and continuous adaptation and innovation. Furthermore, the study aims to determine whether a statistically significant relationship exists between teachers' digital literacy levels and instructional effectiveness, identify challenges encountered in integrating digital technologies into instructional practices, and propose an enhancement program to

strengthen teachers' digital competencies and teaching effectiveness. The investigation focuses on 150 public elementary school teachers from selected schools in District VI, Manila, and provides context-specific evidence to inform professional development initiatives, ICT resource allocation, and continuous instructional improvement.

Conceptual and Theoretical Framework

This study is anchored on the Technological Pedagogical Content Knowledge (TPACK) framework developed by Mishra and Koehler (2006), which extends Shulman's (1986) concept of Pedagogical Content Knowledge (PCK) by incorporating technological knowledge as an essential component of effective instruction. The TPACK framework emphasizes the interconnected roles of technological knowledge, pedagogical knowledge, and content knowledge in designing and delivering meaningful learning experiences. It suggests that effective technology integration requires teachers not only to demonstrate digital proficiency but also to apply technological resources appropriately within specific instructional contexts. Accordingly, the framework provides a theoretical basis for examining the relationship between teachers' digital literacy and instructional effectiveness in public elementary schools in District VI, Manila. The study further adopts the Input-Process-Output (IPO) model as its conceptual framework. The input consists of teachers' digital literacy levels and instructional effectiveness, including their respective indicators, alongside challenges related to ICT access, professional development, and institutional support. The process involves gathering data through a validated and reliability-tested researcher-made questionnaire, analyzing descriptive results using means and standard deviations, determining the relationship between digital literacy and instructional effectiveness through Pearson's product-moment correlation coefficient, and conducting thematic analysis of the challenges encountered by teachers. The output is a proposed professional development framework, specifically Project DIGI-LEAP, designed to address identified competency gaps and strengthen technology-integrated instructional practices. Integrating the TPACK framework and IPO model establishes a systematic approach to understanding how teachers' technological competencies relate to instructional effectiveness and how empirical findings can inform targeted professional development initiatives. This framework emphasizes the importance of aligning digital skills with pedagogical practices, instructional content, and available institutional resources to promote effective and sustainable technology integration in elementary education.

Sustainable Development Goal and Multidisciplinary Sustainability Relevance

The study primarily supports Sustainable Development Goal (SDG) 4: Quality Education, particularly the promotion of inclusive, equitable, and effective learning opportunities through improved teacher competencies and technology-supported instruction. By examining the relationship between teachers' digital literacy and instructional effectiveness, the study contributes to understanding how technological knowledge, pedagogical practices, and access to digital resources can strengthen educational quality in public elementary schools. The proposed Project DIGI-LEAP professional development program further supports continuous teacher capacity-building and the sustainable integration of digital technologies into classroom instruction. Beyond SDG 4, the study is also relevant to SDG 9: Industry, Innovation and Infrastructure, through its emphasis on improving ICT infrastructure, digital resource availability, and technology-supported educational innovation, and SDG 10: Reduced Inequalities, through efforts to address disparities in teachers' access to digital tools, training, and institutional support. Its multidisciplinary relevance encompasses education, information and communication technology, organizational development, and educational management. By identifying barriers to digital integration and proposing targeted interventions, the study offers a practical foundation for strengthening instructional quality, promoting equitable access to educational technology, and supporting long-term institutional sustainability.

2. METHODOLOGY

Research Design

This study employed a descriptive-correlational research design to examine the relationship between teachers' digital literacy levels and their instructional effectiveness in public elementary schools in District VI, Manila. The descriptive component assessed teachers' digital literacy in terms of technological skills, information and communication literacy, critical and creative use of digital tools and platforms, professional development and training, and access to ICT resources. The correlational component determined the relationship between these digital literacy dimensions and teachers' instructional effectiveness in integrating technology into teaching and learning. The study primarily utilized quantitative data collected through a structured questionnaire. Short-answer, open-ended questions were also incorporated to identify challenges encountered by teachers in integrating digital technologies into their instructional practices. These qualitative responses were analyzed thematically to supplement and enrich the descriptive and correlational findings. This approach enabled the study to examine the relationship between digital literacy and instructional effectiveness while providing contextual insights into the challenges affecting technology integration in public elementary education.

Research Locale or Study Setting

The study was conducted in selected public elementary schools in District VI, Manila, Philippines. This urban educational setting was selected because of its diverse teaching environments, high student density, and varying levels of access to information and communication technology (ICT) resources. Differences in technological infrastructure, professional development opportunities, and institutional support provided a relevant context for examining teachers' digital literacy and instructional effectiveness. The investigation focused on public elementary schools under the Department of Education, where teachers integrate digital technologies into lesson planning, instructional delivery, classroom management, and assessment. The study was limited to selected public elementary schools within District VI, Manila, excluding private schools, secondary schools, and higher education institutions. This geographical and institutional scope enabled a context-specific examination of digital literacy competencies, instructional practices, and challenges associated with technology integration in public elementary education.

Participants or Data Sources

The respondents comprised 150 public elementary school teachers from selected schools in District VI, Manila, Philippines. They included regular teachers, ICT teachers, and master teachers employed under the Department of Education who were actively engaged in classroom instruction. The participants represented different grade levels, learning areas, and teaching experiences, providing diverse perspectives on digital literacy and technology-integrated instructional practices. Purposive sampling was employed because the complete official population of public elementary school teachers in District VI was unavailable. Participants were selected based on their relevant experience and exposure to digital instruction. The inclusion criteria covered teachers who had participated in ICT-related professional development, had access to technological resources, and had implemented digital literacy strategies in their instructional practices. Respondents' demographic and professional characteristics, including age, gender, highest educational attainment, years of teaching experience, subject area taught, and participation in ICT-related training, were collected for descriptive purposes. The respondents' questionnaire responses served as the primary data source for assessing digital literacy levels, instructional effectiveness, and challenges associated with technology

integration. These data also provided the empirical basis for identifying professional development needs and proposing interventions to strengthen technology-supported teaching practices in public elementary schools.

Research Instruments or Materials

The study utilized a researcher-made survey questionnaire to assess teachers' digital literacy levels, instructional effectiveness, and challenges encountered in integrating digital technologies into classroom instruction. The instrument consisted of a demographic profile section and three main sections. The first assessed digital literacy across five dimensions: technological skills, information and communication literacy, critical and creative use of digital tools and platforms, professional development and training, and access to ICT resources. The second evaluated instructional effectiveness in terms of digital lesson planning, technology-enhanced instructional delivery, digital classroom management, ICT-supported assessment and feedback, and continuous adaptation and innovation. The third examined technical, pedagogical, and contextual challenges affecting technology integration. The questionnaire contained 50 structured items rated using a four-point Likert scale: 4 (Very High), 3 (High), 2 (Low), and 1 (Very Low), together with one short-answer question for qualitative responses. The demographic profile gathered information for respondent characterization but was excluded from the presentation of results. To establish content validity, the instrument underwent expert evaluation by three specialists in educational technology, digital pedagogy, and research methodology, who assessed its relevance, clarity, and alignment with the study variables. A pilot test involving 30 public elementary school teachers excluded from the main sample was conducted to determine internal consistency. Cronbach's alpha yielded an overall reliability coefficient of 0.95, indicating excellent internal consistency (Tavakol & Dennick, 2011). These procedures supported the instrument's suitability for assessing digital literacy and instructional effectiveness among the study respondents.

Data Gathering Procedure

Data collection followed a systematic procedure in accordance with the research guidelines of the Department of Education. Before administering the questionnaire, the researcher submitted a formal request to the Schools Division Superintendent of the Division of City Schools, Manila, and subsequently obtained permission from the Public Schools District Supervisors and school heads of the participating public elementary schools. Following authorization, the researcher distributed the validated questionnaires to the selected teachers through printed and digital formats to ensure accessibility and convenience. Each questionnaire included an informed consent form explaining the study's purpose, voluntary participation, confidentiality, anonymity, and exclusive use of collected information for research purposes. Respondents were given sufficient time to complete the instrument, while coordination with designated school personnel facilitated questionnaire distribution, retrieval, and follow-up reminders through established communication channels. After collecting the completed questionnaires, the researcher systematically organized and encoded the responses for statistical analysis. Quantitative data were processed using appropriate statistical software, while responses to the open-ended question were examined to identify recurring challenges associated with digital technology integration. These procedures supported the systematic collection of data on teachers' digital literacy and instructional effectiveness in District VI, Manila.

Data Analysis

The collected data were organized, encoded, and analyzed using appropriate statistical software. Means and standard deviations were computed to assess teachers' digital literacy levels and instructional effectiveness across their respective dimensions. The mean determined

the average level of each indicator, while the standard deviation measured the variability of respondents' ratings. Weighted means were interpreted using a four-point scale with equal intervals: 3.26–4.00 (Very High), 2.51–3.25 (High), 1.76–2.50 (Low), and 1.00–1.75 (Very Low). Demographic information was collected solely for respondent characterization and was excluded from the statistical analysis and presentation of results. Pearson's product-moment correlation coefficient (r) was employed to determine the relationship between teachers' digital literacy levels and instructional effectiveness. The analysis assessed the strength, direction, and statistical significance of the association between the two variables. Cronbach's alpha was also computed during instrument testing to establish internal consistency. Responses to the open-ended question were examined through thematic analysis to identify recurring technical, pedagogical, and institutional challenges affecting digital technology integration. The combined findings provided the empirical basis for developing a professional enhancement program aimed at strengthening teachers' digital competencies and instructional practices.

Ethical Considerations

The study adhered to established ethical research principles to protect the rights, privacy, and welfare of participating teachers. Ethical approval was secured from PHINMA Saint Jude College Graduate School, while the necessary permissions were obtained from the Schools Division Office of Manila and the heads of participating public elementary schools. Before data collection, respondents provided informed consent after being informed of the study's objectives, procedures, and voluntary nature. Participants were assured of their right to withdraw at any time without consequences. Confidentiality and anonymity were maintained throughout the research process. No personally identifiable information was included in the survey data, and all responses were anonymized during encoding, securely stored, and used exclusively for research purposes. Data handling complied with the Data Privacy Act of 2012 (Republic Act No. 10173). The study also upheld fairness, non-discrimination, and freedom from coercion or undue influence. Findings were reported accurately and objectively to preserve research integrity and protect participants' interests.

3. RESULTS AND DISCUSSION

3.1 Teachers' Digital Literacy Levels

The assessment of teachers' digital literacy levels in selected public elementary schools in District VI, Manila, revealed an overall mean of 3.432 (SD = 0.699), interpreted as Very High. This indicates that respondents generally demonstrated strong digital competencies across technological skills, information and communication literacy, critical and creative use of digital tools and platforms, professional development and training, and access to ICT resources. However, differences among these dimensions revealed areas requiring further institutional support. Professional development and training obtained the highest mean of 3.528 (SD = 0.679), interpreted as Very High. The strongest indicator was the perceived contribution of continuous professional development to quality digital-supported instruction (M = 3.593, SD = 0.643). This suggests that teachers recognize the importance of ongoing training in strengthening their technological competence and instructional practices. The findings are consistent with Mailizar, Umam, and Elisa (2022), who emphasized the contribution of professional learning opportunities to teachers' digital skills, confidence, and technology integration. Technological skills ranked second, with a mean of 3.503 (SD = 0.655), also interpreted as Very High. Teachers demonstrated considerable confidence in operating computers and mobile devices for instructional purposes (M = 3.591, SD = 0.635), adapting to new technologies (M = 3.559, SD = 0.629), and integrating digital tools into classroom instruction (M = 3.525, SD = 0.604). However, troubleshooting basic

technical problems received a comparatively lower rating (M = 3.345, SD = 0.731), indicating a potential need for additional technical support and practical troubleshooting training. The critical and creative use of digital tools and platforms obtained a mean of 3.468 (SD = 0.617), interpreted as Very High. Teachers demonstrated proficiency in designing engaging digital learning activities (M = 3.497, SD = 0.604) and incorporating multimedia resources to improve lesson comprehension (M = 3.492, SD = 0.604). Nevertheless, encouraging learners to use technology for critical thinking and problem-solving and modifying instructional strategies through digital innovation received comparatively lower ratings (both M = 3.441). These findings align with Runge et al. (2023), who highlighted teachers' capacity to develop creative and technology-supported learning activities. The results suggest that further development is needed to promote more advanced and learner-centered applications of educational technology. Information and communication literacy registered a mean of 3.467 (SD = 0.635), interpreted as Very High. Teachers demonstrated strong competence in locating reliable digital instructional resources (M = 3.514, SD = 0.613), guiding learners in the ethical use of online information (M = 3.503, SD = 0.614), and collaborating through digital communication platforms (M = 3.489, SD = 0.650). However, evaluating the credibility of online information received the lowest rating within this dimension (M = 3.392, SD = 0.650), suggesting the importance of strengthening critical evaluation skills when selecting digital instructional materials. Access to ICT resources obtained the lowest mean of 3.195 (SD = 0.888), interpreted as High. Although teachers acknowledged that improved ICT availability enhances instructional effectiveness (M = 3.350, SD = 0.836), school internet connectivity received the lowest rating (M = 2.983, SD = 0.932). The availability of ICT facilities also received a comparatively modest rating (M = 3.136, SD = 0.894). These findings indicate that technological infrastructure remains a significant concern despite teachers' generally strong digital competencies. Limited connectivity and uneven access to digital resources may restrict the consistent implementation of technology-enhanced learning activities. Overall, the findings demonstrate that public elementary school teachers possess strong digital literacy competencies, particularly in professional development, technological skills, and creative technology integration. However, the comparatively lower assessment of ICT resources highlights a gap between teachers' digital capabilities and the technological support available in their schools. Strengthening internet connectivity, improving access to instructional technologies, and providing targeted professional development may help translate teachers' digital competencies into more consistent and effective classroom practices.

3.2 Teachers' Instructional Effectiveness

The assessment of teachers' instructional effectiveness in selected public elementary schools in District VI, Manila, yielded an overall mean of 3.444 (SD = 0.665), interpreted as Very High. This finding indicates that respondents demonstrated strong self-reported instructional practices in integrating digital technologies into lesson planning, instructional delivery, classroom management, assessment, and continuous innovation. The results are consistent with Runge et al. (2023), who emphasized the relationship between teachers' digital competencies and the quality of technology-enhanced instruction. Continuous adaptation and innovation obtained the highest mean of 3.525 (SD = 0.613), interpreted as Very High. Teachers demonstrated considerable openness to modifying their teaching approaches to incorporate digital innovations (M = 3.567, SD = 0.572), using technology to respond to learners' changing needs (M = 3.540, SD = 0.598), and exploring new digital tools to improve instructional practices (M = 3.533, SD = 0.587). These findings suggest that teachers recognize the importance of adapting their

instructional strategies to emerging educational technologies. This observation aligns with Orakova et al. (2024), who highlighted continuous pedagogical innovation as an important component of teachers' digital competence. Technology-enhanced instructional delivery ranked second, with a mean of 3.520 (SD = 0.617), interpreted as Very High. This indicates that teachers effectively incorporated digital tools and multimedia resources into classroom instruction, particularly when explaining complex concepts and improving lesson comprehension. The findings suggest that technology integration supports teachers' capacity to present instructional content in accessible and engaging ways, although opportunities remain to strengthen interactive and learner-centered digital activities. Lesson planning using digital tools obtained a mean of 3.479 (SD = 0.615), also interpreted as Very High. This result reflects teachers' positive assessment of digital resources in preparing, organizing, and delivering instructional content. Digital tools contributed to lesson clarity, instructional organization, and the alignment of learning activities with educational objectives. The findings indicate that teachers have incorporated technology into instructional preparation as part of their regular teaching practices. Digital classroom management registered a mean of 3.443 (SD = 0.665), interpreted as Very High. Teachers demonstrated competence in using digital platforms to communicate classroom rules, provide announcements, and organize learning activities. Nevertheless, maintaining consistent digital engagement and monitoring learners' participation may remain challenging when technological resources and internet connectivity are limited. ICT-supported assessment and feedback received the lowest mean of 3.253 (SD = 0.765), interpreted as High. Teachers reported using digital tools to assess learners' academic performance (M = 3.373, SD = 0.710), track learning progress (M = 3.327, SD = 0.755), and communicate areas for improvement through digital feedback (M = 3.333, SD = 0.730). However, administering quizzes, tests, and performance tasks through online platforms obtained the lowest rating (M = 3.073, SD = 0.812), followed by providing timely feedback through digital means (M = 3.160, SD = 0.778). These findings are consistent with Dhahri and Khribi (2023) and Yeşilyurt and Vezne (2023), who emphasized the contribution of digital assessment tools to monitoring learning progress and supporting instructional feedback. The comparatively lower use of online assessments also aligns with Sulaiman et al. (2023), who identified technological infrastructure and device availability as important requirements for effective digital assessment. Overall, the findings demonstrate that teachers reported strong instructional effectiveness, particularly in adapting to technological innovations, delivering technology-enhanced lessons, and preparing digital instructional materials. However, ICT-supported assessment and feedback remained comparatively less developed. This disparity suggests that teachers' readiness to integrate technology does not necessarily translate into equally strong implementation across all instructional functions. Improving access to digital assessment platforms, strengthening internet connectivity, and providing targeted training in technology-supported evaluation may help address these limitations and promote more comprehensive digital integration in public elementary education. The OECD (2023) also emphasizes that effective digital education depends on aligned infrastructure and educator capacity, while UNESCO (2023) cautions that technology access alone does not ensure improved teaching and learning.

3.3 Relationship Between Digital Literacy and Instructional Effectiveness

The Pearson product-moment correlation analysis revealed statistically significant positive relationships between all five dimensions of teachers' digital literacy and the five domains of instructional effectiveness in selected public elementary schools in District VI, Manila.

Correlation coefficients ranged from r = .398 to r = .622, indicating moderate positive relationships across all evaluated dimensions, with reported significance values of p = .000 (p < .05). Consequently, the null hypothesis stating that there is no significant relationship between teachers' digital literacy levels and instructional effectiveness was rejected. These findings are consistent with Orakova et al. (2024), who emphasized the association between digital literacy, pedagogical performance, and effective technology integration. The strongest relationship was observed between the critical and creative use of digital tools and platforms and lesson planning using digital tools (r = .622, p = .000). This was followed by the relationship between critical and creative digital tool usage and technology-enhanced instructional delivery (r = .585, p = .000). Information and communication literacy was also positively associated with technology-enhanced instructional delivery (r = .580, p = .000), while technological skills demonstrated a significant relationship with the same instructional domain (r = .576, p = .000). These findings suggest that teachers who demonstrate stronger competencies in selecting, evaluating, and creatively applying digital resources also tend to report more effective lesson preparation and technology-supported instruction. The results align with Uzun et al. (2023) and Runge et al. (2023), who highlighted the importance of creative digital applications and information literacy in designing and delivering technology-enhanced lessons. Professional development and training likewise demonstrated significant positive relationships with instructional effectiveness, particularly lesson planning (r = .571), continuous adaptation and innovation (r = .529), and digital classroom management (r = .526). These associations indicate that teachers who report stronger engagement in professional learning also tend to demonstrate greater instructional competence in integrating technology into classroom practices. Access to ICT resources exhibited significant positive relationships with all instructional effectiveness domains, although its correlations were generally lower than those involving creative digital competencies. Its highest association was with ICT-supported assessment and feedback (r = .541), followed by lesson planning using digital tools (r = .531). The lowest correlation across all evaluated relationships was between access to ICT resources and continuous adaptation and innovation (r = .398, p = .000). This suggests that technological resources support effective instruction, but resource availability alone may not fully account for teachers' capacity to innovate and adapt their pedagogical approaches. Overall, the findings establish a statistically significant positive association between teachers' digital literacy levels and instructional effectiveness. Higher digital literacy ratings were consistently associated with stronger ratings of technology-integrated instructional practices. The particularly strong relationships involving critical and creative digital competencies emphasize the importance of developing higher-order technological and pedagogical skills alongside basic technical proficiency. These results support the need for targeted professional development, improved ICT accessibility, and institutional initiatives that strengthen the meaningful integration of digital technologies into public elementary education.

3.4 Challenges in Digital Technology Integration

The thematic analysis of teachers' open-ended responses identified four major challenges affecting the integration of digital literacy into instructional practices in selected public elementary schools in District VI, Manila: internet connectivity, availability and accessibility of ICT devices, availability of ICT resources and facilities, and funding and financial support. These challenges demonstrate that despite teachers' generally high digital literacy levels, technological and institutional limitations continue to affect the consistent implementation of digital instruction. Internet connectivity emerged as a major barrier to effective technology integration.

Teachers reported slow, unstable, or unavailable internet connections that disrupted online learning activities, multimedia presentations, and access to digital instructional platforms. One participant stated, "Lack of Internet connection sometimes" (Teacher Respondent 1), highlighting the unpredictable availability of internet services during classroom instruction. Such interruptions require teachers to modify planned activities or rely on offline alternatives. This finding is consistent with Boonmoh and Sanmuang (2024), who identified inadequate network infrastructure and unreliable connectivity as barriers to technology-supported teaching. Availability and accessibility of ICT devices constituted another significant challenge. Teachers reported insufficient access to functional computers, laptops, tablets, and other digital devices necessary for classroom activities. The problem extended to learners, particularly those without personal devices at home, limiting opportunities for technology-supported learning beyond the classroom. One respondent emphasized the need for "Accessibility to gadgets" (Teacher Respondent 5). These findings indicate that unequal access to digital equipment restricts teachers' ability to implement interactive learning activities and technology-based assessments consistently. Availability of ICT resources and facilities was also identified as a challenge. Teachers reported limited subject-specific digital instructional materials, inadequate interactive educational software, and insufficiently equipped ICT facilities. One participant stated, "No adequate materials to integrate ICT to my subject" (Teacher Respondent 8), while another identified "The readiness of school facilities" (Teacher Respondent 10) as a concern. These responses suggest that access to devices alone is insufficient when appropriate instructional content, software, and functional learning facilities are unavailable. The findings differ from De León, Corbeil, and Corbeil (2022), whose research focused primarily on teacher education pedagogy and individual digital competence rather than school-level infrastructure readiness. Funding and financial support emerged as the fourth major challenge. Teachers identified insufficient institutional funding for ICT equipment, internet subscriptions, software, and facility maintenance. One respondent emphasized the need for "Enough funds for internet connection" (Teacher Respondent 4), while another highlighted "Adequate funding for facilities and implementation of ICT Integration in schools" (Teacher Respondent 7). These responses indicate that inadequate financial resources can limit the sustainability of digital instruction and compel teachers to use personal funds for internet connectivity and instructional materials. This finding is consistent with Muntu, Yuliana, and Tarigan (2023), who emphasized the importance of institutional financial support and technological infrastructure investment. It also differs from Demir, Aktı Aslan, and Demir (2022), whose research focused on teachers' personal motivation and lifelong learning tendencies rather than institutional financing. Overall, the identified challenges reveal a persistent gap between teachers' digital competencies and the resources available to support technology-integrated instruction. Unreliable internet connectivity, insufficient digital devices, inadequate instructional resources, and limited institutional funding collectively constrain the implementation of digital teaching strategies. These findings reinforce the quantitative results showing comparatively lower ratings for access to ICT resources and ICT-supported assessment and feedback. Addressing these barriers requires coordinated institutional support, improved technological infrastructure, equitable access to digital learning resources, and sustainable funding to strengthen instructional effectiveness in public elementary schools.

3.5 General Discussion

Based on the quantitative and qualitative findings, the study proposed Project DIGI-LEAP (Digital Integration and Guided Instruction for Learning Enhancement and Adaptive Pedagogy), a structured enhancement program designed to strengthen teachers' digital literacy and instructional effectiveness in selected public elementary schools in District VI, Manila. The program addresses the identified gaps in ICT infrastructure, digital assessment practices, instructional resources, and institutional support while building on teachers' existing technological competencies. The proposed program was developed in response to teachers' Very High overall digital literacy level (M = 3.432) and instructional effectiveness (M = 3.444), alongside comparatively lower ratings for access to ICT resources (M = 3.195) and ICT-supported assessment and feedback (M = 3.253). The significant positive relationships between digital literacy and instructional effectiveness further support the importance of strengthening both technological competencies and the resources necessary for their effective application. Project DIGI-LEAP incorporates several interconnected interventions. The first focuses on ICT infrastructure and connectivity upgrades, including improvements to campus internet networks and the establishment of device-sharing systems to promote equitable access to digital technologies. The second emphasizes capacity-building in digital assessment and feedback, particularly through workshops on online evaluation platforms, automated feedback systems, interactive assessments, and technology-supported lesson planning. These activities directly address the comparatively limited implementation of digital assessment practices identified in the study. The third intervention involves establishing subject-specific digital resource repositories containing curated instructional materials, multimedia resources, interactive applications, and offline-accessible learning content. These repositories are intended to support teachers in developing relevant and engaging instructional activities despite connectivity limitations. The fourth intervention introduces a Tech-Buddy peer mentoring system, through which technologically proficient teachers provide practical assistance to colleagues in troubleshooting devices, using educational software, and integrating digital tools into classroom instruction. The fifth intervention emphasizes sustainable funding and institutional partnerships to support ICT equipment procurement, internet subscriptions, software access, and facility maintenance. School administrators, ICT coordinators, division supervisors, and other stakeholders are expected to coordinate the implementation of these initiatives. The program identifies public elementary school teachers as its primary beneficiaries, with pupils benefiting indirectly through improved access to interactive and technology-supported learning experiences. Project DIGI-LEAP is proposed for phased implementation within one school year, integrating infrastructure improvements, professional development, resource development, peer mentoring, and institutional support. Its implementation is intended to strengthen teachers' capacity to design technology-enhanced lessons, conduct digital assessments, provide timely feedback, and adapt instructional strategies to learners' needs. Overall, Project DIGI-LEAP provides a research-based framework for addressing the gap between teachers' digital competencies and the technological conditions supporting classroom instruction. By combining professional development with infrastructure improvement, resource accessibility, collaborative mentoring, and sustainable institutional support, the proposed program aims to promote equitable, effective, and sustainable digital integration in public elementary education. The proposed mentoring and training components are consistent with the call for collaborative, sustained teacher professional development in UNESCO and International Task Force on Teachers for Education 2030 (2024).

4. CONCLUSIONS AND RECOMMENDATIONS

The study concludes that public elementary school teachers in District VI, Manila, demonstrate very high levels of digital literacy and instructional effectiveness, reflecting their competence in using digital technologies for lesson planning, instructional delivery, classroom management, and continuous pedagogical innovation. Professional development and technological skills emerged as major strengths, while access to ICT resources and ICT-supported assessment and feedback remained comparatively less developed. The statistically significant moderate positive relationships between digital literacy and instructional effectiveness indicate that stronger digital competencies are associated with more effective technology-integrated instructional practices. However, unreliable internet connectivity, inadequate digital devices, limited instructional resources, and insufficient institutional funding continue to constrain the consistent implementation of digital instruction.

Based on these findings, the study recommends that the Department of Education, local government units, and school administrators prioritize improvements in internet connectivity, ICT infrastructure, and equitable access to digital learning devices through appropriate institutional funding. School heads and ICT coordinators should conduct targeted professional development through In-Service Training (INSET) and School Learning Action Cell (SLAC) sessions, particularly in digital assessment, automated feedback, interactive instructional materials, and higher-order digital pedagogy. The proposed Project DIGI-LEAP should be considered for implementation to strengthen digital resource accessibility, establish Tech-Buddy peer mentoring networks, and promote collaboration among teachers. Partnerships with parent-teacher associations, alumni, nongovernmental organizations, and private sector stakeholders are also recommended to support sustainable ICT integration.

The findings contribute to understanding the relationship between teachers' digital literacy and instructional effectiveness while highlighting the importance of institutional resources in supporting meaningful technology integration. By addressing both pedagogical competencies and infrastructural limitations, Project DIGI-LEAP offers a practical framework for strengthening digital instruction and promoting more equitable learning opportunities. Future researchers are encouraged to evaluate the implementation and long-term effectiveness of the proposed program, particularly its influence on teachers' instructional practices and students' academic performance across different grade levels and educational settings.

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