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Bridging the Digital Divide: A Literature Review on Technology Integration Competencies in Higher Education

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Abstract*—This study presents a comprehensive literature review focused on the analysis of needs, design, development, implementation, and evaluation of instructional modules aimed at enhancing technology integration competences among educators in higher education. Utilizing a systematic literature review methodology, the study is organized around six key themes corresponding to the ADDIE research process: identifying technology integration gaps, assessing digital needs, designing competence frameworks, developing training modules, implementing training programs, and evaluating training effectiveness. The findings reveal significant challenges faced by educators, including inadequate institutional support, insufficient infrastructure, and the need for targeted professional development. Moreover, the study underscores the importance of incorporating ethical considerations into technology training and the necessity for continuous evaluation to measure training impact effectively. Insights derived from the literature highlight the imperative of equipping educators with both technical skills and pedagogical strategies for meaningful technology integration, ultimately aiming to enhance teaching effectiveness and improve student learning outcomes.*

Keywords*—Higher Education, Professional Development, Instructional Design, Needs Assessment, Digital Competence, Pedagogical Strategies, Training Evaluation, Ethical Use of Technology, ADDIE Model.*

I. INTRODUCTION

In today's digital era, integrating technology into higher education is crucial for enhancing teaching effectiveness and improving student learning outcomes. The widespread adoption of computer-generated modalities is driving educational innovation and transforming pedagogical approaches (Padilla et al., 2024). Digital learning tools have reshaped educational landscapes, with many proving to be promising pedagogical resources (Travero & Padilla, 2025).

However, significant challenges persist, particularly in developing countries like the Philippines, where educators often contend with outdated equipment, unstable internet connectivity, and limited technical support (Goles et al., 2024; Morales et al., 2021; Travero, 2023). These infrastructural limitations hinder the seamless integration of digital tools into teaching and learning processes.

A systematic literature review indicates that faculty members frequently struggle with inadequate institutional support, a critical factor in the successful digitalization of education (Nagy & Dringó-Horváth, 2024; Vatanartiran & Karadeniz, 2015). Additionally, the absence of comprehensive professional development and continuous mentorship further exacerbates the competency gap in educators' technological skills (Akram et al., 2021; Edouard, 2023). Research underscores that effective technology integration extends beyond mere access to digital resources; it also requires equipping educators with the necessary skills and confidence to use these tools effectively in their teaching practices (Liang, 2021; Amhag et al., 2019).

To address these gaps, training programs must move beyond basic digital literacy and focus on pedagogical strategies that foster active student engagement. In response to these challenges, this paper presents a comprehensive review of literature examining the needs assessment, design, development, implementation, and evaluation of training programs aimed at enhancing faculty members' competence in technology integration. Grounded in the ADDIE model, this study provides insights into developing effective instructional modules that address key barriers to technology adoption in higher education.

This literature review is structured around six thematic areas aligned with the ADDIE framework: (1) technology integration challenges, (2) needs assessment of digital competency gaps, (3) designing a competence framework, (4) developing instructional modules, (5) implementing training programs, and (6) evaluating training effectiveness. The chapter concludes by synthesizing insights from the reviewed literature, demonstrating their relevance to the present study, and highlighting their implications for improving technology integration in higher education.

II. METHODS

This study employed a systematic literature review methodology to analyze existing research and practices relevant to technology integration in higher education. The systematic approach was designed to ensure a comprehensive and unbiased synthesis of literature, allowing for the identification of key themes, gaps, and best practices in technology training for educators. A structured search strategy was implemented to identify peer-reviewed articles, books, and relevant conference papers from various academic databases. Keywords such as "technology integration,"

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"higher education," "faculty training," and "digital literacy" were utilized to filter pertinent resources. The criteria for inclusion focused on studies published within the last ten years to ensure relevance to contemporary educational contexts.

Selected studies were thoroughly reviewed to extract relevant data, including findings related to technology integration challenges, needs assessments, pedagogical frameworks, and training effectiveness. A thematic analysis approach was adopted, categorizing extracted data into six prominent themes aligned with the ADDIE instructional design model: technology integration gaps, needs assessment on digital gaps, designing competence frameworks, developing instructional modules, implementing training, and evaluating training effectiveness.

To assess the impact of the technology training programs reviewed, metrics such as participant satisfaction, learning outcomes, and practical application of skills were analyzed. Pre- and post-test results, along with qualitative feedback from participants, were integrated to evaluate the effectiveness of the training models identified in the literature. The culmination of the literature review involved synthesizing key insights and findings, which informed the subsequent design and development of instructional modules aimed at bridging identified gaps in technology integration among faculty members. The synthesis process focused on ensuring that the training addressed specific challenges faced by educators, thereby enhancing their digital competencies and pedagogical approaches.

III. Results And Discussion

A. Gaps in Technology Integration

As education continues to evolve in the digital age, many higher education institutions still face significant challenges in fully integrating technology. And while technology advances the educational landscape and makes learning more convenient, it makes skills like critical thinking neglected (Herda et al., 2024). One of the major hurdles is the uneven access to essential infrastructure and resources (GKrimpizi et al., 2023; Cullinan et al., 2021).

In countries like the Philippines, many faculty members struggle with outdated equipment, unstable internet connections, and insufficient technical support, making it challenging to incorporate digital tools into their teaching (Goles et al., 2024; Morales et al., 2021). Financial constraints and maintenance issues can slow technology adoption even in well-funded universities. Without a reliable infrastructure, educators miss out on opportunities to explore innovative teaching strategies and harness the full potential of digital learning.

Consistently highlighted in the literature are the significant challenges to technology integration: institutional support and infrastructure. Vatanartiran and Karadeniz (2015) identified executive (managerial and financial), infrastructural (technological and physical), and instructional (teaching materials and competencies) issues. Similarly, Nagy & Dringó-Horváth, 2024) noted that limited institutional support significantly impacts the effectiveness of digitalization in higher education, noting the need for robust ICT infrastructure and training programs. Mastul et al. (2023) and Alvarez (2020) identified key challenges such as inadequate infrastructure and technical support, limited teacher training, limited access to technology tools, and technical difficulties. Resource constraints are closely related to infrastructure problems (Al-Sindi et al., 2023), including slow internet, load shedding, and inadequate facilities (Akram et al., 2022). Lawrence (2020) pointed out that insufficient support and training significantly affected the effective use of technology. These studies emphasized the need for comprehensive support, including well-funded initiatives, professional development for educators, and equitable access to technology.

Technology integration in education goes beyond just having the proper infrastructure—it also requires equipping educators with the skills and confidence to use digital tools effectively. While some faculty members may have basic digital literacy, many still need additional training to incorporate technology into their teaching seamlessly. The real challenge is learning how to use these tools and applying them to enhance student engagement and improve learning outcomes. Additionally, some educators struggle with resistance to change, uncertainty about best practices, or a lack of confidence in using technology, making it even more crucial to provide targeted support and professional development.

The competency gap in technological skills among educators (Akram et al., 2021; Edouard, 2023) highlights the need for well-structured training and mentorship programs that support faculty at different experience levels. Many seasoned educators who began teaching before the digital era often struggle to adapt to new tools and platforms, making them hesitant to integrate technology into their teaching. At the same time, younger faculty members, while more familiar with digital tools, may lack the necessary training to use them effectively for student engagement and learning. Technology enhancement training should go beyond basic digital literacy and focus on practical, pedagogical strategies that help educators integrate technology into their lessons seamlessly.

Cultural and contextual challenges, such as classroom conditions and cultural restrictions (Khan, 2016; Karkouti, 2023), significantly shape how technology is adopted in educational settings. Cultural factors also play a crucial role in technology adoption. In some societies, traditional teaching methods are deeply ingrained, and there may be resistance to shifting towards more interactive, technology-driven approaches. Some educators may feel uncomfortable incorporating digital tools if they perceive them as undermining their authority or the established teacher-centered approach. Additionally, cultural norms regarding internet use, content restrictions, and attitudes toward digital collaboration can affect how students and teachers engage with technology in the classroom.

Psychological barriers also significantly hinder technology adoption, including technostress, resistance to change, and low

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self-efficacy. Harrel and Bynum (2018) highlights internal challenges, such as teachers' lack of confidence and differing perceptions of technology's role in education, can impact successful integration. To overcome these obstacles, institutions must provide strong professional development programs and create a culture encouraging positive attitudes toward technology use (Panakaje, 2024; Nagy & Dringó-Horváth, 2024). Effective technology integration relies on well-structured teacher training, responsible implementation, and clear policies safeguarding student data. Tortola (2024) emphasizes that equipping educators with the necessary skills and ongoing support enables schools to foster dynamic, technology-enhanced classrooms that benefit both teachers and students.

Closing these gaps requires a well-rounded approach that improves access to essential resources and empowers faculty with the skills and confidence to integrate technology into their teaching. This means offering professional development programs tailored to their needs, providing continuous mentorship, and ensuring strong institutional support. When universities address the lack of infrastructure and the need for faculty training, they create an environment where technology can be used more effectively and equitably in higher education.

B. Needs Assessment on Digital Gap

This section outlined the importance of conducting a needs analysis to identify faculty gaps in knowledge, skills, and attitudes toward technology integration. Addressing these gaps allows for effectively overcoming technology integration barriers and promoting meaningful and intentional use of technology in teaching.

a. Needs Analysis Design

The UNESCO Information and Communication Technology Competency Framework for Teachers (ICT-CFT) (UNESCO, 2018) provided a global standard for integrating ICT into teaching. Recognizing the growing role of ICT in transforming education to meet 21st-century demands, this framework provides a structured approach to understanding the skills, knowledge, and attitudes teachers need to incorporate technology into their instructional practices effectively. As digital tools become essential in the classroom, using the ICT-CFT as a foundation for assessing faculty needs helps to identify areas where further development is required.

This framework is organized into six (6) key aspects of teaching: Understanding ICT in Education, Curriculum and Assessment, Pedagogy, ICT Tools and Skills, Organizations and Administration, and Teacher Professional Learning. Each aspect is further structured into three proficiency levels: Knowledge Acquisition, Knowledge Deepening, and Knowledge Creation, guiding educators from basic digital literacy to more advanced applications of technology promoting student-centered learning and innovation. By aligning the needs analysis with these levels, institutions can pinpoint whether faculty needs to use digital tools, integrate ICT into lessons, or create interactive learning experiences.

The UNESCO ICT CFT is a practical guide for professional development, instructional design, and policy-making. Using the ICT-CFT as a base for needs analysis allows for a structured evaluation of faculty competence in key areas such as understanding digital resources, applying ICT in lesson design, fostering collaborative learning, and ensuring responsible digital citizenship. Through surveys, self-assessments, and classroom observations, valuable insights can be gathered into the faculty's strengths and areas for improvement. The findings then guide the development of targeted training programs to bridge the competency gaps, ensuring faculty members receive the support they need.

Focusing on the faculty's challenges and needs makes the technology integration enhancement training more relevant. Educators gain technical skills and build confidence in using technology to enhance student learning. Ultimately, the UNESCO ICT CFT serves as both a guide and a roadmap for developing a more technology-ready faculty while improving overall learning outcomes.

b. Key Competences in the TICE Training

The survey on technology integration competence uncovered three key competencies at the intersection of knowledge, skills, and attitudes. These competencies are ICT-enhanced teaching, the infusion of digital skills, and ethical and responsible use of technology.

Adhering to a framework for ICT-enhanced teaching. Professional development plays an important role in helping teachers use technology effectively. Various studies noted that technology should support, rather than drive, teaching practices; technology should serve learning objectives. Glover et al. (2016) advocated "a pedagogy first" approach, encouraging teachers to experiment with technology aligned with pedagogical goals, supported by a consultative process and a Teaching Approaches Menu. Bonfiglio-Pavisich (2018), through her Leading Lights Programs, highlighted the alignment of technology with pedagogy to create meaningful, student-centered learning experiences using tools like TIM Matrix. Similarly, Mariscal et al. (2023) stressed the need for professional development to build teachers' competence in integrating educational technology, addressing the gap between positive attitudes and practical application, and ensuring diverse, engaging learning experiences.

For professional development to drive successful technology integration, studies advocated that educators must have the knowledge and skills to implement frameworks that integrate technological tools with pedagogical strategies to enhance personalized and meaningful learning experiences. Successful technology integration, therefore, required a thoughtful, pedagogically-driven approach supported by professional development and adequate resources. Zhang and Zhang (2022) highlighted intelligent technologies like eco-classrooms and flipped classrooms, enabling adaptable, interactive teaching tailored to students' needs. Crompton (2024) introduced the SETI framework, taking a holistic approach considering social, environmental, and technological factors to comprehensive technology integration. Uslu and Usluel (2019) proposed a model addressing teacher competencies and school-level support, showing that these factors significantly influence technology use. Arora and Chander (2020) stressed that the technology integration

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framework must emphasize learners' centrality. Further, they argued that no single framework can apply universally to all learning environments; educators must choose the model that best aligns with their specific context and instructional goals.

These studies demonstrated that integrating technology into teaching required a well-thought-out approach that balanced pedagogical goals with technological tools. Successful integration is supported by frameworks and models that consider various factors, including teacher competence and institutional support. Technology should not be used in isolation but to enhance and enrich teaching and learning, fostering environments that promote meaningful learning experiences for students.

Teaching Ethics and Responsible Use of Technology. As technology integration continues to evolve in educational settings, it is essential to equip teachers with the knowledge to navigate ethical challenges in digital environments. Teaching ethics and responsible use of technology is a critical component of professional learning programs for educators.

Several studies highlighted the importance of incorporating ethical considerations into educational technology training. Balbaa et al. (2023) examine ethical challenges in education, including concerns about student data privacy and online learning integrity, emphasizing the need for frameworks to guide responsible digital tool usage. Pulijala (2024) explored ethical issues tied to emerging technologies like Artificial Intelligence and Virtual Reality, focusing on privacy, equity, and transparency, and advocated for balanced implementation strategies that uphold fairness and inclusivity. On the one hand, Atencio and Acuna (2024) highlighted efforts in Latin American universities to integrate ethical training and institutional policies, promoting sustainable use of technology. Arguing that effective educational technology use requires technical and ethical understanding, Gomes-Trigueros (2023) and Davies and West (2014) underscored the importance of incorporating ethical considerations into professional development. Lapuzina (2023) stressed integrating computer ethics into technical education curricula to prepare students for ethical challenges in technology development.

These reviewed studies emphasized the critical role of ethical considerations in technology integration within educational contexts. By embedding digital ethics into professional development initiatives and curricula, educators and future professionals can be equipped to make responsible and informed decisions, ensuring that technology is aligned with educational values and social responsibilities. These underlined the importance of balancing technological innovation with ethical awareness to foster a sustainable and inclusive educational environment.

Enhancing Digital Skills. With technology integration becoming essential to modern teaching and learning, the need for training to enhance digital skills is increasingly acknowledged in the education setting. Several studies have provided valuable insights into the significance of such training, bringing to the surface teachers' perceptions, practices, and challenges in adopting technology.

Akram et al. (2022) found that teachers view ICT integration positively. They acknowledged that incorporating technology made learning more interactive, exciting, and motivating for students. However, slow internet, inadequate infrastructure, and insufficient training hinder effective use. The study highlighted the need for targeted professional development, adequate resources, and supportive policies to enhance ICT integration. Liang's (2021) study further reinforced the idea that while teachers generally hold positive attitudes toward technology integration in their English language classes, they predominantly use technology for teacher-centered approaches rather than fostering active student engagement. The study found that external challenges, such as lack of technical and pedagogical training, were more significant than internal barriers. This suggested a pressing need for professional development that improves teachers' technical skills and enhances their ability to use technology in ways that actively involve students in the learning process. Similarly, Amhag et al. (2019) underscored the necessity for comprehensive training in digital tools for pedagogical purposes. The findings revealed that teachers needed to primarily utilize digital tools for teaching purposes, and many needed more confidence and knowledge to integrate them into their pedagogy effectively. The study pointed to the need for pedagogical support and professional development programs to help educators understand the value of digital tools and apply them effectively in their teaching contexts.

These studies highlighted the critical role of teacher training in enhancing digital skills among educators. Effective professional development programs should focus on improving teachers' technical skills and emphasize the pedagogical aspects of technology integration. Addressing technical and pedagogical needs fosters an interactive, engaging, and effective learning environment, ultimately benefitting teachers and students.

The studies highlighted that technology integration in education requires professional development programs that equip teachers with technical skills and pedagogical strategies. These insights guided the design of this researcher's technology integration training, emphasizing the importance of frameworks that align technology with teaching goals to support learning objectives. Moreover, the studies stressed the need for training to address ethical considerations, helping educators navigate the responsible use of digital tools. Focusing on technical competence and pedagogical application, the training aimed to foster engaging, student-centered learning environments that promote meaningful learning experiences.

C. Designing Competence Framework

This section laid the groundwork for the study by presenting key frameworks and models that inform the design of instructional modules, ensuring alignment with best practices in technology integration and effective teaching.

Technology Integration Frameworks

Several widely recognized frameworks support teachers in developing the digital skills needed for effective technology integration in the classroom (Becirovic, 2023; Falloon, 2020).

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These include DigCompEdu, UNESCO ICT Competency Framework for Teachers (ICT CFT), TPACK, and SAMR.

The DigCompEdu framework focuses on how teachers can use technology to enhance their teaching. It highlights five essential areas: information and media literacy, communication and collaboration, content creation, responsible use, and digital problem-solving. It outlines 22 specific competencies across six domains to provide practical guidance, including professional engagement, digital resources, teaching strategies, assessment, empowering learners, and fostering students' digital skills (Redecker & Punie, 2017). The TPACK framework, developed by Koehler and Mishra (2009) and based on Shulman's (1986) Pedagogical Content Knowledge (PCK), emphasizes the balance between content knowledge (CK), pedagogical knowledge (PK), and technological knowledge (TK). Instead of viewing these as separate areas, TPACK shows how their integration allows teachers to use technology effectively to support learning. The SAMR framework (Puentedura, 2014) provides a roadmap for incorporating technology into lessons. It outlines four levels—Substitution, Augmentation, Modification, and Redefinition—to help teachers assess and refine how they use digital tools. By moving beyond essential substitution, educators can create more engaging, transformative learning experiences for students.

To truly harness the power of technology in education, teachers need more than just technical skills—they need confidence and a deep understanding of integrating digital tools into their teaching. As role models, they should feel comfortable using technology to guide students in developing their digital competence. Becirovic (2023) emphasized that these frameworks offer valuable support in helping teachers navigate technology integration and create meaningful learning experiences. Travero and Rubin (2021) also support this notion indicating the importance of integrating TPACK framework in creating instructional materials like educational videos.

Researchers like Korucu-Kis and Ozmen (2018), Suarez et al. (2018), and Falloon (2020) develop frameworks to help teachers develop digital technology integration.

Korucu-Kis and Ozmen (2018) introduce the Integrated Technology Competence (ITC) framework, which highlights how teachers' awareness, beliefs, knowledge, and skills shape their ability to integrate technology effectively in the classroom. The framework consists of four key components that work together in practice. Technological awareness refers to how well teachers understand their strengths and gaps regarding technology. Technological beliefs include their confidence in using technology, their teaching philosophies, and other attitudes that influence how they incorporate digital tools. Technological knowledge is about knowing which technologies and teaching strategies best support student learning, while technological skills focus on a teacher's ability to use digital tools effectively in the classroom. These components do not operate in isolation; instead, they constantly interact, shaping how teachers decide technology use. The ITC framework challenges the idea that simply learning how to use technology is enough. Instead, it emphasizes the need for a more holistic approach, considering how teachers' experiences, mindsets, and expertise play a role in meaningful technology integration.

Suarez et al. (2018) developed a model that explains how teachers' technological and pedagogical skills influence their use of digital tools in their personal-professional tasks and the classroom. The model highlights the interconnected nature of these competencies—technological skills shape pedagogical abilities and affect how teachers engage with technology in their work. At the same time, strong pedagogical skills contribute to both personal-professional use and classroom integration. The model also recognizes that personal and contextual factors influence teachers' adoption of and application of technology. By illustrating these relationships, it provides valuable guidance for teacher training, helping educators make meaningful use of digital tools in their teaching.

Falloon's (2020) Teacher Digital Competence (TDC) Framework helps educators develop the skills and knowledge they need to use technology effectively in teaching. It highlights that digital competence is not just about knowing how to use tools but about applying them in meaningful, student-centered ways.

The framework is built around three key areas: curriculum, personal-ethical, and personal-professional competence. Curriculum competence uses technology to support subject knowledge, teaching strategies, and lesson design, aligning with the TPACK model. Personal-ethical competence emphasizes responsible technology use, covering topics like digital citizenship, ethics, online safety, and well-being. Personal-professional competence highlights the importance of ongoing learning, connecting with professional networks, and using digital tools to grow as an educator.

Enhancing digital competence is a continuous journey that requires teachers to reflect, adapt, and refine their use of technology over time (Falloon, 2020). The framework serves as a guide to help educators move beyond basic digital skills, encouraging them to use technology to enhance student learning.

These frameworks provide valuable guidance in helping educators develop digital competence and effectively integrate technology into their teaching. While DigCompEdu, ICT CFT, TPACK, and SAMR offer structured approaches to using digital tools in education, newer models like the ITC framework (Korucu-Kis & Ozmen, 2018), Suarez et al.'s (2018) model and Falloon's (2020) TDC framework take a more holistic view. They emphasize that digital competence goes beyond technical skills—it involves mindset, ethical awareness, and continuous professional growth. By integrating these insights into teacher training, educators can move beyond basic digital literacy and use technology in meaningful ways that enhance student learning.

D. Developing the Modules

This section discusses the basis for developing the technology integration enhancement modules and covers their evaluation to ensure they are appropriate for the technology integration competence enhancement training.

a. Module Development Guide

The development of these modules was centered on Reigeluth's elaboration theory and Kolb's Triple E Framework.

The Elaboration Theory of Reigeluth (Cakiroglu & Ozturk, 2014) underscored a systematic approach to sequencing instructional content to enhance learning and comprehension. The theory proposed that instruction should begin with a simple, foundational view of the subject matter before progressing to more complex ones. This approach ensures learners build a coherent mental framework, allowing them to understand how detailed concepts relate to the broader picture. Central to the theory is progressive elaboration, which guarantees that new information is introduced logically, moving from general to specific. According to Cakiroglu and Ozturk (2014), this approach supported mastering complex topics and fostered meaningful learning by helping learners see the connections between concepts.

The Triple E Framework (Kolb, 2020) offered a practical approach to designing and evaluating effective technology integration in education. Unlike other models focusing primarily on technology's functionality, Triple E emphasized how technology supports engagement, enhancement, and extension of learning objectives. This framework shifted the focus from technology to its impact on student learning and alignment with educational goals.

The first pillar, engagement, emphasizes using technology to actively involve students in learning by fostering focused participation and minimizing distractions. Beyond passive interaction with technology, this encourages meaningful peer collaboration and a deeper connection to the content. The second pillar, enhancement, highlights how technology can improve efficiency, effectiveness, and depth of learning if offered a scaffold that traditional methods cannot provide. Lastly, the extension pillar ensured that technology connected classroom experiences to real-world contexts and fostered lifelong learning skills.

A key feature of the Triple E framework is its student-centered focus, evaluating technology based on its impact on learning rather than its features. By aligning technology use with specific learning goals, the framework ensures that it is integrated purposefully, avoiding the trap of using the technology for its own sake (Gaer & Reyes, 2022). The framework's strength lies in its practicality, alignment with 21st-century skills, and emphasis on active learning. It provides clear guidelines for teachers to select and integrate technology that promotes meaningful learning experiences and real-world challenges for students.

Pratama (2022) strongly supports the Triple E Framework, which focuses on helping students achieve learning objectives through technology integration through its elements of engagement, where technology captures students' interest in the lesson; enhancement, which deepens their understanding, especially on a cognitive level; and extension, which allows learning to continue beyond the classroom. Pratama's research found that integrating technology tools in the classroom keeps students engaged and helps them grasp concepts more effectively and continue learning even after class. This approach ultimately benefits both teachers and students in reaching their learning goals.

The University of the Philippines-Open University's Massive Open Distance eLearning (MODeL) Course on Technology for Teaching and Learning series in 2024 showed adherence to this framework of Triple E. The three courses that made up this MODeL: Introduction to Technology for Teaching and Learning, Teaching and Learning with Modern ICTs, and Blended Teaching and Learning with OERs, were presented through videos to engage students in the lessons; discussion forums, graded quizzes, and assignments to enhance learning and course requirements that ensured learnings were extended in the real-world environment of its teacher-students.

The Elaboration Theory offered valuable insights for designing the technology integration competence enhancement training stressing the sequencing content from basic, initial concepts to more complex applications. The Triple E complemented these perspectives by focusing on the practical application of technology to engage learners, enhance instruction, and extend learning experiences beyond the classroom. These frameworks guide the development of the instructional modules to be theoretically grounded and practically relevant. These assure that the training built the necessary ICT competencies and equipped the faculty to integrate technology meaningfully into their pedagogical practices, ultimately promoting improved student learning outcomes.

b. Instructional Module Evaluation

Studies evaluating instructional modules emphasized content accuracy, clarity, and appropriateness as criteria for effectiveness. Sulman et al. (2023) assessed modules designed for teachers' capacity building and found the modules highly valid in equipping educators with the skills necessary for inclusive education. Similarly, Torrefranca and Rodriguez (2021) noted strong agreement among evaluators on their modules' effectiveness and significant improvement in students' learning. Tugade's (2016) modules were rated excellent for their content quality, learning tasks, and instructional strategies. The study recommended further training for teachers in module development. Yongco and Valle (2022) found that the module was practical in format, content, and clarity but required updates for accuracy and relevance.

Other studies provided valuable insights into module refinement. Munfaati et al. (2022) analyzed modules on practical English and highlighted its strengths in integrating language skills within a realistic context but noted weaknesses in vocabulary support. Mallilin et al. (2024) assessed self-learning modules and emphasized the need for elaboration and interaction in addressing the challenges of independent learning. Darmiany et al. (2022) explored Self-Regulated Learning (SRL) in reflective learning, demonstrating positive correlations between SRL strategies and learning outcomes. Seden et al. (2023) examined self-assessment's impact on evaluative skills and found significant improvements when students engaged with well-defined rubrics and criteria. Lastly, Tarmizi and Janan (2022) validated a reading skills

module using content validity indices, reporting high ratings for usability, content, and alignment with teaching standards.

Studies by Torrefranca and Rodriguez (2021), Seden et al. (2023), and Cruthaka & Pinngern (2016) also measured training and teaching effectiveness using pre/post assessments. The work of Bluman (2018) guided the statistical significance in establishing effectiveness as well as reliability measures. These metrics ensured that training effectiveness was statistically validated and practically meaningful.

Module evaluation is critical to the success of the training. With a focus on content and content accuracy, clarity, and appropriateness, module evaluation confirmed that the instructional materials met the intended learning objectives and addressed the needs of the participants. The evaluation identified content gaps, highlighted improvement areas, and aligned with best instructional design practices.

E. Implementing the Training

This section reviews local studies implementing training packages and e-resources to enhance the competencies of pre-service and in-service teachers. These works emphasized aligning training programs with faculty needs and incorporating active learning strategies in the training implementation.

Studies by Segumpan (2023), Llumuljo (2023), Ramirez (2022), and Alava (2017) focused on equipping pre-service teachers and in-service faculty with the necessary competencies to integrate technology into teaching. Segumpan (2023) designed and implemented an instructional e-package to enhance PSTs' digital competence in teaching Media and Information Literacy (MIL). Using the DigComp framework, the training improved the participants' competencies in digital tools, leading to highly positive evaluations from experts and significant gains in PSTs' performance. To address the gap in the faculty's digital skills, Llumuljo (2023) designed and developed training modules for college physical education instructors focusing on content creation as the least developed skill of the participants. Based on Kolb's Experiential Learning theory, the modules improved digital skills. Moreover, Ramirez (2022) developed and evaluated an e-training package on Technological Pedagogical Content Knowledge (TPACK) for science PSTs. The study revealed a significant increase in the PSTs' TPACK levels, particularly in content and technological knowledge, while pedagogical knowledge was already at an expert level. Alava (2017) developed a training package using the ASSURE model for Biology lesson planning, integrating content, teaching strategies, and classroom technologies.

Studies by Anar (2024), Timula (2024), and Micayabas (2017) employed instructional design frameworks to create specialized training programs for pre-service teachers (PSTs). Anar (2024) enhanced PSTs through the Professional Development Learning Induction Program (PDLIP). Timula's (2024) study promoted heritage conservation by teaching indigenous games. The developed Cultural Preservation Learning Package (CPLP) achieved outcomes such as culture knowledge integration and innovative education practices emphasizing the value of cultural identity. Micayabas (2017) utilized the ADDIE model to design climate change integration modules for Music, Arts, Physical Education, and Health (MAPEH) majors. Both studies highlighted the importance of systematic instructional design in meeting specific training objectives and received positive feedback for clarity and appropriateness.

All these studies implemented training programs that were meticulously designed, ensuring a well-prepared learning environment, actively engaging learners through diverse activities, and providing comprehensive training. The trainings were conducted over two to three days in residential or face-to-face and virtual or in-person training sessions. During the implementation, participants used the training modules designed and developed by the authors and validated by a panel of experts. Local and/or international resource persons spearheaded the lecture via video-conferencing facility or in-person discussion. Training teams facilitated the comprehensive preparations and smooth conduct of the training activities. Participants' needs were attended to, and feedback was sought to improve succeeding sessions further.

These ISD studies emphasized the importance of careful planning and preparation and the meticulous implementation of training programs to successfully achieve the training objective and address faculty needs through targeted professional development programs.

F. Evaluating Training Effectiveness

Assessing the effectiveness of the training and the quality of the instructional modules is an essential procedure. This section examines processes for evaluating the training's impact and the modules' content, clarity, and appropriateness, ensuring they meet participants' needs and learning objectives.

Kirkpatrick and Kirkpatrick's (2006) Four Levels of Training Evaluation provided a structured approach to assess the effectiveness of training programs. The first level, Reaction, measured participants' satisfaction and engagement, offering insights into how well the training resonates with them. The second level, Learning, evaluates the knowledge, skills, and attitudes gained, often through assessments or practical demonstrations. At the third level, Behavior, the focus shifted to how participants apply what they learned from the training to their real-world work environment. Finally, the Results level examined the outcomes from the attendance to the training. This framework provided a comprehensive understanding of a training's effectiveness, encompassing participants' experience and measurable organizational results.

Several studies highlighted the importance of tailored training programs and evaluation models in enhancing technology integration, teaching effectiveness, and professional development. Rahmadani and Ambon (2022) evaluated distance training using Kirkpatrick's model, finding high participant satisfaction and improved learning outcomes, particularly among younger teachers with strong technology skills. Asgar and Satyanarayana (2021) assessed a faculty development program. They successfully enhanced participants' knowledge and skills in designing self-learning materials for open distance learning with suggestions for improvement in future sessions. Moreover, Borate et al.

(2014) applied Kirkpatrick's model to evaluate employee training, finding significant positive impacts across all levels, including improved attitudes, skills, and performance.

Local studies on Instructional Systems Design also evaluated the effectiveness of training programs using Kirkpatrick's evaluation model. Llumuljo (2023), Segumpan (2023), and Micayabas (2017) assessed the Reaction, learning, Behavior, and results, yielding insights into the strengths and areas for improvement in their training. Ramirez (2022), Anar (2024), Timula (2024), and Alava (2017) incorporated expert feedback to refine their packages, ensuring relevance and impact. Across these studies, evaluations confirmed significant improvements in participants' competencies.

Other studies employed other models to evaluate training and teaching impacts. For example, Thaliyan et al. (2023) focused on corporate e-learning programs using the ADDIE model, revealing high employee satisfaction and active organizational assessment of training impacts. In the academic context, Akram et al. (2021) examined online teaching competencies during CoViD 19 using the TPACK model, identifying strong content knowledge but weaker technological skills and recommending the integration of TPACK into faculty development initiatives. Bajracharya (2021) emphasized using TPACK and SAMR models for effective technology integration, advocating for detailed instructional guidance to reduce cognitive load. Finally, Cruthaka and Pinngern (2016) developed a training program for university lecturers, finding significant improvements in technology competencies.

Aside from collectively emphasizing the importance of structured training programs and evaluation frameworks, these studies highlighted the value of assessing satisfaction, learning outcomes, and practical application while tailoring content to participants' needs and context. In addition, these studies underscored the significance of well-designed, systematically evaluated training programs for optimizing technology integration competence in education.

Evaluating the effectiveness of training programs is essential for understanding their impact on participants' learning, skills development, and overall performance. The reviewed studies pointed to rigorous evaluation as crucial for ensuring training programs successfully achieve their objectives. Structured frameworks comprehensively assessed participant satisfaction, learning outcomes, real-world application, and overall results. The multi-level evaluation ensures the training engages and leads to measurable knowledge, skills, and performance improvements. Moreover, incorporating appropriate statistical measures helped validate training effectiveness and delivered meaningful and impactful training results. Tools and approaches such as expert reviews, learner feedback, and pre/post assessments provided insights into how effectively the materials support learning outcomes, bridging the gap between training design and its real-world impact.

IV. Insights and Implications

The insights from the reviewed literature and studies provided valuable guidance in shaping this study to enhance faculty competence in technology integration. These insights informed every stage of the process—from identifying faculty needs to designing, developing, and implementing a structured training program. By applying instructional design frameworks, the study ensured a systematic approach that addressed faculty challenges and facilitated the gradual mastery of digital tools and effective teaching strategies. The training modules were intentionally designed to be practical and hands-on, equipping educators with skills they could immediately apply in their classrooms.

A recurring theme in the literature was educators' challenges in integrating technology effectively. These challenges underscored the importance of offering targeted, needs-based training that empowers faculty across different backgrounds. Rather than introducing new tools, the training focused on building confidence and competence, ensuring educators could seamlessly align technology with their instructional goals. The studies also emphasized that technology should support learning rather than dictate it, reinforcing the need for thoughtful and purposeful integration. Ethical considerations played a key role in the training design, encouraging faculty to make responsible and informed decisions when using digital tools in education.

Furthermore, the literature highlighted the importance of continuous evaluation in instructional design. This insight reinforced the need to assess the training program's effectiveness regularly, ensuring that it engaged participants and led to measurable improvements in their skills and teaching practices. By synthesizing these findings, the study developed a well-rounded and adaptable training program that fosters faculty growth in technology integration, ultimately enhancing teaching effectiveness and student learning experiences.

The findings of this study offer several important implications for higher education institutions aiming to enhance technology integration among faculty. First, it underscores the necessity for targeted professional development programs that don't merely focus on technical skills but also address the pedagogical implications of technology use in teaching. Institutions should prioritize training that equips educators with the knowledge and strategies needed for effective technology integration, fostering an environment where technology enhances instructional practices instead of dominating them.

Second, the emphasis on ethical considerations in the training modules implies that faculty must be prepared to navigate digital landscapes responsibly. Institutions should incorporate discussions on digital citizenship, ethical use of technology, and data privacy into their training frameworks to ensure educators can make informed decisions regarding technology adoption and use in their classrooms.

Moreover, the study highlights the importance of continuous evaluation and feedback mechanisms in training initiatives. Educational institutions are encouraged to implement robust assessment strategies that not only measure immediate learning outcomes but also track long-term impacts

on teaching effectiveness and student engagement. By aligning evaluation methods with training objectives, institutions can make data-informed adjustments to their programs, thereby enhancing overall training efficacy.

Lastly, the insights gained emphasize the need for collaboration across departments and disciplines to create a cohesive approach to technology integration. Encouraging interdisciplinary partnerships can broaden the scope of training and foster innovative teaching practices that leverage diverse technological tools and methods. As faculty become more proficient in integrating technology, the collective enhancement of teaching practices can lead to enriched learning experiences for students, preparing them for a digitally-driven world.

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