© IJARW | ISSN (O) - 2582-1008
August 2026 | Vol. 8 Issue. 2
www.ijarw.com

TEACHERS' TECHNOLOGY INTEGRATION ON TEACHING EFFECTIVENESS IN MATHEMATICS IN SOUTHERN BUKIDNON

Exame Odencio Capangpangan[1], Lance Kenneth Onyot Cagata[2], Mia Daisy Rose Alin Lagaras[3], Jeanesa Equipaje Boncales[4], Irish Lawas Agustin[5] , Oscar J. Arigo Jr [6]

Don Carlos Polytechnic College, Purok 2, Población Norte, Don Carlos, Bukidnon 8712, Philippines

ABSTRACT

This study examined the relationship between teachers' technology integration and teaching effectiveness in Mathematics in selected public secondary schools in Southern Bukidnon. It specifically assessed teachers' level of technology integration in terms of perceived ease of use, perceived usefulness, and attitude toward technology. In parallel, teaching effectiveness was evaluated based on subject matter knowledge, instructional planning and strategies, assessment practices, learning environment, and communication skills. A descriptive-correlational research design was employed to determine the extent of the relationship between the two variables. The study involved 43 Mathematics teachers selected through cluster sampling from the municipalities of Don Carlos and Maramag, Bukidnon. Data were collected using adapted survey questionnaires that measured both technology integration and teaching effectiveness. The gathered data were analyzed using descriptive statistics, such as mean and standard deviation, and inferential statistics, particularly Pearson's correlation coefficient, to examine the relationship between variables.

The findings revealed that teachers demonstrated a high to very high level of technology integration across all measured indicators. Similarly, teaching effectiveness was consistently rated at a very high level in all domains. Furthermore, the results showed a significant positive relationship between teachers' technology integration and their teaching effectiveness.

Based on these findings, it was concluded that increased use of technology, along with positive perceptions toward it, contributes to improve instructional practices in Mathematics. The study concludes that effective technology integration enhances the overall quality of teaching.

It is recommended the continuous development of teachers' digital competencies to sustain and further improve teaching effectiveness and student learning outcomes in Mathematics.

Keyword: Teachers' Technology Integration, Teaching Effectiveness in Mathematics

1. INTRODUCTION

The integration of technology in education has become increasingly important in enhancing teaching and learning processes, particularly in mathematics education. With the continuous advancement of digital tools, teachers are expected to incorporate technology to improve instructional delivery, student engagement, and learning outcomes. Technology enables teachers to present mathematical concepts in more interactive, visual, and meaningful ways, thereby enhancing students' understanding and retention (Haleem et al., 2022). In the context of Southern Bukidnon, the level of technology integration varies depending on teachers' competencies, availability of resources, and institutional support.

Despite its recognized benefits, many mathematics teachers still face challenges in effectively integrating technology into their teaching practices. These challenges include limited access to technological resources, insufficient training, lack of confidence in using digital tools, and inadequate administrative support. As a result, some teachers continue to rely on traditional teaching methods that may not fully address the diverse learning needs of students. Ertmer and Ottenbreit-Leftwich (2016) emphasized that barriers to technology integration are often linked to both external and internal factors. In the Philippine context, similar challenges have been observed, where teachers' readiness and access to technology influence their classroom practices (Roble et al., 2019). This situation raises concerns regarding teaching effectiveness and whether technology integration significantly contributes to improved instructional outcomes.

The importance of this study lies in its potential to examine how technology integration influences teaching effectiveness in mathematics. The findings will provide valuable insights for teachers in improving their instructional strategies using technology. Additionally, school administrators may utilize the results to design relevant professional development programs and improve the allocation of technological resources. Enhancing teaching effectiveness through technology integration can lead to better student learning experiences and improved academic performance in mathematics (Darling-Hammond et al., 2020).

Several studies support the positive impact of technology integration on teaching effectiveness. Research indicates that teachers who effectively integrate technology can enhance student engagement and improve conceptual understanding in mathematics (Tondeur et al., 2017). According to Dirk Tondeur et al. (2017), teachers who meaningfully integrate technology into their instruction demonstrate more effective teaching practices, as digital tools support interactive and student-centered learning. In the Philippine setting, digital pedagogy has been found to improve students' engagement and achievement in mathematics (Saliao & Cajandig, 2025). Similarly, technology integration supports student motivation and learning, although its effectiveness depends on proper implementation (Delos Santos & Tan, 2025). These findings highlight the importance of equipping teachers with the necessary skills and resources to integrate technology meaningfully into their instructional practices.

The study aimed to examine the relationship between teachers' technology integration and teaching effectiveness in Mathematics in Southern Bukidnon. Specifically, it aimed to describe the level of teachers' technology integration in terms of perceived ease of use, perceived usefulness, and attitude toward integrating technology. It also evaluated the level of teaching effectiveness of Mathematics teachers in terms of subject matter knowledge, instructional planning and strategies, assessment, learning environment, and effective communication. The study was conducted within one academic term, beginning with the preparation of research instruments, and securing necessary approvals, followed by data collection, analysis, and interpretation, and culminating in the completion and presentation of the research findings.

1.1 Statement of the Problem

This study was conducted to determine the level of teachers' technology integration and their relationship to teaching effectiveness in mathematics in Southern Bukidnon.

Specifically, this study aimed to answer the following questions:

1. What is the level of teachers' technology integration in Mathematics class in terms of:

   a. Perceived ease of use;

   b. Perceived usefulness; and

   c. Attitude towards integrating?

2. What is the level of teaching effectiveness of mathematics teachers in terms of:

   a. Subject Matter Knowledge;

   b. Instructional Planning and Strategies;

   c. Assessment;

   d. Learning Environment; and

   e. Effective communication?

3. Is there a significant relationship between teachers' technology integration and teaching effectiveness in mathematics in Southern Bukidnon?

1.2 Hypothesis of the Study

The hypothesis was drawn based on the stated objectives and were tested at the 0.05 level of significance:

H_{a1}: There is a significant relationship between teachers' technology integration and teaching effectiveness in mathematics.

2.METHODOLOGY

This chapter presented the research locale, research design, respondents of the study, the research instrument, data gathering procedure, ethical consideration, and the statistical analysis employed.

2.1 Research Design

This study employed a descriptive-correlational research design to examine the relationship between Mathematics teachers' technology integration and teaching effectiveness in public secondary schools in Southern Bukidnon. This design was appropriate as it allowed for the description of existing conditions and the examination of relationships among variables without manipulation (John W. Creswell, 2018). Descriptive-correlational designs were commonly used in educational research to explore variable relationships in real-world classroom settings where experimental control was not feasible (Gay, Mills, and Airasian, 2018).

This design allowed for a comprehensive analysis of the variables and their relationships within the study by not only describing their individual levels but also examining how they interacted with one another. This provided a clearer understanding of possible patterns and linkages between technology integration and teaching effectiveness in the context of Mathematics instruction.

2.2 Locale of the Study

This study was conducted in selected public secondary schools in Southern Bukidnon during the School Year 2025–2026 under the supervision of the Department of Education – Schools Division of Bukidnon. The participating schools were in the municipalities of Don Carlos and Maramag.

In Don Carlos, the selected schools included Don Carlos National High School, Old Nongnongan National High School, New Nongnongan National High School, and Kiara National High School. In Maramag, the selected schools included Bukidnon National School of Home Industries and San Miguel National High School.

Bukidnon is a landlocked province in Region X (Northern Mindanao), characterized by predominantly agricultural landscapes, rolling plateaus, and mountainous terrain. Public secondary schools in Southern Bukidnon demonstrated variability in terms of technological infrastructure, availability of instructional tools, and internet connectivity. The municipalities of Maramag and Don Carlos served as the selected locales of the study, providing a relevant setting for examining the use of technology in public secondary schools.

The respondents of this study consisted of mathematics teachers employed in the identified public secondary schools within these municipalities. Their inclusion provided an appropriate context for examining technology use and its relationship to teaching effectiveness in mathematics instruction.

2.3 Sampling Procedure

This study employed a cluster sampling method to select the respondents of the study. The target population consisted of Mathematics teachers from selected secondary schools in Southern Bukidnon.

In this method, municipalities served as clusters. Selected municipalities were chosen, and all Mathematics teachers within the schools of these municipalities were included as respondents. This approach ensured efficient data collection while representing teachers from different municipal contexts within the area.

Cluster sampling was appropriate given the geographical distribution of municipalities, allowing the researchers to gather reliable data on teachers' technology integration practices and their impact on teaching effectiveness in Mathematics.

2.4 Research Instrument

The study utilized an adapted survey questionnaire as the primary instrument for data collection. The instrument was adopted from the studies of Muhammad Akram (2018) and Mark Catamin (2024) and was used to gather data from Mathematics teachers in public secondary schools in the municipalities of Don Carlos and Maramag, Southern Bukidnon. The instrument consisted of two main parts corresponding to the variables of the study.

Part I focused on teachers' technology integration in Mathematics, covering perceived ease of use, perceived usefulness, and attitude toward integrating digital technologies. Part II measured teaching effectiveness, including subject matter knowledge, instructional planning and strategies, assessment, learning environment, and effective communication.

2.5 Scoring Procedure

To determine the levels of Technology Integration and Teaching Effectiveness of Mathematics teachers, a five-point Likert scale was used for the two variables of the study. Ratings range from 1 to 5, where 5 - Strongly Agree, 4 - Agree, 3 - Neutral, 2 - Disagree, and 1 - Strongly Disagree. This consistent scale allowed for a standardized assessment across all measured domains.

In determining the level of teachers' technology integration, the following scale was used:

Scale	Descriptive Rating	Qualitative Interpretation
4.50 – 5.00	Strongly Agree	Very High
3.50 – 4.49	Agree	High
2.50 – 3.49	Neutral	Moderate
1.50 – 2.49	Disagree	Low
1.00 – 1.49	Strongly Disagree	Very Low

In determining the level of teaching effectiveness of mathematics teachers', the following scale was used:

Scale	Descriptive Rating	Qualitative Interpretation
4.50 – 5.00	Strongly Agree	Very High
3.50 – 4.49	Agree	High
2.50 – 3.49	Neutral	Moderate
1.50 – 2.49	Disagree	Low
1.00 – 1.49	Strongly Disagree	Very Low

2.6 Ethical Considerations

The research was conducted in strict adherence to research ethics. Prior to the conduct of the study, permission was sought from the proper authorities, including the school principals of selected secondary schools in Don Carlos, and Maramag. Informed consent was obtained from the mathematics teacher-respondents after the researchers thoroughly explain the nature, objectives, and procedures of the study on technology integration, and teaching effectiveness in mathematics. Participants are assured of the principles of confidentiality, anonymity, and voluntary participation. They will be informed that their identities would be kept strictly anonymous, and that any information gathered would be used solely for academic purposes to improve mathematics teaching practices in Southern Bukidnon. Furthermore, participants are assured that they had the right to refuse to answer any questions they deemed inappropriate and could withdraw from the study at any time should they feel uncomfortable.

2.7 Data Gathering Procedure

The data collection for this study was conducted through scheduled visits to selected schools. On the first day, the researchers prepared snacks for the respondents as a gesture of appreciation and proceeded to BNSHI School, where the questionnaires were efficiently administered due to the cooperation of the respondents. The researchers then proceeded to Don Carlos National High School, where the data gathering process was similarly smooth and well-organized.

On the following day, the researchers continued the data collection at San Nicolas National High School but experienced a brief delay as the respondents were on break. They then proceeded to Old Nongnongan National High School, where minor difficulties in locating the school were encountered, however, data collection was successfully completed upon arrival due to the respondents' cooperation. The researchers also visited New Nongnongan National High School, where permission was secured from the principal before administering the questionnaires to identified Mathematics teachers.

Finally, the researchers proceeded to Kiara National High School, where a short delay occurred due to the principal's unavailability, but assistance from a teacher facilitated the completion of the process. Despite minor challenges such as scheduling constraints, travel difficulties, and waiting periods, the data collection was successfully completed through the cooperation of school personnel and respondents.

2.8 Statistical Treatment

The data gathered were statistically analyzed using descriptive statistics such as mean, standard deviation, frequency, and percentages. These were used to determine the level of teachers' technology integration and teaching effectiveness of Mathematics teachers in Southern Bukidnon in terms of perceived ease of use, perceived usefulness, attitude toward integration, subject matter knowledge, instructional planning and strategies, assessment, learning environment, and effective communication.

To determine the relationship between teachers' technology integration and teaching effectiveness, the Pearson Product-Moment Correlation was employed. This statistical tool was used to identify whether a significant relationship existed between teachers' technology integration and the teaching effectiveness of Mathematics teachers.

3.RESULTS AND DISCUSSIONS

3.1 The Level of Teachers' Technology in terms of Perceived Ease of Use

The following data presented the level of teacher technology integration in terms of perceived ease of use among mathematics teachers. It reflected the respondents' perceptions regarding how easy and manageable digital technologies were to use in mathematics instruction. The results provided insights into teachers' confidence and comfort in integrating technology into their teaching practices.

Table 1 presents the level of teacher technology integration in terms of Perceived Ease of Use. The overall mean is 4.40, interpreted as Agree and classified as High, indicating that mathematics teachers find digital technologies manageable and straightforward to incorporate into their instruction. The highest mean score is 4.47, corresponding to the statement "I find it easy to learn mathematics through integrating digital technologies," suggesting that teachers perceive technology as a user-friendly tool that facilitates learning.

Table 1. Level of Teacher Technology Integration in terms of Perceived Ease of Use

Statement	Mean	Qualitative Interpretation
I find it easy to learn mathematics through integrating digital technologies.	4.47	High
Integrating digital technologies in mathematics teaching is easy and understandable.	4.44	High
I find It easy to integrate digital technologies in face to face mathematics lesson in my class.	4.42	High
My interaction with digital technologies in mathematics teaching is easy and flexible	4.37	High
It is easy to become skillful in integrating digital technologies in mathematics teaching.	4.33	High
Weighted Mean	4.40	High

Legend:

Scale	*Descriptive Rating*	*Qualitative Interpretation*
4.50 – 5.00	*Strongly Agree*	*Very high*
3.50 – 4.49	*Agree*	*High*
2.50 – 3.49	*Neutral*	*Moderate*
1.50 – 2.49	*Disagree*	*Low*
1.00-1.49	*Strongly Disagree*	*Very low*

Conversely, the lowest mean is 4.33, which relates to the indicator "It is easy to become skillful in integrating digital technologies in mathematics teaching." Though still within the High category, it highlights an area where developing advanced proficiency might be perceived as slightly more challenging.

In the Department of Education (2018), particularly in mathematics instruction requires the visualization of abstract ideas, demonstration of problem-solving processes, and application of concepts to real-life situations. Easy-to-use technology tools enable teachers to present these concepts effectively, without being preoccupied with technical operations. This allows them to focus on designing appropriate teaching strategies, facilitating student learning, and addressing learning gaps.

The results further imply that when teachers find technology easy to use, it enhances their willingness to adopt and sustain its use in the classroom. It fosters a positive attitude towards innovation and reduces resistance to change. However, the relatively lower rating on becoming skillful signals the need for continuous capacitybuilding in advanced technical skills and pedagogical integration, which could further strengthen instructional quality and innovation.

These findings are supported with the study of Li et al. (2025), who emphasized that perceived ease of use is a critical factor that directly influences teachers' adoption and continuous use of digital tools in modern education. Similarly, Kamalov et al. (2023) highlighted that user-friendly interfaces and accessible platforms significantly increase teachers' confidence and willingness to integrate technology into daily instruction. Furthermore, the work of UNICEF (2025) in various countries confirms that when technology is designed to be easy to use, it becomes a powerful enabler for effective teaching and learning, especially in mathematics. Moreover, DepEd's Computerization Program (2025) underscores the importance of providing accessible and easy-to-use digital resources, which significantly influences the motivation and instructional creativity of mathematics teachers (Amaludin et al., 2025).

3.2 The Level of Teacher's Technology Integration in terms of Perceived Usefulness

The following data presented the level of teacher technology integration in terms of perceived usefulness among mathematics teachers. It reflected the respondents' beliefs regarding the value and benefits of integrating digital technologies in mathematics instruction. The results provided insights into how technology supported teachers' professional practice, productivity, and students' learning performance.

Table 2 presents the level of teacher technology integration in terms of Perceived Usefulness. The overall mean is 4.63, interpreted as Strongly Agree and classified as Very High, indicating that teachers strongly believe in the value and benefits of technology in education.

Table 2. Level of Teacher's Technology Integration in terms of Perceived Usefulness

Statement	Mean	Qualitative Interpretation
Integrating digital technologies in my mathematics teaching is useful for my learning and professional practice.	4.72	Very High
Integrating digital technologies in mathematics teaching makes it easier for me to learn and watch	4.65	Very High
Integrating digital technologies in my mathematics class enables me to accomplish tasks effectively.	4.63	Very High
Integrating digital technologies in my mathematics teaching increases my productivity.	4.58	Very High
Integrating digital technologies in my mathematics class improves students' learning performance.	4.56	Very High
Weighted Mean	4.63	Very High

Legend:

Scale	*Descriptive Rating*	*Qualitative Interpretation*
4.50 – 5.00	*Strongly Agree*	*Very high*
3.50 – 4.49	*Agree*	*High*
2.50 – 3.49	*Neutral*	*Moderate*
1.50 – 2.49	*Disagree*	*Low*
1.00-1.49	*Strongly Disagree*	*Very low*

The highest mean score is 4.72, corresponding to the statement "Integrating digital technologies in my mathematics teaching is useful for my learning and professional practice," suggesting that teachers recognize technology as a vital tool for their own growth and instructional effectiveness. Conversely, the lowest mean is 4.56, which relates to the indicator "Integrating digital technologies in my mathematics class improves students' learning performance." Though still rated Very High, it suggests that while teachers are confident about the benefits, they may perceive the direct impact on student achievement as an area that requires further observation or evidence.

In the Department of Education (2017), particularly in mathematics instruction, the very high level of perceived usefulness implies that educators view technology as an essential component of modern pedagogy. They recognize its potential to enhance instruction, increase productivity, and improve learning outcomes. For mathematics teachers, whose subject requires visualization and interactive engagement, the usefulness of technology is evident in making abstract concepts more concrete and understandable.

The results further imply that when teachers strongly believe in the usefulness of technology, they are highly motivated to integrate it effectively into their teaching practices. This positive perception drives them to explore innovative strategies and invest time in learning new tools. It also suggests that technology is no longer viewed as an optional add-on but as a necessity for delivering relevant and engaging instruction in the 21st century.

These findings are supported with the systematic review of Viberg et al. (2023), which revealed that digital tools such as simulations, interactive software, and AI-based applications have a strong positive impact on learning outcomes in mathematics. Similarly, Tabach (2025) emphasized that when teachers perceive technology as useful, it leads to more creative teaching methods, higher student engagement, and better academic results. Furthermore, the study of Aguhayon et al. (2023) confirms that effective technology integration significantly improves conceptual understanding and performance in mathematics. Moreover, DepEd's Digital Rise Program (2022) highlights the importance of technology in equipping learners and teachers with 21st century skills, which significantly influence the quality of instruction and student achievement (Drijvers & Sinclair, 2024).

3.3 The Level of Teacher Technology Integration in terms of Attitude toward integrating

The following data presented the level of teacher technology integration in terms of perceived usefulness. It reflected the respondents' perceptions regarding the benefits and effectiveness of integrating digital technologies in mathematics instruction. The results provided insights into how technology supported teaching practices, productivity, and students' learning performance.

Table 3 presents the level of teacher technology integration in terms of attitude toward integrating digital technologies in Mathematics teaching.

Table 3. Level of Teacher Technology Integration in terms of Attitude toward integrating

Statements	Mean	Qualitative Interpretation
Integrating digital technologies in mathematics teaching makes learning more interesting.	4.79	Very High
I like learning mathematics with the use of digital technologies.	4.74	Very High
Integrating digital technologies in mathematics teaching is fun.	4.72	Very High
Integrating digital technologies in mathematics teaching has a positive effect on learning.	4.58	Very High
Weighted Mean	4.71	Very High

Legend

Scale	*Descriptive Rating*	*Qualitative Interpretation*
4.50 – 5.00	*Strongly Agree*	*Very high*
3.50 – 4.49	*Agree*	*High*
2.50 – 3.49	*Neutral*	*Moderate*
1.50 – 2.49	*Disagree*	*Low*
1.00-1.49	*Strongly Disagree*	*Very low*

The overall weighted mean is 4.71, interpreted as Strongly Agree and classified as Very High, indicating that teachers demonstrate a highly positive attitude toward the use of digital technologies in their instructional practices. This suggests that teachers are not only open to technology integration but are also highly receptive to its role in enhancing the teaching and learning process.

The highest mean score is 4.79, corresponding to the statement "Integrating digital technologies in mathematics teaching makes learning more interesting," suggesting that teachers strongly recognize the role of technology in increasing student engagement and interest. However, the lowest mean is 4.58, which relates to the indicator "Integrating digital technologies in mathematics teaching has a positive effect on learning." Although still within the Very High category, it indicates that while teachers are highly positive toward technology use, there may be a slight need for further validation of its direct impact on students' learning outcomes.

In the context of the Department of Education (2019), particularly in Mathematics instruction, the very high level of attitude toward technology integration reflects a strong culture of openness and adaptability among teachers. This positive disposition supports the effective implementation of digital tools and aligns with current educational reforms promoting 21st century teaching and learning. For Mathematics teachers, who often deal with abstract concepts, having a positive attitude toward technology enhances their ability to deliver lessons in a more interactive and meaningful way.

The results imply that when teachers possess a positive attitude toward technology integration, they are more likely to adopt innovative teaching strategies and create engaging learning environments. Their enthusiasm and willingness to use digital tools contribute to improved classroom dynamics and increased student participation. However, the relatively lower mean on the perceived effect on learning suggests that continuous monitoring and evaluation of technology's impact on academic performance remain essential.

These findings are supported by recent research studies that emphasize the influence of teachers' attitudes and beliefs on successful technology integration. For example, Scherer, Howard, Tondeur, and Siddiq (2019) found that educators with positive attitudes toward digital technologies are significantly more likely to integrate them effectively in classroom instruction, resulting in enhanced teaching practices. Similarly, Viberg et al. (2023) reported that the use of digital tools in mathematics education contributes to heightened student engagement and motivation. In addition, Tondeur, Van Braak, Sang, Voogt, Fisser, and Ottenbreit-Leftwich (2017) highlighted that teachers' beliefs regarding the usefulness and ease of use of technology serve as key determinants of their actual technology adoption in instructional settings. Furthermore, Hew and Brush (2020) underscored that teachers' favorable dispositions toward technology are associated with more frequent and meaningful implementation of digital resources, thereby fostering interactive and student-centered learning environments.

3.4 The Level of Teaching Effectiveness in terms of Subject Matter Knowledge

The following data presented the level of teaching effectiveness in terms of subject matter knowledge among mathematics teachers. It reflected the respondents' competence in delivering mathematics content and integrating technology into instruction. The results provided insights into teachers' ability to apply diverse teaching strategies, connect lessons to real-life situations, and support students' understanding through digital resources.

Table 4. Level of Teaching Effectiveness in terms of Subject Matter Knowledge

Statements	Mean	Qualitative Interpretation
I teach mathematics concepts through a variety of teaching strategies, including technology-based methods.	4.65	Very High
I connect mathematics topics to practical life applications using technology when appropriate.	4.60	Very High
I explain mathematics concepts according to students' intellectual, physical, and emotional needs with the support of technology.	4.53	Very High
I link present mathematics lessons with past and future learning experiences using digital tools.	4.47	High
I demonstrate accurate knowledge of mathematics content while teaching using technology.	4.44	High
I make mathematics content accessible to	4.37	High

students through digital resources		
Weighted Mean	4.51	Very High

Legend

Scale	*Descriptive Rating*	*Qualitative Interpretation*
4.50 – 5.00	*Strongly Agree*	*Very high*
3.50 – 4.49	*Agree*	*High*
2.50 – 3.49	*Neutral*	*Moderate*
1.50 – 2.49	*Disagree*	*Low*
1.00-1.49	*Strongly Disagree*	*Very low*

The data presented in the table 4 shows the level of teaching effectiveness of mathematics teachers in terms of subject matter knowledge. The overall mean score is 4.51, which is described as "Strongly Agree" and interpreted as Very High. This indicates that teachers demonstrate a very high level of competence in delivering mathematics content, particularly when integrating technology into their instruction.

Among the indicators, the highest mean score is 4.65, corresponding to the statement "I teach mathematics concepts through a variety of teaching strategies, including technology-based methods." This suggests that teachers are highly capable of using diverse and technology-supported strategies to enhance students' understanding of mathematical concepts. Similarly, a high mean of 4.60 shows that teachers effectively connect mathematics to real-life applications using technology, reinforcing the relevance of the subject to learners.

On the other hand, the lowest mean score is 4.37, interpreted as "Agree" and High, which refers to making mathematics content accessible through digital resources. Although still rated highly, this comparatively lower score implies that there may be minor challenges in ensuring accessibility of digital materials for all students.

The results imply that mathematics teachers possess strong subject matter knowledge and are effective in integrating technology into their teaching practices. However, there is still a need to further enhance access to digital resources to ensure inclusive and equitable learning opportunities. Strengthening technological support and resource availability can help sustain and further improve teaching effectiveness in mathematics.

These findings are supported by several studies. Lee et al. (2018) highlighted that teachers who acquire advanced knowledge of mathematics demonstrate greater effectiveness in teaching the subject. Moreover, Novianti and Febrialismanto (2020) emphasized that teachers who understand the interplay between content and teaching methods are better able to design assessments that accurately measure students' comprehension and progress. Furthermore, Linda Darling-Hammond et al. (2020) emphasized that access to quality instructional materials and technology enhances teacher effectiveness and student learning outcomes. Similarly, Avalos (2018) stressed that effective professional development requires both strong content knowledge and adequate support systems to sustain teacher growth.

3.5 Level of Teaching Effectiveness in terms of Instructional Planning Strategies

The following data presented the level of teaching effectiveness in terms of instructional planning strategies among mathematics teachers. It reflected the respondents' ability to plan and deliver mathematics instruction using appropriate teaching strategies, materials, and digital tools. The results provided insights into how teachers utilized technology and instructional resources to address students' learning needs and enhance classroom engagement.

Table 5. Level of Teaching Effectiveness in terms of Instructional Planning Strategies

	Mean	Qualitative Interpretation
I use available resources, including digital tools, to meet students' mathematics learning needs.	4.67	Very High
I use different mathematics teaching strategies to enhance students' understanding, including technology.	4.63	Very High

I use appropriate mathematics materials, technology, and resources while teaching.	4.58	Very High
I engage, motivate, and maintain students' attention in mathematics lessons using technology.	4.53	Very High
I adjust my mathematics teaching methodology to make topics relevant to students' lives through technology.	4.49	High
I teach mathematics lessons according to students' individual differences using technology.	4.40	High
Weighted Mean	4.55	Very High

Legend

Scale	*Descriptive Rating*	*Qualitative Interpretation*
4.50 – 5.00	*Strongly Agree*	*Very high*
3.50 – 4.49	*Agree*	*High*
2.50 – 3.49	*Neutral*	*Moderate*
1.50 – 2.49	*Disagree*	*Low*
1.00-1.49	*Strongly Disagree*	*Very low*

Table 5 presents the level of teaching effectiveness in terms of instructional planning strategies. As shown in the table, the overall weighted mean of 4.55, interpreted as Strongly Agree with a qualitative description of Very High, indicates that the respondents perceive teachers to demonstrate a very high level of effectiveness in planning and delivering mathematics instruction. A closer examination of the indicators reveals that the highest mean of 4.67 was obtained by the statement, "I use available resources, including digital tools, to meet students' mathematics learning needs." This indicates that teachers are perceived to be highly resourceful and capable of maximizing available instructional materials and technologies to support student learning.

This is followed by the statement, "I use different mathematics teaching strategies to enhance students' understanding, including technology," with a mean of 4.63, and "I use appropriate mathematics materials, technology, and resources while teaching," with a mean of 4.58. These results consistently reflect a strong integration of both traditional and modern teaching approaches in instructional planning. On the other hand, the lowest mean of 4.40 was recorded for the statement, "I teach mathematics lessons according to students' individual differences using technology." Although still interpreted as Agree with a qualitative description of High, this finding suggests that differentiated instruction through technology is slightly less emphasized compared to other instructional planning strategies.

The results highlight a potential area for improvement, particularly in the use of technology for differentiated instruction. While teachers are already integrating digital tools, further strengthening their ability to address diverse learner needs through more individualized approaches may enhance the inclusiveness and responsiveness of instruction.

These findings are aligned with the Technological Pedagogical Content Knowledge (TPACK) Theory, which posits that effective teaching occurs when teachers successfully integrate content knowledge, pedagogical skills, and technological competence. The very high ratings across indicators suggest that such integration is evident in teachers' instructional planning practices. Furthermore, these results support the findings of Darling-Hammond et al. (2017), who emphasized that well-designed instruction, supported by appropriate strategies and technology, enhances student learning outcomes. This is further reinforced by DepEd Order No. 42, s. 2017, which highlights the importance of designing instruction that is responsive to learners' needs and aligned with curriculum standards. Similarly, Garcia and Santos (2021) found that the effective integration of technology in lesson planning is associated with higher levels of teaching effectiveness and student engagement. In the same way, Reyes and Dela Cruz (2023) reported that the use of varied instructional strategies, combined with digital tools, significantly improves students' understanding in mathematics.

3.6 The Level of Teaching Effectiveness in terms of Assessment

The following data presented the level of teaching effectiveness in terms of instructional planning strategies among mathematics teachers. It reflected the respondents' ability to plan and deliver mathematics instruction using appropriate teaching strategies, materials, and digital tools. The results provided insights into how teachers utilized technology and instructional resources to address students' learning needs and enhance classroom engagement.

Table 6. Level of Teaching Effectiveness in terms of Assessment

Statements	Mean	Qualitative Interpretation
I maintain a record of students' mathematics results.	4.86	Very High
I encourage students to improve their mathematics performance after assessments.	4.81	Very High
I use multiple assessment strategies in mathematics.	4.70	Very High
I conduct class tests in mathematics to monitor students' performance regularly.	4.65	Very High
I evaluate students' mathematics performance and provide timely feedback on their errors.	4.49	High
Weighted Mean	4.70	Very High

Legend

Scale	*Descriptive Rating*	*Qualitative Interpretation*
4.50 – 5.00	*Strongly Agree*	*Very high*
3.50 – 4.49	*Agree*	*High*
2.50 – 3.49	*Neutral*	*Moderate*
1.50 – 2.49	*Disagree*	*Low*
1.00-1.4	*Strongly Disagree*	*Very low*

Table 6 presents the level of teaching effectiveness in terms of assessment. As reflected in the table, the overall weighted mean of 4.70, interpreted as Strongly Agree with a qualitative description of Very High, indicates that the respondents perceive teachers to demonstrate a very high level of effectiveness in assessment practices. Among the indicators, "I maintain a record of students' mathematics results" obtained the highest mean of 4.86, suggesting that teachers consistently monitor and document student performance. This is followed by "I encourage students to improve their mathematics performance after assessments," with a mean of 4.81, which reflects teachers' role in promoting student motivation and continuous improvement.

In addition, "I use multiple assessment strategies in mathematics," with a mean of 4.70, and "I conduct class tests in mathematics to monitor students' performance regularly," with a mean of 4.65, both received a Very High interpretation.

These findings indicate that teachers employ varied and systematic assessment approaches to effectively track student progress and understanding. Meanwhile, the lowest mean of 4.49 was recorded for "I evaluate students' mathematics performance and provide timely feedback on their errors." Although still interpreted as Agree with a qualitative description of High, this result suggests that the timeliness and depth of feedback may be an area for further enhancement. This may be attributed to factors such as workload or time constraints; however, this requires further investigation.

The findings suggest that teachers effectively utilize assessment not only for grading purposes but also as a tool for monitoring learning progress, identifying students' strengths and weaknesses, and guiding instructional decisions. The high rating in maintaining student records further indicates systematic tracking of student achievement, which is essential for informed teaching practices.

These findings are supported by Suurtamm et al. (2016), who emphasized that classroom assessment plays a crucial role in improving mathematics instruction by providing evidence of student understanding that teachers can use to refine their teaching strategies. Likewise, Andersson and Palm (2017) found that formative assessment practices, particularly continuous monitoring, and feedback, significantly improve students' mathematics achievement. Moreover, Niyibizi and Mutarutinya (2024) reported that the use of multiple assessment strategies and constructive feedback enhances students' engagement, comprehension, and academic performance in mathematics. These studies reinforce the present findings that effective assessment practices are associated with a very high level of teaching effectiveness.

3.7 The Level of Teaching Effectiveness in terms of Learning Environment

The following data presented the level of teaching effectiveness in terms of learning environment among mathematics teachers. It reflected the respondents' ability to create a positive, engaging, and technology-supported classroom atmosphere for mathematics instruction. The results provided insights into how teachers used digital tools to encourage participation, maintain classroom management, and support students' learning experiences.

Table 7. Level of Teaching Effectiveness in terms of Learning Environment

Statement	Mean	Qualitative Interpretation
I create an attractive and friendly learning environment for mathematics using digital tools	4.63	Very High
I ensure students' active participation in mathematics lessons through technology.	4.60	Very High
I create a climate of mutual trust and respect in the mathematics classroom, incorporating technology.	4.58	Very High
I emphasize continuous improvement toward students' mathematics achievement using digital resources.	4.56	Very High
I ensure that lower-achieving students have opportunities to succeed in mathematics using technology.	4.49	High
I maintain a mathematics classroom setting that minimizes disruption with the support of technology	4.42	High
Weighted Mean	4.55	Very High

Legend:

Scale	*Descriptive Rating*	*Qualitative Interpretation*
4.50 – 5.00	*Strongly Agree*	*Very high*
3.50 – 4.49	*Agree*	*High*
2.50 – 3.49	*Neutral*	*Moderate*
1.50 – 2.49	*Disagree*	*Low*
1.00-1.49	*Strongly Disagree*	*Very low*

The data in Table 7 presents the level of teaching effectiveness in mathematics in terms of learning environment. The overall weighted mean is 4.55, which falls under the descriptive rating of "Strongly Agree" and is interpreted as Very High. This indicates a highly favorable perception of teachers in creating an effective and supportive learning environment using digital technology.

Among the indicators, the highest mean value is 4.63, which corresponds to the statement "I create an attractive and friendly learning environment for mathematics using digital tools," indicating that teachers are highly capable of designing engaging and motivating classrooms. On the other hand, the lowest mean value is 4.42, found in the statement "I maintain a mathematics classroom setting that minimizes disruption with the support of technology," which is still rated as High but suggests that classroom management using technology needs slight improvement.

In the context of mathematics teaching in Southern Bukidnon, the results imply that teachers are effective in integrating digital tools to promote active participation, mutual respect, and continuous improvement in student learning. However, the slightly lower rating in managing disruptions indicates the need to strengthen strategies in handling technology-related challenges inside the classroom. The results further imply that an effective digital learning environment contributes to better teaching effectiveness, as it enhances student engagement and supports diverse learning needs. When teachers are confident in using technology, they are more capable of delivering meaningful and interactive mathematics lesson.

These findings are supported by recent studies that emphasized the importance of digital literacy and technology integration in improving teaching effectiveness. According to Saliao and Cajandig, the use of digital tools in mathematics instruction significantly enhances students' engagement and academic performance. Likewise, studies from MDPI (2022) revealed that effective integration of technology leads to improved instructional practices and learning outcomes. Similarly, the work of Ertmer and Ottenbreit-Leftwich (2019) emphasized that teachers' ability to create technology-supported learning environments strengthens student participation and achievement. Furthermore, the Department of Education (2019) highlights the integration of ICT as a core competency for enhancing teaching performance and creating effective learning environments.

3.8 The Level of Teaching Effectiveness in terms of Effective communication

The following data present the level of teaching effectiveness in terms of effective communication among Mathematics teachers. It shows their ability to communicate mathematical concepts clearly and accurately to students, including the use of appropriate language and explanations to support learning.

Table 8. Level of Teaching Effectiveness in terms of Effective communication

Statement	Mean	Qualitative Interpretation
I respond to students' questions in appropriate mathematical language.	4.70	Very High
I use correct mathematical vocabulary and grammar when teaching mathematics.	4.58	Very High
I explain mathematics lessons according to the age and ability of my students.	4.51	Very High
Weighted Mean	4.60	Very High

Legend:

Scale	*Descriptive Rating*	*Qualitative Interpretation*
4.50 – 5.00	*Strongly Agree*	*Very high*
3.50 – 4.49	*Agree*	*High*
2.50 – 3.49	*Neutral*	*Moderate*
1.50 – 2.49	*Disagree*	*Low*
1.00-1.49	*Strongly Disagree*	*Very low*

The data in Table 8 presents the level of teaching effectiveness in mathematics in terms of effective communication. The overall weighted mean is 4.60, which falls under the descriptive rating of "Strongly Agree" and is interpreted as Very High. This indicates that teachers demonstrate a high level of effectiveness in communicating mathematical concepts clearly and appropriately to students.

The highest mean score of 4.70 corresponds to the statement, "I respond to students' questions in appropriate mathematical language," indicating that teachers are highly skilled in addressing students' inquiries with accurate and precise mathematical terms. In contrast, the lowest mean of 4.51 is for the statement, "I explain mathematics lessons according to the age and ability of my students." Although still rated Very High, this suggests a slight need to further improve strategies for tailoring explanations to the diverse learning needs of students.

The findings indicate that teachers in Southern Bukidnon effectively use appropriate language, vocabulary, and explanations to support student understanding, which contributes to better comprehension and increased engagement in learning. Effective communication plays a crucial role in mathematics instruction, as it allows teachers to present concepts clearly, respond accurately to student inquiries, and guide learners toward deeper understanding. When explanations are tailored to students' levels of knowledge and ability, classroom interaction is enhanced, and students develop greater confidence in their mathematical skills. The results suggest that when teachers communicate mathematics concepts clearly and appropriately, students are better able to understand, engage, and build confidence, highlighting the vital role of communication in effective teaching.

These results are supported by research highlighting the importance of teacher communication. John Hattie (2018) emphasized that clarity in teaching significantly affects student achievement. Similarly, Robin Alexander (2020) noted that effective classroom dialogue improves understanding and participation. Moreover, OECD (2019) reported that clear and precise communication by teachers is a key factor in enhancing learning outcomes and fostering student engagement.

3.9 Correlation analysis Between the Teachers' Technology Integration and Teaching Effectiveness in Mathematics in Southern Bukidnon

The following data present the correlation analysis between teachers' technology integration and teaching effectiveness in Mathematics in Southern Bukidnon. It shows the relationship between the two variables, specifically whether the extent of teachers' use of technology is associated with their level of teaching effectiveness.

Table 9. Correlation analysis Between the Teachers' Technology Integration and Teaching Effectiveness in Mathematics

Variable	Correlation coefficient (r)	Probabilities (p)
Technology Integration and Teaching Effectiveness	.616	.000**

** . Correlation is significant at the 0.01 level (2-tailed)

Table 9 presents the correlation analysis between teachers' technology integration and teaching effectiveness in Mathematics. The results revealed a correlation coefficient of $r = 0.616$ with a p-value of 0.000, which is significant at the 0.01 level of significance. This indicates that there is a strong positive and statistically significant relationship between teachers' technology integration and teaching effectiveness in Mathematics.

As the obtained p-value (0.000) is less than the 0.01 level of significance, the hypothesis was accepted. This indicates that there is a significant relationship between teachers' technology integration and teaching effectiveness in Mathematics. The finding emphasizes that integrating technology in mathematics instruction plays an important role in enhancing teaching effectiveness. It further implies that strengthening teachers' technological competencies may lead to more effective instructional practices and improved student learning outcomes.

The result implies that higher levels of technology integration among teachers are associated with higher levels of teaching effectiveness. This suggests that when mathematics teachers effectively utilize digital technologies in instruction, they tend to demonstrate improved instructional delivery, enhanced classroom engagement, more effective communication, and better support for students' learning needs.

Recent studies have shown a significant relationship between teachers' technology integration and teaching effectiveness. Bond et al. (2020) reported that higher levels of digital technology integration are significantly associated with improved instructional quality and student engagement. Similarly, Petko et al. (2021) found a significant positive relationship between ICT integration in teaching and teachers' instructional effectiveness, particularly when technology use is aligned with pedagogical goals. Scherer, Siddiq, and Tondeur (2019) also confirmed a significant relationship between teachers' ICT competence and effective teaching practices, including instructional delivery and classroom management. These findings support the result of the present study that teachers' technology integration is significantly related to teaching effectiveness in Mathematics.

4.ACKNOWLEDGMENT

The researchers would like to express their deepest gratitude to our Almighty God, for His divine guidance, wisdom, and strength throughout the completion of this academic endeavor. His grace has been our constant source of perseverance and inspiration.

The researchers extend their sincere appreciation to their research adviser, Oscar J. Arigo Jr., MS, for his invaluable guidance, patience, constructive feedback, and continuous support throughout the conduct of this study. His expertise and mentorship greatly contributed to the successful completion of this research.

The researchers are also grateful to the members of the research panel, Fe B. Nambatac, PhD, Marianeña P. Rama, MS, and Ariel M. Berico, MS, for their insightful comments, professional suggestions, and encouragement that helped improve the quality of this study.

Special thanks are extended to the administration of Don Carlos Polytechnic College, particularly to the College of Education, for providing the necessary academic environment and institutional support that made this research possible.

The researchers would also like to express their heartfelt gratitude to the participating schools and Mathematics teachers in the municipalities of Don Carlos and Maramag, Bukidnon, for their cooperation and willingness to take part in this study. Their participation played a vital role in the completion of this research.

Furthermore, the researchers extend their appreciation to their families and friends for their unwavering moral, emotional, and financial support, as well as for their understanding and encouragement throughout this research journey.

Lastly, to all individuals who have contributed in one way or another to the success of this study, the researchers extend their sincerest gratitude and appreciation.

REFERENCES

[1]. Abbasi, S., Ayoob, T., Malik, A., & Memon, S. I. (2021). Perceptions of students regarding E-learning during COVID-19 at a private medical college. Pakistan Journal of Medical Sciences, 37(1), 1–6.

[2]. Abdu, R. (2018). Teachers' challenges in implementing information and communication technology in secondary schools. International Journal of Education and Development Using ICT, 14(2), 45–59.

[3]. Abella, J. M., & Dela Rosa, P. T. (2025). ICT access, teacher attitudes, and digital competency among Filipino educators. Philippine Journal of Educational Technology, 6(1), 25–39.

[4]. Aguilon, M. C., & Guhao, E. S. (2024). Instructional performance and students' academic achievement in secondary schools. Philippine Journal of Education Studies, 12(1), 45–58.

[5]. Agyei, D. D., & Voogt, J. (2016). Examining factors affecting beginning teachers' transfer of learning of ICT-enhanced learning activities in their teaching practice. Australasian Journal of Educational Technology, 32(3), 1–17.

[6]. Alabdulaziz, M. S. (2021). Digital transformation in education: Teachers' digital competence and readiness. Education and Information Technologies, 26(6), 1–18.

[7]. Alegado, P. J., & Olipas, C. N. (2023). Digital competence and technology integration among public school teachers in the Philippines. International Journal of Educational Technology, 20(2), 112–126.

[8]. Aliazas, V. L. (2024). Blended learning practices and teaching effectiveness in Philippine secondary schools. Asia Pacific Journal of Multidisciplinary Research, 12(2), 78–89.

[9]. Alqahtani, T., Ibrahim, M., & Hassan, M. (2023). Digital transformation in education: Teachers' perceptions and technology integration practices. Education and Information Technologies, 28(5), 5671–5690.

[10]. Ancho, I. V., & Arrieta, G. S. (2021). Filipino teacher professional development in the time of COVID-19. Education Research International, 2021, 1–10.

[11]. Andersson, C., & Palm, T. (2017). The impact of formative assessment on student achievement: A study of the effects of changes to classroom practice after a comprehensive professional development programme. Learning and Instruction, 49, 92–102.

[12]. Amaludin, A., Rahmawati, Y., Suyono, S., & Wahono, B. (2021). The effect of technology integration on teaching and learning quality. Journal of Physics: Conference Series, 1819(1)

[13]. Aquino, R. M., & Chavez, L. P. (2022). Outcomes-based education and teaching effectiveness in Philippine higher education institutions.

Philippine Social Science Journal, 5(3), 34–46.

[14]. Asad, M. M., Hussain, A., Wadho, M., Khand, Z. H., & Churi, P. P. (2020). Integration of e-learning technologies for interactive teaching and learning process. International Journal of Advanced Computer Science and Applications, 11(12), 1–7.

[15]. Aslam, S., Adefila, A., & Bagiya, Y. (2021). ICT integration in teaching and learning: A systematic literature review. Education and Information Technologies, 26(4), 1–20.

[16]. Atabek, O. (2020). Alternative certification program preservice teachers' integration of technology in teaching. Contemporary Educational Technology, 11(3), 246–261.

[17]. Bandura, A. (1986). Social foundations of thought and action: A social cognitive theory. Prentice-Hall.

[18]. Barrot, J. S., Llenares, I. I., & Del Rosario, L. S. (2021). Students' online learning challenges during the pandemic and how they cope with them. Education and Information Technologies, 26(6), 7321–7338

[19]. Bashir, A. (2025). The effect of perceived usefulness and perceived ease of use on learning motivation in online platforms. International Journal of Innovative Science and Technology Research.

[20]. Bond, M., Buntins, K., Bedenlier, S., Zawacki-Richter, O., & Kerres, M. (2020). Mapping research in student engagement and educational technology: A systematic evidence map. International Journal of Educational Technology in Higher Education, 17(1), 2.

[21]. Brookhart, S. M. (2017). How to give effective feedback to your students (2nd ed.). ASCD.

[22]. Casey, G., & Bruce, B. C. (2011). The practice profile of inquiry: Connecting digital literacy and pedagogy. Journal of Adolescent & Adult Literacy, 55(2), 152–161.

[23]. Cedeño, M. R., & Mongas, A. T. (2025). Student-centered instructional practices and academic engagement in public secondary schools. Philippine Journal of Educational Research, 14(1), 21–39.

[24]. Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. MIS Quarterly, 13(3), 319–340.

[25]. Darling-Hammond, L., Hyler, M. E., & Gardner, M. (2017). Effective teacher professional development. Learning Policy Institute. https://learningpolicyinstitute.org

[26]. Darling-Hammond, L., & Hyler, M. E. (2019). Preparing educators for the time of COVID and beyond. Learning Policy Institute.

[27]. De Vera, J. L., Ramos, J. P., & Santos, M. R. (2021). ICT competence and challenges among public secondary school teachers in the Philippines. Asia Pacific Journal of Multidisciplinary Research, 9(3), 102–110.

[28]. Dela Cruz, J. R., & Mendoza, A. L. (2022). Digital competence and instructional innovation among teachers in Bukidnon. Mindanao Education Review, 4(2), 44–58.

[29]. Demir, K., & Akpinar, E. (2018). The effect of mobile learning applications on students' academic achievement and attitudes toward mobile learning. Malaysian Online Journal of Educational Technology, 6(2), 48–59.

[30]. Department of Education. (2010). DepEd Order No. 78, s. 2010: Guidelines on the implementation of the DepEd Computerization Program (DCP). https://www.deped.gov.ph/wp-content/uploads/2010/06/DO-No.-78-s.-2010.pdf

[31]. Department of Education. (2019). DepEd Order No. 21, s. 2019: Policy guidelines on the K to 12 Basic Education Program. https://www.deped.gov.ph/2019/08/22/do-21-s-2019-policy-guidelines-on-the-k-to-12-basic-education-program.

[32]. Department of Education (DepEd). (2022). Basic education report 2022. Department of Education, Republic of the Philippines. https://www.deped.gov.ph

[33]. Department of Education (DepEd). (2025). Brightening the future of Philippine education. Retrieved from https://www.deped.gov.phDepartment of Education (DepEd). (2022). Basic education report 2022. Department of Education, Republic of the Philippines. https://www.deped.gov.ph

[34]. De Castro, J. R., & Beltran, M. S. (2023). Instructional clarity and academic performance in secondary science classrooms. International Journal of Instruction, 16(2), 345–360.

[35]. Ertmer, P. A., & Ottenbreit-Leftwich, A. T. (2010). Teacher technology change: How knowledge, beliefs, and culture intersect. Journal of Research on Technology in Education, 42(3), 255–284.

[36]. Ertmer, P. A., & Ottenbreit-Leftwich, A. T. (2019). Teacher technology change: How knowledge, confidence, beliefs, and culture intersect. Journal of Research on Technology in Education, 51(2), 99–113.

[37]. Filiz, A., & Gür, H. (2026). Investigating mathematics teachers' technology acceptance and self-efficacy for technology integration: A structural equation modeling approach. International Electronic Journal of Elementary Education, 18(3), 391–406.

[38]. Granić, A., & Marangunić, N. (2019). Technology acceptance model in educational context: A systematic literature review. British Journal of Educational Technology, 50(5), 2572–2593.

[39]. Hatlevik, O. E., & Christophersen, K. A. (2023). Digital competence and student-centered learning environments: Implications for teacher practice. Computers & Education, 194, 104662.

[40]. Hattie, J. (2017). Visible learning for teachers: Maximizing impact on learning. Routledge.

[41]. Hodgson, V., & Shah, S. (2017). The social learning potential of ICT in higher education. British Journal of Educational Technology, 48(2), 345–356.

[42]. Hussain, I. (2018). Role of ICT in improving teaching and learning process. Journal of Education and Educational Development, 5(1), 123–137.

[43]. Hyang, S., & Rim, H. (2023). Teachers' digital literacy and professional flexibility in technology-enhanced learning. Educational Technology Research and Development, 71(4), 1235–1252.

[44]. Ilomäki, L., & Lakkala, M. (2018). Digital technology and practices for school improvement: Innovative digital school model. Research and Practice in Technology Enhanced Learning, 13(1), 1–32

[45]. Instefjord, E. J., & Munthe, E. (2017). Preparing pre-service teachers to integrate technology: An analysis of the emphasis on digital competence in teacher education curricula. European Journal of Teacher Education, 40(5), 673–691.

[46]. Jogezai, N. A., Baloch, F. A., Jaffar, M., Shah, T., & Khilji, G. K. (2018). Teachers' attitudes towards ICT integration in secondary schools. Journal of Educational Research, 21(1), 1–15.

[47]. Kamalov, F., Santandreu Calonge, D., & Gurrib, I. (2023). New era of artificial intelligence in education: Toward a sustainable multidisciplinary approach. Sustainability, 15(16), 12451.

[48]. Karagul, B. I., Seker, M., & Aykut, C. (2021). Digital literacy and self-directed learning readiness among secondary school students. Education and Information Technologies, 26(4), 1–18

[49]. Koehler, M. J., Mishra, P., & Cain, W. (2017). What is technological pedagogical content knowledge (TPACK). Journal of Education, 193(3), 13–19.

[50]. Kraft, M. A., & Papay, J. P. (2016). The durability of teacher effectiveness: The role of instructional improvement and school context. Educational Evaluation and Policy Analysis, 38(4), 609–630.

[51]. Licen, S., & Prosen, S. (2024). Integrating digital competence in teacher education: Toward sustainable teaching frameworks. Sustainability, 16(2), 845.

[52]. Lin, T. J., Wang, X., & Tsai, C. C. (2022). Teachers' digital literacy and its relationship with classroom engagement and learning outcomes. Computers & Education, 176, 104353.

[53]. Linus, A. A., Aladesusi, G. A., Ishola, A. M., & Fasina, J. E. (2025). Perceived usefulness, ease of use, and intention to utilize online tools for learning among college of education students. Indonesian Journal of Multidisciplinary Research, 5(1), 41–52.

[54]. Luna, R. B. (2022). Professional development participation and instructional competence of public school teachers. Philippine Journal of Teacher Education, 8(1), 55–70.

[55]. Lyu, H., & Luo, N. (2024). Digital literacy and teacher job performance: The mediating role of technological self-efficacy. Education Sciences, 14(1), 57.

[56]. Mah, D. K., & Groß, B. (2024). Rethinking digital pedagogy: Technology integration as a pedagogical imperative. Computers & Education: Artificial Intelligence, 5, 100134.

[57]. Maulana, R., Helms-Lorenz, M., & van de Grift, W. (2017). Validating a model of effective teaching behaviour of pre-service teachers. Teachers and Teaching, 23(4), 471–493.

[58]. Nikolopoulou, K., & Gialamas, V. (2016). Barriers to ICT use in high schools: Greek teachers' perceptions. Journal of Computers in Education, 3(1), 59–75.

[59]. OECD. (2018). Effective teacher policies: Insights from PISA. OECD Publishing. https://doi.org/10.1787/9789264301603-en

[60]. OECD. (2019). PISA 2018 results (Volume I): What students know and can do. OECD Publishing.

[61]. Olipas, C. N., & Alegado, P. J. (2025). Digital divide and problem-solving skills among rural students in the Philippines. International Journal of Educational Development, 102, 102789. https://doi.org/10.1016/j.ijedudev.2024.102789

[62]. Osorio, A., & Banzato, M. (2022). Digital competence and educational innovation: Perspectives from European higher education. Education Sciences, 12(6), 397.

[63]. Organisation for Economic Co-operation and Development (OECD). (2019). TALIS 2018 results (Volume I): Teachers and school leaders as lifelong learners. OECD Publishing.

[64]. Overa, P. M., Bellino, J. R., & Bellino, M. T. (2025). Teaching effectiveness and student academic performance in Piñan National High School. Mindanao Education Review, 6(1), 15–28.

[65]. Saklaki, M., & Gardikiotis, A. (2024). Teachers' digital competence and ethical norms in contemporary education. Computers in Human Behavior Reports, 12, 100311.

[66]. Scherer, R., Siddiq, F., & Tondeur, J. (2019). The technology acceptance model (TAM): A meta-analytic structural equation modeling approach explaining teachers' adoption of digital technology in education. Computers & Education, 128, 13–35.

[67]. Schindler, L. A., Burkholder, G. J., Morad, O. A., & Marsh, C. (2017). Computer-based technology and student engagement: A critical review of the literature. International Journal of Educational Technology in Higher Education, 14(1), 25.

[68]. Song, Y., & Kong, S. C. (2017). Investigating students' acceptance of a statistics learning platform using Technology Acceptance Model. Journal of Educational Computing Research, 55(6), 865–897.

[69]. Stronge, J. H. (2018). Qualities of effective teachers (3rd ed.). ASCD.

[70]. Suurtamm, C., Thompson, D. R., Kim, R. Y., Moreno, L. D., Sayac, N., Schukajlow, S., Silver, E. A., & Ufer, S. (2016). Assessment in mathematics education: Large-scale assessment and classroom assessment. Springer.

[71]. S., et al. (2023). Impacts of digital technologies on education and factors

influencing schools' digital capacity. Education and Information Technologies, 28(1), 1–30.

[72]. Taherdoost, H. (2018). A review of technology acceptance and adoption models and theories. Procedia Manufacturing, 22, 960–967.

[73]. Tondeur, J., Scherer, R., Siddiq, F., & Baran, E. (2017). A comprehensive analysis of preservice teachers' readiness to integrate technology in education. Educational Technology Research and Development, 65(3), 555–575.

[74]. Toquero, C. M. (2020). Challenges and opportunities for higher education amid the COVID-19 pandemic: The Philippine context. Pedagogical Research, 5(4), em0063.

[75]. Tschannen-Moran, M., & Gareis, C. R. (2019). Faculty trust in the principal: An essential ingredient in high-performing schools. Journal of Educational Administration, 57(5), 567–583.

[76]. UNESCO. (2018). ICT competency framework for teachers (Version 3). United Nations Educational, Scientific and Cultural Organization.

[77]. Valtonen, T., Hyypiä, M., Mäkitalo-Siegl, K., & Sointu, E. (2022). Teachers' digital competence and its relation to pedagogical beliefs and classroom practices. Computers & Education, 179, 104418.

[78]. Viberg, O., Grönlund, Å., & Andersson, A. (2023). Digital technology in mathematics education: A systematic review of engagement and learning outcomes. Computers & Education, 193, 104652.

[79]. Voogt, J., Fisser, P., Pareja Roblin, N., Tondeur, J., & van Braak, J. (2016). Technological pedagogical content knowledge – A review of the literature. Journal of Computer Assisted Learning, 29(2), 109–121.

[80]. Wang, Y., & Baek, Y. (2023). Digital literacy matrix and teacher professional development in smart education systems. Educational Technology & Society, 26(4), 85–98.

[81]. Zhao, Y., & Frank, K. A. (2003). Factors affecting technology uses in schools: An ecological perspective. American Educational Research Journal, 40(4), 807–840.