



ASSESSING THE PERCEIVED EFFECTIVENESS OF EDUCATIONAL APPLICATIONS AND TECHNOLOGIES IN TEACHING NUMERACY TO GRADE 6 PUPILS

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ABSTRACT

This study examined the teachers' perceptions of the effectiveness of educational apps and technologies used in teaching numeracy and how such perceptions are related to the teachers' ratings of the numeracy performance of Grade 6 pupils in the public elementary schools from the Schools Division Office of Iriga City for the school year 2025-2026. The study adopted the quantitative correlational research design, which included 60 Grade 6 teacher-respondents. A questionnaire was used as a research instrument to find out the effectiveness in terms of instructional delivery, student engagement, assessment and feedback, and educational resources. It further used descriptive statistics such as frequency, percentage, and Pearson product-moment correlation. Results revealed that educational applications and technologies were perceived to be highly effective overall in the implementation of the numeracy instruction ($M=3.72$), with instructional delivery as the highest-rated dimension. Teacher-rated numeracy performance was also rated highly ($M=3.37$). A significant, positive correlation was found between overall perceived effectiveness of educational applications and technologies and teacher-rated numeracy performance ($r=.691$, $p<.001$). Among the four dimensions, learner engagement had the strongest relationship with teacher-rated numeracy performance. These findings imply that the higher the teacher ratings of perceived effectiveness of educational applications and technologies, the higher the teacher ratings of numeracy performance. However, as this study employed a correlational design, causality cannot be inferred. Based on these findings, the Technology-Enhanced Numeracy Instruction Framework (TENIF) is proposed to enrich the implementation of numeracy instruction by enhancing the dimensions of technology integration, learner engagement, assessment and feedback, and access to learning resources.

KEYWORDS: Educational Applications, Educational Technology, Grade 6 Numeracy, Learner Engagement, Teacher-Rated Numeracy Performance, Technology Integration

I. INTRODUCTION

1.1. Background of the Study

Applications of educational technology and digital tools allow for improvement of mathematics lessons by means of interactive activities, digital exercises, and evaluation and feedback. However, the effectiveness of such technologies can only be ensured when the technology is aligned with the goals and requirements of instructional lessons. In the review study of Ran et al. (2022) on K-12 mathematics education, a small but statistically significant positive effect of technology was reported on mathematics achievement. This shows that technology can be helpful in learning mathematics, provided that it is properly incorporated into lessons.

In the case of the Philippines, Sasota et al. (2021) have found that teachers' attitudes toward ICT, ICT skills, and the availability of resources influenced technology integration depending on whether teachers teach science or mathematics. Likewise, Manaban et al. (2025) investigated ICT competence of elementary mathematics teachers and barriers to technology integration in elementary mathematics lessons.

Despite these findings, further investigation is warranted into the relationship between teachers' perceived effectiveness of educational applications and technologies and pupils' numeracy performance in specific local contexts. In particular, evidence is needed concerning Grade 6 pupils in public elementary schools in the Schools Division Office (SDO) of

Iriga City. This study, therefore, determines teachers' perceived effectiveness of educational applications and technologies in terms of instructional delivery, learner engagement, assessment and feedback, and accessibility of learning resources. It also examines the relationship between perceived effectiveness and pupils' aggregate numeracy performance using a quantitative-correlational design. The results obtained may serve as localized data to help with the design of an appropriate Instructional Enhancement Program for numeracy. The paper focuses on statistical association but not causation.

1.2 Statement of the Problem

This study aimed to determine the level of perceived effectiveness of educational applications and technologies in teaching numeracy to Grade 6 pupils and examine its relationship with their numeracy performance, as assessed by Grade 6 teachers in the Public elementary schools in SDO-Iriga City. Specifically, it sought to answer the following research questions:

1. What is the demographic profile of the teacher-respondents in terms of:
 - 1.1 age;
 - 1.2 sex;
 - 1.3 length of service in teaching Mathematics; and
 - 1.4 highest educational attainment?



2. What is the level of perceived effectiveness of educational applications and technologies in teaching numeracy to Grade 6 pupils in terms of:
 - 2.1 instructional delivery;
 - 2.2 learner engagement;
 - 2.3 assessment and feedback; and
 - 2.4 accessibility of learning resources?
3. What is the level of teacher-rated numeracy performance of Grade 6 pupils as assessed by Grade 6 teachers?
4. Is there a significant relationship between the perceived effectiveness of educational applications and technologies and the teacher-rated numeracy performance of Grade 6 pupils?
5. Based on the findings of the study, what instructional enhancement program may be proposed to strengthen the integration and perceived effectiveness of educational applications and technologies in teaching Grade 6 numeracy?

1.3 Hypotheses

The following null hypothesis was tested at .05 level of significance:

H₀₁: There is no significant relationship between the perceived effectiveness of educational applications and technologies and the numeracy performance of Grade 6 pupils.

1.4 Purpose of the Study

This quantitative-correlational study aimed to identify the perceived effectiveness of educational applications and technologies in teaching numeracy of Grade 6 pupils as perceived by Grade 6 teachers in the public elementary schools in the Schools Division Office (SDO) of Iriga City. It assessed the perceived effectiveness of educational apps and technologies in terms of instructional delivery, learners' engagement, assessment and feedback, and access to learning resources. It also determined the numeracy performance of Grade 6 pupils based on the teacher's assessment or numeracy assessment, and investigated the possible correlation of teachers' perceived effectiveness on the numeracy performance of Grade 6 pupils.

This study sought to contribute context-specific empirical data that would contribute to knowledge in supporting numeracy learning through technology and the development of an Instructional Enhancement Program. The results of this study could inform teachers, school principals, and other education stakeholders' decision-making around the use of educational applications and technology to support elementary mathematics teaching. Additionally, the study contributed to the realization of SDG 4 (Quality Education) by helping to promote access to quality, equitable learning opportunities. The nature of this study was correlative in that it examined the relationship(s) between the variables but did not establish a causal relationship.

1.5 Scope and Delimitations

The study design employed in this study was quantitative-correlational research that aimed to determine the perceived level of effectiveness of educational apps and technologies in the teaching of numeracy of the Grade 6 pupils

in the public elementary schools in the Schools Division Office (SDO) of Iriga City during the School Year 2025-2026. The perceived effectiveness of educational apps and technologies in terms of instructional delivery, learner engagement, assessment and feedback, and accessibility of learning resources was measured and correlated to the pupils' total numeracy achievement.

The sample consisted of sixty (60) Grade 6 teachers who were randomly sampled using the stratified random sampling technique to provide an equal chance for the participating public elementary schools' different groups of qualified teachers. Data on perceived effectiveness were collected through a researcher-modified questionnaire adopting the Technological Pedagogical Content Knowledge (TPACK) Framework by Mishra and Koehler (2006), and data on numeracy performance were collected from validated assessment records. Where individual scores of pupils were provided, these scores were then averaged to obtain a class mean, which was then correlated with the perceived effectiveness scores of the teachers.

The study focused solely on Grade 6 numeracy teaching and the variables stated in SDO-Iriga City. The study did not consider other variables that could have been related to numeracy results, like parental influence, teacher efficiency, and others. The study did not consider other variables that could have been related to numeracy results, like Socioeconomic background and the availability of assistance to pupils. The study relied on the responses of the teachers and the available assessment records.

The implications also hint at the possibility of suggesting an Instructional Enhancement Program to raise Grade 6 numeracy teachers' willingness to incorporate educational applications and technologies in their lessons.

II. REVIEW OF RELATED LITERATURES AND STUDIES

2.1 Review of Empirical Studies

Educational Applications and Technologies in Mathematics Education

Educational software and digital technology could provide benefits in the delivery of mathematical concepts, where it can be used in interactive visual forms, digital exercises, collaborative work and multimedia. The review by Engelbrecht and Borba (2024) surveyed research in digital technology in mathematics education, but more specifically on the characteristics of teaching practices, environments of learning, and the nature of mathematical collaboration. Likewise, UNESCO (2023) raised the need to monitor educational technology solely on its influence on relevant learning that is accessible and equitable, rather than on availability.

In mathematics education research, the effectiveness of technology is contingent on the context of usage. According to a meta-analysis by Ran et al (2022) on 77 studies with 151 effect sizes, there was a small yet statistically significant positive effect of technology on K-12 mathematics performance. They examined the influence of use, such as collaboration, problem solving, conceptual development, and adaptive practice. Their research supports the use of perceived



effectiveness of educational apps in actual numeracy classes, rather than just looking at the availability of the technology.

Teachers' Technology Integration and TPACK

Teachers are central to technology enhancement, and their knowledge and skills have a significant impact on how digital tools support learning. The framework Technological Pedagogical Content Knowledge (TPACK) (Mishra and Koehler, 2006) illuminates this relationship among technological knowledge, pedagogical knowledge and content knowledge, which should be integrated for effective use of technology. The theoretical background of this investigation is motivated by the analytical use of the TPACK framework.

In the case of Philippine studies, the investigation by Sasota et al. (2021) investigated the will-skill-tool model of technology integration by science and mathematics teachers. The results of the study demonstrate that teachers' disposition to employ technology, their educational technology skills, and educational technology tools can be a valid predictor that explains classroom integration. Furthermore, Manaban et al. (2025) examined elementary mathematics teachers' ICT competence and barriers to technology integration in Bais City. The research is conclusive evidence that teacher competence and barriers to implementation could be possible factors to consider in relation to educational technology in elementary mathematics education.

A systematic review by Li et al. (2025) of the literature of TPACK in primary school mathematics education has identified four main categories of research: Lesson planning, lesson design, and decision making; Assessment and learner achievement; Teacher knowledge and models of professional development; A further realization is that assessment of teachers' use of technology needs to be sensitive to the context. This aligns with employing TPACK as a theoretical framework in this study and operationalizing teaching and learning as: delivery, engagement, assessment and feedback, and access.

Learner Engagement, Assessment, Feedback, and Access to Resources

Learner engagement is a vital aspect of technology integration in maths lessons. As indicated by the findings from the literature, apps are likely to promote learner engagement when they include the features of participation, visualization of concepts, and practice. It is not just necessary to focus on the attraction of digital tools while determining learner engagement, but also on the effectiveness of learning. Additionally, the study of Ran et al. (2022) advocates for choosing technology tools based on the purpose and learning outcomes.

They are equally important because, through assessment and feedback, teachers will be able to understand what is missing and how to cater to the needs of the learners. By looking at 44 empirical studies of feedback in children's literacy, math, HS, and problem-solving education, Fyfe et al (2023) concluded that feedback could contribute to learning. However, whether it is effective depends on how it is given and the attributes of the learner; this evidence lends itself to the study of assessment and feedback as an implementation dimension of perceived technology effectiveness, while digital assessment is not certain to determine improved performance.

Access needs to be considered, too, as teachers and students need access to appropriate digital resources for them to teach and practice. UNESCO (2023) has stressed the need to also think about the use of educational technology in relation to equity and access, for instance, whether learners are able to make meaningful use of the resources provided. Li et al. (2025) found differences in technology use between urban and rural primary mathematics teachers in China, showing how access to resources and possibly training could be linked to the use of technology. These studies are from another country, but they would be relevant to studying the use of technology in the specific context of our schools.

Numeracy Performance and the Research Gap

The numeracy test includes knowledge of numbers, calculation skills, problem-solving involving numbers, and math itself. Use of technology can help students increase their numeracy skills through images and activities, repetition, and feedback. It must be borne in mind that the ability of pupils in mathematics is affected by many aspects of teaching and circumstances, and technology should not be seen as the only driver.

The literature explored has already laid the foundation for the inquiry about technology integration in mathematics teaching and its possible association with learning achievement. However, as the cited international and Philippine studies discussed learning achievement in general in terms of mathematics achievement, teacher competence, TPACK, and technology integration. The present study endeavors to investigate a more specific research question, among Grade 6 teachers, the Extent of teachers' perceived effectiveness on use of educational applications and technology in terms of instructional delivery, learners engagement, assessment and feedback, and learner's ability to easily access the learning resources; and the concurrent Extent of pupils' aggregate numeracy achievement in public elementary schools in the Schools Division Office of Iriga City.

Through a quantitative-correlational design, the study is expected to generate local data on numeracy instruction and the development of an Instructional Enhancement Program. The results of the study will be viewed as relationships among variables, not as causal relationships of educational technologies to numeracy performance.

2.2 Theoretical Framework

The study is based on the TPACK Framework (Mishra & Koehler, 2006). The framework argues that successful educational use of technology most probably benefits from an optimal alignment of TK, PK, and CK. TPACK becomes, in relation to Grade 6 numeracy instruction, the basis for understanding how teachers can combine several educational applications and technologies with adequate modes of instruction and mathematical content.

The study explores four facets of perceived technology effectiveness: instructional delivery, engagement, assessment and feedback, and access to learning materials. These four dimensions of perceived technology effectiveness are not parts of the original TPACK Framework but were created specifically for this study as indicators to explore technology integration in Grade 6 numeracy.



The TPACK Framework guides the examination of the relationship between teachers' perceived effectiveness of educational applications and technologies and Grade 6 pupils' numeracy performance. Using a quantitative-correlational design, the study determines whether a significant association exists between these variables without establishing causation. The findings provide a basis for developing a proposed Instructional Enhancement Program to strengthen technology integration in Grade 6 numeracy instruction.

2.3 Conceptual Framework

The conceptual framework illustrates the relationship between the two principal variables of the study: the perceived effectiveness of educational applications and technologies (independent variable) and Grade 6 pupils' numeracy performance (dependent variable).

The independent variable is measured through four operational dimensions: instructional delivery, learner engagement, assessment and feedback, and accessibility of learning resources, as rated by Grade 6 teachers. The dependent variable is represented by the aggregate or mean numeracy scores of the pupils handled by the participating teachers, based on available numeracy assessment records.

The framework examines whether a significant relationship exists between teachers' perceived effectiveness ratings and pupils' numeracy performance. Consistent with the quantitative-correlational research design, the relationship is interpreted as an association rather than evidence of causation.

The findings provide the basis for developing a proposed Instructional Enhancement Program that addresses the areas identified through the study.

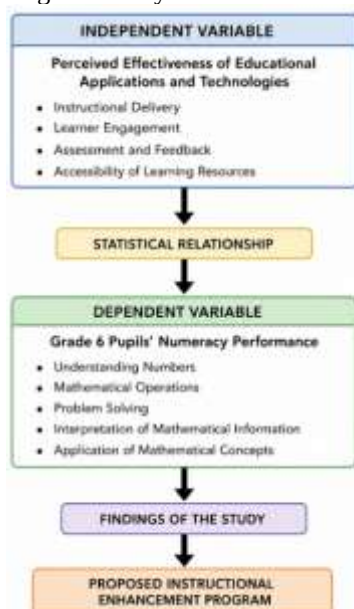


Figure 1. Research Paradigm

Figure 1 presents the independent variable, its four operational dimensions, and the dependent variable. The connecting arrow represents the statistical relationship examined between the principal variables, not a causal relationship. The findings serve as the basis for the proposed Instructional Enhancement Program.

2.3 Research Gap and Justification

Previous literature has explored topics such as educational technology and the mathematics classroom, technology usage by teachers, learner engagement, and achievement. However, there is a limitation that the findings of these studies, in terms of grade levels, context, research variables, and procedures, may not be directly extended and applied to Grade 6 numeracy instruction in the SDO of Iriga City.

A content analysis of the selected literature has indicated that there is little evidence that describes a relationship between teachers' perceptions of the perceived effectiveness of educational applications and technologies and the Grade 6 pupils' performance in numeracy in the local context. To fill this gap, the study measured perceived effectiveness in terms of delivery of instruction, learner motivation, assessment and feedback, and access to learning resources in relation to pupils' overall numeracy performance. The results provide localized empirical evidence that would potentially support numeracy teaching and learning and pave the way for the formulation of an appropriate Instructional Enhancement Program.

III. RESEARCH METHODOLOGY

3.1 Research Design

A quantitative correlational research method was used in the study to examine the association between the Grade 6 pupils' perceived effectiveness of the use of educational application and technology and on their numeracy skills and performance of Grade 6 pupils in public elementary schools in the Schools Division Office of Iriga City in the School Year 2025-2026. As defined by Creswell and Creswell (2023), a quantitative research method is appropriate for gaining an understanding of the relationships between the variables, as it involves the collection and analysis of numerical data.

In addition, the independent variable was the perceived effectiveness of the use of educational applications/technologies in delivering lessons, engaging learners, assessing and providing feedback to learners, and providing access to learning resources. The dependent variable was pupils' performance in numeracy as measured by the criterion described in the data collection procedure of this study. The study set out to determine the existence or non-existence of a relationship between the variables and used the results as input to the proposed 'effective use of educational applications and technologies to advance learning and raise standards (UK)' instructional improvement program.

3.2 Variables and Operational Definitions

This study had two variables: the independent variable and the dependent variable. The independent variable is the perceived effectiveness of applications and technology in education. This is measured through instructional delivery, students' engagement, assessment and feedback, and learning resources accessibility. On the other hand, the dependent variable is the numeracy test performance of Grade 6 pupils according to the teachers' ratings of each teacher's grouping.

The study administered a modified questionnaire from the Technological Pedagogical Content Knowledge (TPACK) Framework created by Mishra and Koehler (2006). This may



be a basis of evidence for the development of a proposed Instructional Enhancement Program.

3.3 Population and Sampling

The study involved 60 Grade 6 teachers from public elementary schools in SDO-Iriga City. A stratified random sampling method was used, with each of the schools as the strata. The number of respondents per school was proportionate to the total number of Grade 6 teachers in the respondents' schools who met the inclusion criteria. Within the strata, the researcher randomly selected the respondents from among those who met the inclusion criteria.

In the analysis, each teacher was treated as an individual teacher/classroom unit. The technology-effectiveness score for each teacher was associated with the numeracy-performance rating of the pupils in that teacher's class.

3.3 Research Locale

The study was conducted in public elementary schools within SDO-Iriga City, Camarines Sur, during School Year 2025–2026. The locale was selected because it provided access to eligible Grade 6 teachers involved in numeracy instruction and educational technology integration. The study's findings were interpreted within this specific educational context.

3.4 Research Instrument

Data was gathered using a questionnaire, which was adapted by the researcher, in two parts. Part I consisted of 28 items, organized under four dimensions, which include instructional delivery, learner engagement, assessment & feedback, and accessibility of learning resources. The four dimensions consisted of 7 items, assessed on a 4-point Likert scale from 1 (Ineffective) to 4 (Highly Effective).

Part II was designed to gauge the teacher's general assessment of her Grade 6 pupils' numeracy achievement using a four-point scale from 1 (Very Low) to 4 (Very High). These assessments are probably reflective of classroom assessments rather than individual pupils' test performance.

3.5 Validity and Reliability

A total of three experts in educational technology, mathematics teaching, and educational research were tasked to review the questionnaire for its appropriateness in relation to the study objectives. A pilot test of the questionnaire was conducted on teachers not part of the sample population in the study. The Cronbach's alpha was used to determine the reliability of the tool.

The coefficient of the tool was 0.96, while the coefficients of delivery of instruction, engagement of learners, assessment and feedback, and availability of learning materials

were 0.94, 0.95, 0.93, and 0.94, respectively. These coefficients indicated that the tool had high internal consistency.

3.6 Data Collection Procedures

Before the collection of the data, the researcher obtained approval for conducting the study from the teachers-in-charge. The questionnaire was checked for validation, pilot tested, and finalized before being administered to the selected respondents. The respondents were provided with an explanation regarding the study and gave their consent.

The submitted questionnaires were then checked for accuracy, coded, and input into a statistical database. For each teacher, a total classroom-level numeracy-performance rating was derived, as well as a single composite rating of technology effectiveness. No pupil test scores or personal information were gathered; data were stored confidentially and used solely for study.

3.7 Ethical Considerations

Informed consent, voluntary participation, confidentiality of the data, and privacy of information were observed in the study. All approvals from the school and the university were granted before conducting the research. Participants were free to refuse participation and did not face any consequences. The data collected were stored in a secure place, and only the combined results of the subjects' responses were presented. It abides by the policies of the institution and the Philippine Data Privacy Act of 2012 (Republic Act no. 10173).

3.8 Data Management and Data Analysis Procedures

Before performing the statistical analysis, the collected data were checked for completeness, coding errors, missing data, and outliers with SPSS (the Statistical Package for the Social Sciences).

Respondent demographic variables were described in terms of frequencies and percentages. Perceived technology effectiveness and teacher-rated numeracy scores were described by means and standard deviations. The correlation between the two composite variables was investigated with Pearson's product-moment correlation coefficient (r) at the 0.05 level of significance. Linearity, approximate normality of the scores, and the presence of influential outliers were checked. Spearman's rank order correlation was a consideration if the assumptions for the Pearson test were not substantially met.

The null hypothesis is that there is no significant relationship between the perceived effectiveness of educational apps and technologies and the performance of 6th-grade pupils in numeracy. This hypothesis was rejected if $p \leq .05$; the null was not rejected if $p > .05$.



IV. RESULTS AND DISCUSSION

Question 1. What is the demographic profile of the teacher-respondents in terms of age, sex, length of service in teaching Mathematics, and highest educational attainment?

Table 1
Distribution of Respondents' Profile (n = 60)

Profile	Category	f	%
Age (in years)	21–29 years old	7	11.70
	30–40 years old	26	43.30
	41–50 years old	21	35.00
	51 years and above	6	10.00
	Total	60	100.00
Sex	Male	23	38.30
	Female	37	61.70
	Total	60	100.00
Length of Service	Less than 5 years	11	18.30
	6–15 years	24	40.00
	16–25 years	17	28.30
	26–35 years	7	11.70
	36 years and above	1	1.70
	Total	60	100.00
Highest Educational Attainment	Bachelor's Degree	5	8.30
	Master's Earned Units	31	51.70
	Master's Degree	18	30.00
	Doctorate Earned Units	5	8.30
	Doctorate Degree	1	1.70
	Total	60	100.00

Note. *f* represents the frequency or number of respondents in each category. Percentage (%) represents the proportion of respondents relative to the total sample size (*n*).

Table 1 describes the demographic profile of the 60 teacher-respondents in terms of age, sex, length of service, and educational attainment. The different age ranges of teachers in this sample revealed that most teachers in this group were between the ages of 30 and 40 years (43.30%), and 35.00% of teachers were between the ages of 41 and 50 years. Only 11.70% of teachers in this sample were from 21-29 years of age, and only 10.00% of teachers in this sample were from 51 years of age and above. Moreover, the number of teachers who were female was higher than that of males (61.70% vs. 38.30%). Teachers' length of service showed that most of the teachers have a teaching experience of 6-15 years (40.00%), followed by 16-25 years (28.30%). Less than 5 years was at 18.30% while 26-35 years was at 11.70%. The teachers who had been in the teaching profession for 36 years or more were only at 1.70%. About educational attainment, many of the teachers had attained master's degrees (51.70%), followed by 30.00% master's degrees, 8.30% doctorate degrees, 8.30% bachelor's degrees and 1.70% doctorate degrees.

Wohlfart and Wagner (2023), in an umbrella review of 23 systematic reviews with 1,062 primary studies, stressed the

significance of teachers' digital literacy, technology integration, and professional development. According to the OECD (2023), digital education will mostly be successful if educators acquire digital skills and start to use technology intentionally in teaching and learning. These findings could also be connected to the idea of Technological Pedagogical Content Knowledge (TPACK) – the intersection of technological, pedagogical, and content knowledge. Recent research still sees TPACK as a successful approach for the integration of technology into education (Wohlfart & Wagner, 2023). Thus, the professional background of the participants provides a necessary context, while their assessment of the educational applications and technologies presents evidence of the effectiveness of the discussed tools.

Question 2. What is the level of perceived effectiveness of educational applications and technologies in teaching numeracy to Grade 6 pupils in terms of instructional delivery, learner engagement, assessment and feedback, and accessibility of learning resources?

Table 2

Level of Perceived Effectiveness of Educational Applications and Technologies in Teaching Numeracy to Grade 6 Pupil

Utilization of Educational Applications and Technologies in Numeracy Instruction	M	SD	Verbal Interpretation
Instructional Delivery	3.81	0.41	Highly Effective
Learner Engagement	3.80	0.42	Highly Effective
Assessment and Feedback	3.64	0.53	Highly Effective
Accessibility of Learning Resources	3.62	0.59	Highly Effective
Overall	3.72	0.49	Highly Effective

Legend: 3.51–4.00 Very High, 2.51–3.50 High, 1.51–2.50 Low, and 1.00–1.50 Very Low.

Note. *M* represents the mean score of respondents' ratings, while *SD* represents the standard deviation.



From **Table 2**, it appears that the application of educational applications and technology to teach numeracy skills to the Grade 6 class was most likely to be effective. This was indicated by the overall grade obtained ($M = 3.72$, $SD = 0.49$). The highest evaluation was for the categories of instruction delivery and learner engagement ($M = 3.81$, $SD = 0.41$ and $M = 3.80$, $SD = 0.42$ respectively) followed by assessment feedback ($M = 3.64$, $SD = 0.53$) and accessibility of learning materials ($M = 3.62$, $SD = 0.59$). While all categories were rated highly effective, accessibility of learning materials had the lowest average score, showing that it could use some improvements. In general, these results indicate that the teachers perceived educational applications and technologies as highly effective in providing support for numeracy instruction.

Recent empirical evidence also supports the potential value of educational technology in mathematics instruction. Akın (2022) finds by meta-analysis of 63 studies, with 115 effects, that there is an indication that web-based mathematics teaching can contribute to mathematics learning, and the effect also relies on features of instruction and assessment procedures.

This shows that there is evidence for the importance of teaching with the aid of technology and that implementation is key when using digital tools.

The relatively high mean score for Instructional Delivery implies that the users see educational technologies as very helpful in delivering the mathematical concepts and structuring the lessons. In addition, the high rating for Learner Engagement is in line with the findings by Nkomo et al. (2021), who studied learner engagement with technological innovations and pointed to the significance of using the technology appropriately. However, comparatively low scores for Assessment and Feedback and Accessibility of Learning Resources indicate areas where improvement might be needed. Indeed, UNESCO (2023) states in its Global Education Monitoring Report that educational technology will benefit students only with the proper application and accessibility.

Question 3. What is the level of teacher-rated numeracy performance of Grade 6 pupils as assessed by Grade 6 teachers?

Table 3
Level of Teacher-Rated Numeracy Performance of Grade 6 Pupils

Indicators	M	SD	Verbal Interpretation
Demonstrate proficiency in performing fundamental mathematical operations accurately	3.37	0.55	High
Apply appropriate mathematical concepts and procedures in solving numeracy-related problems	3.30	0.56	High
Analyze numerical information to arrive at correct mathematical solutions	3.27	0.58	High
Solve real-life mathematical problems using appropriate numeracy skills and strategies	3.47	0.60	High
Interpret mathematical data, tables, graphs, and numerical representations correctly	3.42	0.65	High
Compute mathematical expressions and quantitative problems with accuracy and efficiency	3.37	0.66	High
Achieve the expected Grade 6 numeracy learning competencies based on classroom assessments	3.40	0.62	High
Composite Mean	3.37	0.60	High

Legend: 3.51–4.00 Very High, 2.51–3.50 High, 1.51–2.50 Low, and 1.00–1.50 Very Low.

Note. *M* represents the mean score, while *SD* represents the standard deviation.

Table 3 findings revealed that the teacher-rated numeracy performance of Grade 6 pupils was High ($M = 3.37$), ($SD = 0.60$). Teachers generally perceived pupils as capable of applying mathematical concepts, solving real-life problems, interpreting mathematical information, and attaining expected Grade 6 numeracy competencies. Solving real-life mathematical problems received the highest rating ($M = 3.47$), whereas analyzing numerical information to arrive at correct solutions received the lowest ($M = 3.27$).

These results can be seen in relation to the findings of the study by Rodríguez-Jiménez et al. (2023), which conducted a systematic review on the use of ICT in primary mathematics education, indicating that approaches supported by technology could improve mathematics achievement, motivation, and problem solving. These results are comparable to those of Jensen and Skott (2022), who showed that digital game-based learning is likely to develop mathematical reasoning through

exploration, experimentation, and problem solving. The use of these activities must be aimed at developing mathematical thinking.

In addition, the relatively lower rating for analyzing numerical information in this study suggests that the pupils' analytical reasoning should be improved by activities that involve the interpretation of data, solving problems in more than one step, and getting pupils to explain and justify their answers. Because the study measured teachers' perceptions, the results show perceived numeracy attainment, not that technology causes pupils' attainment.

Question 4. Is there a significant relationship between the perceived effectiveness of educational applications and technologies and the teacher-rated numeracy performance of Grade 6 pupils?



Table 4

Relationship Between Educational Applications and Technologies and Teacher-Rated Numeracy Performance

Variable Relationship	r	p	Decision on H ₀	Interpretation
Instructional Delivery and Numeracy Performance	.681	< .001	Reject	Significant positive relationship
Learner Engagement and Numeracy Performance	.709	< .001	Reject	Significant positive relationship
Assessment and Feedback and Numeracy Performance	.592	< .001	Reject	Significant positive relationship
Accessibility of Learning Resources and Numeracy Performance	.574	< .001	Reject	Significant positive relationship
Overall Educational Applications and Technologies and Numeracy Performance	.691	< .001	Reject	Significant positive relationship

Note. r = Pearson correlation coefficient; p = probability value. The significance level was set at ($\alpha = .05$). A reported p value of .000 should be written as $p < .001$.

Table 4 provides the relationship between the perceived effectiveness of educational applications and technology and the teacher-rated numeracy performance of the Grade 6 pupils. All four dimensions of the learner-centered model have demonstrated a positive statistically significant correlation with the overall perceived effectiveness, i.e., ($r = .691$, $p < .001$). Learner engagement has demonstrated the highest statistically significant positive correlation among the dimensions ($r = .709$, $p < .001$), followed by the instructional delivery ($r = .681$, $p < .001$), assessment and feedback ($r = .592$, $p < .001$), and Accessibility of learning resources ($r = .574$, $p < .001$). It means that the higher the teacher rating of the effectiveness of the use of educational applications and technologies, the higher the teacher rating of pupils' numeracy performance. Hence, the null hypothesis that there is no significant relationship between the two variables is rejected. But it should be noted that the correlational findings do not imply causation.

These results are consistent with those from the study of Akçay et al (2022), who in their meta-analysis found that the use of technology had a positive effect on primary mathematics achievement. Likewise, the study of Rodríguez-Jiménez et al. (2023), a systematic review of information and communication technology in the teaching of primary education, revealed that techniques with technology integration were related to improvements in mathematics achievement, motivation, and problem-solving skills. Such studies provide relevant evidence indicating that technology could enhance mathematics learning, though not conclusively demonstrating the same relationship as in this study.

The strongest correlations for Learner Engagement might be explained by reading the Kacmaz and Dubé (2022) meta-analysis and critical review of digital mathematics games. They found that digital mathematics games could promote student engagement and mathematics performance while noting that results depend on the games' pedagogical strategies and the type of mathematical knowledge each address. This suggests that when choosing and using technology, greater emphasis would be placed on active participation, reasoning, and problem-solving rather than the amount of screen time.

To conclude, the results strongly argue for non-acceptance of the null hypothesis, because the relationship is statistically significant at the .05 level. The results offer an empirical base for the Instructional Enhancement Program as a

whole, especially in relation to improving the degree of engagement of learners and making strides in digital assessment and learning resources access.

Question 5. Based on the findings of the study, what instructional enhancement program may be proposed to strengthen the integration and perceived effectiveness of educational applications and technologies in teaching Grade 6 numeracy?

Technology-Enhanced Numeracy Instruction Framework (TENIF)

The TENIF (The Technology-Enhanced Numeracy Instruction Framework) – to increase numeracy abilities in Grade 6 learners to higher standards of achievement and understanding through strategic use of technology, learner-centered activities, and assessment. The results indicated that applications and technologies were rated as being most effective for teaching numeracy ($M = 3.72$) and the most probable for pupils' teacher-rated numeracy performance ($M = 3.37$). All the factors relating to the use of technology in numeracy instruction were rated as being most effective; however, assessment and feedback, and accessibility of learning resources received relatively lower ratings. Learner engagement was found to have the strongest positive relationship with teacher-rated numeracy performance. Therefore, it is suggested that effective numeracy practices and the use of technology in the classroom be continued, while improving digital assessment tools, providing access to learning resources, and encouraging activities that promote mathematical reasoning and problem-solving.

TENIF can also promote the common core of learning competencies of the MATATAG Curriculum, like numeracy. Moreover, TENIF can promote the Sustainable Development Goal 4, which envisions providing inclusive and equitable quality education for all, as well as the Republic Act No. 10533, the Enhanced Basic Education Act of 2013, and Republic Act No. 9155, or the Governance of Basic Education Act of 2001. Based on the result of the study and the TPACK framework, TENIF can provide teachers with an implementation or guide in the use of appropriate teaching strategies and Grade 6 Mathematics contents for the educational applications and technologies.



Technology-Enhanced Numeracy Instruction Framework (TENIF)

Framework Component	Empirical Basis (Lowest Mean)	Objectives	Strategic Activities	Persons Responsible	Time Frame	Source of Funds	Expected Outcomes	Success Indicators
Phase 1. Digital Instructional Enhancement	Digital tools help me deliver numeracy lessons more effectively (M=3.78)	Strengthen teachers' instructional use of educational technologies.	• Conduct TPACK-based training workshops • Develop multimedia lesson exemplars. • Demonstrate interactive mathematics applications • Peer coaching and classroom observations	School Heads, Mathematics Coordinators, ICT Coordinators, Grade 6 Teachers	Quarter 1- 2	School MOOE/INS ET- Professional Development Fund/ DepEd Training Support: PTA/SGC Assistance	Improved technology-supported lesson delivery.	Improved classroom observations ; increased teacher competency ratings.
Phase 2. Interactive Learner Engagement	Educational technologies encourage collaborative learning (M=3.72)	Increase learner participation and collaborative problem-solving.	• Integrate gamified learning platforms. • Use collaborative digital whiteboards • Conduct technology-assisted group investigations. • Implement project-based numeracy activities.	Mathematics Teachers, ICT Teachers	Quarter 2-3	School MOOE: ICT- Instructional Funds; PTA/SGC Assistance: School Innovation Funds	Higher learner engagement and participation.	Increased learner participation ; improved engagement survey results.
Phase 3. Digital Assessment and Feedback System	Utilize digital quizzes to monitor learner progress (M=3.47)	Improve formative assessment and immediate feedback.	• Implement Google Forms, Quizizz, Kahoot!, Microsoft Forms. • Digital learner progress monitoring. • Automated feedback dashboards. • Quarterly assessment review meetings.	Teachers, Department Head	Quarter 2-4	School MOOE: Assessment/ Instructional Funds: ICT Funds; PTA/SGC Assistance:	Timely learner assessment and intervention.	Increased formative assessment frequency; improved learner progress monitoring.
Phase 4. Accessible	Learners can access digital	Expand equitable access to	• Develop offline and online	School ICT Coordinator,	Quarter 2-3	School MOOE: Learning	Improved accessibility	Increased learner access rates;



Learning Resources	numeracy materials anytime and anywhere (M=3.37)	digital learning resources.	learning modules. • Establish Digital Numeracy Resource Repository. • Produce QR-coded learning materials. • Parent orientation on accessing resources at home.	Teachers, Parents		Resources Funds: ICT Funds; PTA/SGC Assistance; Community/ Partners Support	of learning materials.	higher utilization of digital resources.
Phase 5. Higher-Order Numeracy Enhancement	Analyze numerical information to arrive at correct mathematical solutions (M=3.27)	Strengthen learners' analytical reasoning and problem-solving skills.	- Weekly technology-assisted problem-solving sessions. - Virtual mathematics simulations. - Digital case-based numeracy tasks. - Mathematical reasoning enrichment activities.	Mathematics Teachers	Quarter 2-4	School MOOE: Instructional Funds; Learning Resources Funds; PTA/SGC Assistance; Educational Partners Support	Improved higher-order numeracy competencies.	Increased numeracy assessment scores; improved analytical reasoning performance.
Phase 6. Monitoring, Evaluation, and Sustainability	Significant relationship between technology utilization and numeracy performance (r=.691)	Sustain continuous improvement of technology integration.	- Quarterly classroom monitoring. - Technology integration checklist. - Annual teacher competency assessment. - Program evaluation using learner performance data.	School Administrators, Master Teachers, District Supervisors	Quarter 1-4	School MOOE: School Improvement Funds; District/Division Support; ICT Program Funds; Community/ Partners Assistance	Sustainable technology-enhanced numeracy instruction.	Continuous improvement in technology utilization and learner numeracy outcomes.

V. SUMMARY OF FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

Summary of Findings

The study indicated that most of the 60 teachers responded and were predominantly aged between 30 and 40 years, female, with teaching experience of 6-15 years, and completed master's level coursework. The perceived effect of educational apps/technologies in teaching numeracy to Grade 6 learners was highly effective (M = 3.72), the highest effect of instructional delivery was rated as highly effective, and teacher-rated numeracy performance was rated as high (M = 3.37). There was a significant positive correlation between the perceived overall effectiveness and teacher-rated numeracy performance ($r = .691$, $p < .001$), and engagement had the

highest correlation with the perceived overall effectiveness. These findings guided the formulation of the Instructional Enhancement Program.

Conclusions

Educational applications and technologies were perceived by Grade 6 teachers as highly effective in supporting numeracy instruction, particularly in instructional delivery and learner engagement. Pupils' numeracy performance was rated high, although analyzing numerical information emerged as an area for further improvement. The significant positive relationship between perceived technology effectiveness and teacher-rated numeracy performance indicates that higher ratings of technology effectiveness were associated with higher



ratings of numeracy performance. However, the correlational design does not establish causation.

Recommendations

The public elementary schools of the Schools Division Office of Iriga City may implement the proposed Instructional Enhancement Program for more effective integration of technology in the teaching of grade 6 numeracy. The teachers may undergo professional development activities on the effective use of technology (digital tools), student engagement, and student learning assessment and feedback. Also, the schools may provide an improved number of digital learning resources/activities, and activities that develop analytical reasoning and problem-solving skills. Future research may look into other factors that may influence the perceptions and attitudes of teachers and pupils, and experimental and mixed-method research design on the intervention program and other technological tools.

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