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Integrating Digital Tools in Mathematics Instruction and Its Implications for the Learning Development and Performance in Mathematics

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Abstract*—The main purpose of this study was to determine the relationship between the integration of digital tools in Mathematics instruction and students' learning development and to know its effectiveness on the students' performance. Specifically, it determines the level of integrating digital tools in Mathematics instruction, level of learners' development and performance in Mathematics. It also examined the significant difference in learner performance. Significant relationship between integrating digital tools in Mathematics Instruction and learning development and also significant effect between Integrating digital tools in mathematics instruction and performance of learners in Mathematics. A quantitative research design was utilized in this study, involving 73 Grade 11 students using purposive sampling technique. Data were collected through a validated questionnaire developed by the researchers and were analyzed using both descriptive and inferential statistical methods. Findings show that upon integration of digital tools, interactivity, visualization, and accessibility were very high, while adaptivity, formative feedback and collaborative features are high. Learners' learning development as determined by conceptual understanding and task completion were high with engagement and motivation depicted as very high. Learners' performance in Mathematics was rated as outstanding based on the formative and summative tests. A significant difference between Formative and Summative test as well as significant relationship on learning development were noted but no significant effect on performance. A significant difference was found between learners' formative and summative test scores, as well as significant relationship on learners' learning development in Mathematics. Thus, the hypotheses were rejected. This concludes that the Integrating Digital Tools in Mathematics Instruction influenced the improved learning outcomes of the learners, in both tests, on the other hand, integrating digital tools in Mathematics instruction has no significant effect on learners' performance, leading to the acceptance of the hypothesis. This means that the interactive digital tools alone are not enough to help learners' Mathematics performance. Based on the findings, it is strongly recommended that schools enhance and expand the provision of digital resources and establish more comprehensive support systems to effectively integrate technology into the learning process.*

***Keywords*—** *Digital Tools Integration, Learning Development, Academic.*

I. INTRODUCTION

The integration of digital tools in mathematics instruction has become increasingly important in enhancing the quality of teaching and learning in modern classrooms. These tools provide opportunities to transform traditional instructional approaches by making learning more interactive, engaging, and student-centered. In particular, digital tools support interactivity by allowing learners to actively manipulate mathematical concepts, visualization through dynamic representations of abstract ideas, and accessibility by enabling learners to access materials anytime and anywhere. Furthermore, they offer immediate formative feedback, helping students identify and correct misconceptions in real time, and promote collaborative features that encourage peer interaction and cooperative learning.

In relation to learning development in mathematics, the use of digital tools can significantly influence students' conceptual understanding by presenting concepts in multiple representations and contexts. These tools also assist in improving task completion as learners can work more efficiently with guided instructions and automated support. Additionally, they enhance students' engagement and motivation by incorporating interactive and gamified elements that make learning more meaningful and enjoyable.

Ultimately, the integration of digital tools is expected to impact students' performance in mathematics. This performance can be measured through both formative tests, which monitor ongoing learning and provide continuous feedback, and summative tests, which evaluate overall achievement at the end of an instructional period. By leveraging digital technologies effectively, educators can foster improved learning outcomes and better academic performance in mathematics.

Furthermore, students' performance in mathematics, measured through formative and summative assessments, is a key indicator of learning outcomes. The use of digital tools has the potential to enhance both types of assessment by providing continuous feedback and supporting deeper learning. Thus, this study aims to examine the relationship between the integration of digital tools, learning development, and students' performance in mathematics.

1.1 Statement of the Problem

Problem/s which were addressed by the research

This study aimed to determine the Integrating Digital Tools in Mathematics Instruction and Its Implications for the Learning Development and Performance in Mathematics.

Specifically, it sought to answer the following questions:

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1. What is the level of Integrating Digital Tools in Mathematics Instruction in terms of:
   1.1 Interactivity;
   1.2 Visualization;
   1.3 Accessibility;
   1.4 Adaptivity;
   1.5 Formative Feedback; and
   1.6 Collaborative Features?
2. What is the level of Learners' Learning Development in Mathematics in terms of:
   2.1 Conceptual Understanding;
   2.2 Task Completion;
   2.3 Engagement; and
   2.4 Motivation?
3. What is the level of Learners' Performance in Mathematics in terms of:
   3.1 Formative Test; and
   3.2 Summative Test?
4. Is there a significant difference between the Learners' Performance in Mathematics in terms of Formative Test and Summative Test?
5. Is there a significant relationship between Integrating Digital Tools in Mathematics Instruction and the Learning Development in Mathematics?
6. Is there a significant effect between Integrating Digital Tools in Mathematics Instruction and the Performance in Mathematics?

II. Methodology

A quantitative research design was utilized in this study, involving 73 Grade 11 students using purposive sampling technique. Data were collected through a validated questionnaire developed by the researchers and were analyzed using both descriptive and inferential statistical methods.

III. Results and Discussion

This part presents, analyzes, and interprets the data gathered that showed a significant difference between the Students' Performance in Mathematics in terms of Formative Test and Summative Test, significant relationship between Integrating Digital Tools in Mathematics Instruction and the Students' Learning Development in Mathematics and significant effect between Integrating Digital Tools in Mathematics Instruction and the Students' Performance in Mathematics.

Integrating Digital Tools in Mathematics Instruction

In this study, the integration of digital tools refers to the purposeful use of offline or technology-based applications such as GeoGebra, Excel, and Wolfram Mathematica to support and enhance mathematics instruction.

The level of integration of digital tools in mathematics instruction in terms of interactivity, visualization, accessibility, adaptivity, formative feedback, and collaborative features is revealed in the following tables, which shows the statements, mean, standard deviation, remarks and verbal interpretation. The integration of digital tools in Mathematics instruction enhances both teaching and learning processes by promoting students' engagement, critical thinking, and problem-solving skills through interactive and technology-supported learning experiences, while also assisting teachers in delivering more accessible, adaptive, collaborative, and effective instructional strategies.

Table 1 presents the level of integrating digital tools in mathematics instruction in terms of interactivity as perceived by the students. This also shows the statements along with their corresponding mean, standard deviation, remarks, and verbal interpretation.

Table 1. Level of Integrating Digital Tools in Mathematics Instruction in Terms of Interactivity

STATEMENTS My Teacher…	MEAN	SD	REMARKS
…allows students' to actively participate in mathematical problem-solving.	4.61	0.52	Strongly Agree
…encourages students' engagement through interactive exercises.	4.25	0.52	Strongly Agree
…monitors students' response in real time.	4.17	0.58	Agree
…stimulates active discussion and questioning during the lesson.	4.36	0.51	Strongly Agree
…designs activities where students engage with digital tool.	4.13	0.50	Agree
Weighted Mean	4.31		
SD	0.53		
Verbal Interpretation	Very High		

The results revealed that the mathematics teacher integrated digital tools in Mathematics instruction at a very high level in terms of interactivity. These findings imply that the teacher effectively used digital tools to encourage learners' active participation, engagement, and involvement in mathematical problem-solving activities.

The level of integrating digital tools in Mathematics instruction in terms of interactivity attained a weighted mean of 4.31 and a standard deviation of 0.53, which was verbally interpreted as very high among the respondents. This implies that the teacher consistently applied interactive strategies using digital tools, which supported learners in participating in discussions, answering activities, and engaging meaningfully during the lesson.

In summary, the findings show that learners perceived the teacher's integration of digital tools in Mathematics instruction as highly interactive. This implies that the integration of digital tools creates more opportunities for participants to interact within the mathematics classroom. High levels of agreement for all of the statements indicate that the use of digital technology in the mathematics classroom provides opportunities for students to participate actively, collaborate and discuss with each other, and creates opportunities for teachers to provide more engaged, interactive and effective learning opportunities for their students.

Table 2 presents the extent of integration of digital tools in mathematics instruction in terms of visualization, as perceived and evaluated by the students. It specifically illustrates how digital technologies and interactive learning resources are utilized to enhance visual understanding and presentation of mathematical concepts during instruction. Furthermore, the table includes the different indicator statements together with their corresponding mean scores, standard deviations,

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descriptive remarks, and verbal interpretations, which collectively describe the students' assessment of the effectiveness and consistency of digital tool integration in the learning process.

Table 2. Level of Integrating Digital Tools in Mathematics Instruction in Terms of Visualization

STATEMENTS My Teacher…	MEAN	SD	REMARKS
…helps students understand math concept.	4.52	0.62	Strongly Agree
…illustrates mathematical relationship using animation or simulations.	4.04	0.45	Agree
…displays data and patterns clearly to enhance comprehension.	4.17	0.53	Agree
…represents problem-solving steps visually to aid learning.	4.16	0.55	Agree
…facilitates mental modeling of complex mathematical ideas.	4.28	0.48	Strongly Agree
Weighted Mean	4.23		
SD	0.53		
Verbal Interpretation	Very High		

The results revealed that the mathematics teacher integrated digital tools in Mathematics instruction at a very high level in terms of visualization. These findings imply that the teacher effectively used visual representations to help learners understand mathematical concepts and develop mental models of complex mathematical ideas.

The level of integrating digital tools in Mathematics instruction in terms of visualization attained a weighted mean of 4.23 and a standard deviation of 0.53, which was verbally interpreted as very high among the respondents. This implies that the teacher consistently utilized digital tools to present mathematical ideas visually, making lessons clearer and supporting learners' comprehension of abstract and complex concepts.

In summary, the findings imply that the integration of digital tools creates more opportunities for students to visualize mathematical concepts, processes, and relationships. The high level of agreement across all of the statements indicate that digital technology supports clearer understanding, improve comprehension of abstract ideas, and enable teachers to deliver more effective and visually engaging mathematics instruction.

Table 3 presents a set of indicator statements that describe the different aspects of accessibility in the integration of digital tools in Mathematics instruction. Each statement is accompanied by its corresponding mean score, standard deviation, descriptive remark, and verbal interpretation to provide a detailed analysis of the respondents' perceptions. These statistical measures offer a clearer and more comprehensive understanding of how students view the effectiveness, usability, reliability, and accessibility of digital tools in supporting meaningful and engaging Mathematics learning experiences. In particular, the data reflect the extent to which digital tools allow learners to access learning materials conveniently, participate actively in classroom activities, and accomplish mathematical tasks efficiently. Furthermore, the table highlights how accessible digital resources can help create a more inclusive and learner-centered instructional environment that supports students with different learning needs and abilities. Collectively, the results presented in the table serve as an evaluation of how digital tool integration contributes to improving students' opportunities to engage actively, collaborate effectively, and participate meaningfully in Mathematics instruction.

Table 3. Level of Integrating Digital Tools in Mathematics Instruction in Terms of Accessibility

STATEMENTS My Teacher…	MEAN	SD	REMARKS
…provides students' with easy access to learning resources anytime and anywhere.	4.35	0.60	Strongly Agree
…allows students with different learning abilities to participate fully.	4.36	0.51	Strongly Agree
…ensures that the digital tool can be used across various devices.	4.07	0.53	Agree
…supports equal learning opportunities for all students.	4.27	0.55	Strongly Agree
…enables to share materials efficiently with the class.	4.17	0.55	Agree
Weighted Mean	4.24		
SD	0.55		
Verbal Interpretation	Very High		

The results revealed that the mathematics teacher integrated digital tools in Mathematics instruction at a very high level in terms of accessibility. These findings imply that the teacher effectively used digital tools to provide learners with accessible resources, inclusive participation, and equal opportunities to engage in mathematics learning. Through the use of digital platforms and resources, learners were able to access instructional materials more conveniently and participate in classroom activities regardless of their varying learning abilities.

The integration of digital tools in Mathematics instruction in terms of accessibility obtained a weighted mean of 4.24 and a standard deviation of 0.55, indicating a very high level based on the respondents' assessment. This suggests that the teacher regularly employed digital tools to accommodate learners with varying abilities, make instructional resources easily available, and foster an inclusive Mathematics learning environment.

Table 4 shows the students' perception of the level of integrating digital tools in Mathematics instruction in terms of adaptivity. It also presents the statements with their corresponding mean, standard deviation, remarks, and verbal interpretation.

The results revealed that the mathematics teacher integrated digital tools in Mathematics instruction at a high level in terms of adaptivity. These findings imply that the teacher used digital tools to adjust learning activities, provide feedback, and respond to the different learning needs and progress of the students. This suggests that digital tools are effectively used to support adaptive instruction, allowing teachers to differentiate learning and respond to individual student needs.

The integration of digital tools in Mathematics instruction in terms of adaptivity achieved a weighted mean of 4.11 and a standard deviation of 0.55, indicating a high level based on the respondents' evaluation. This implies that the teacher used

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digital tools to address individual learning needs, promote self-evaluation and reflection, and adjust instructional activities according to the learners' progress and performance.

Table 4. Level of Integrating Digital Tools in Mathematics Instruction in Terms of Adaptivity

STATEMENTS My Teacher…	MEAN	SD	REMARKS
…adjusts content match the students learning level.	4.19	0.59	Agree
…offers personalized practice activities based on students' performance.	4.13	0.60	Agree
…modifies lesson to accommodate diverse learning style.	3.88	0.57	Agree
…responds to students' progress by providing tailored learning path.	4.09	0.41	Agree
…encourages self-assessment and reflection through feedback features.	4.25	0.57	Strongly Agree
Weighted Mean	4.11		
SD	0.55		
Verbal Interpretation	High		

Table 5. Level of Integrating Digital Tools in Mathematics Instruction in Terms of Formative Feedback

STATEMENTS My Teacher…	MEAN	SD	REMARKS
…gives students' immediate feedback on the students' assessment through digital platform.	4.31	0.54	Strongly Agree
…identifies mistakes so students can correct them promptly.	4.32	0.60	Strongly Agree
…tracks students' progress for better learning outcome.	4.05	0.63	Agree
…provides suggestions to improve problem solving skills of the students.	4.09	0.62	Agree
…reinforces learning through corrective fed	4.04	0.51	Agree
Weighted Mean	4.16		
SD	0.58		
Verbal Interpretation	High		

Table 5 presents the level of integrating digital tools in Mathematics instruction in terms of formative feedback, as perceived by the students. It includes the statements together with their corresponding mean, standard deviation, remarks, and verbal interpretation.

The findings showed that formative feedback through digital tools was highly evident in the teacher's Mathematics instruction. This indicates that the teacher utilized digital platforms to deliver prompt assessment feedback, help learners identify and correct their errors, and support the development of their mathematical understanding and problem-solving skills. Through immediate and meaningful feedback, learners were given opportunities to recognize areas that needed improvement and make necessary adjustments in their learning.

The level of integrating digital tools in Mathematics instruction in terms of formative feedback obtained a weighted mean of 4.16 and a standard deviation of 0.58, which was verbally interpreted as high among the respondents. This suggests that the teacher effectively utilized digital tools to give immediate feedback, help learners recognize and correct their mistakes, and support their progress in Mathematics through appropriate suggestions and corrective feedback.

Table 6 above shows the level of integrating digital tools in mathematics instruction in terms of collaborative features.

The findings indicated that collaborative features of digital tools were applied at a high level in the teacher's Mathematics instruction. This implies that the teacher utilized digital platforms to encourage learners to work together, share their ideas, and participate in group activities related to mathematical learning. Through these collaborative opportunities, students were supported in developing teamwork, communication, and shared problem-solving skills.

Table 6. Level of Integrating Digital Tools in Mathematics Instruction in Terms of Collaborative Features

STATEMENTS My Teacher…	MEAN	SD	REMARKS
…enables students to work together in mathematical task.	4.29	0.59	Strongly Agree
…supports group discussion or ideas sharing.	4.32	0.55	Strongly Agree
…allows peer to peer learning through interactive platform.	4.12	0.70	Agree
…facilitates joint-problem solving activities among students.	4.04	0.45	Agree
…encourages team work by assigning collaborative tasks digitally.	3.97	0.64	Agree
Weighted Mean	4.15		
SD	0.58		
Verbal Interpretation	High		

The level of integrating digital tools in Mathematics instruction in terms of collaborative features obtained a weighted mean of 4.15 and a standard deviation of 0.58, which was verbally interpreted as high among the respondents. This means that students frequently engage in activities that promote shared problem solving, critical discussion, and collective cognitive responsibility. This suggests that the teacher used digital tools to promote cooperation among learners and provide opportunities for meaningful interaction during mathematical activities.

Learning Development in Mathematics

In this study, it refers to the progressive improvement in learners' mathematical knowledge, computational skills, critical thinking abilities, problem-solving competencies, and positive attitudes toward mathematics as influenced by the effective integration and utilization of digital tools, interactive technologies, and innovative learning platforms in the teaching and learning process.

The table 7 presents level of learners' learning development in mathematics in terms of conceptual understanding, task completion, engagement and motivation were treated statistically using mean and standard deviation. Table 7 above shows the level of students' learning development in mathematics in terms of conceptual understanding.

The results show that all statements were rated Agree or Strongly Agree, indicating that students perceive digital tools as effective in enhancing their understanding of mathematical concepts. This suggests that students are regularly able to clarify abstract ideas, apply learned principles to problem-

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solving, and strengthen their critical thinking through guided digital exercises.

Table 7. Level of Learning Development in Mathematics in Terms of Conceptual Understanding

STATEMENTS The use of digital tools…	MEAN	SD	REMARKS
…enhances my comprehension of mathematical concept.	4.28	0.73	Strongly Agree
…clarifies abstract ideas using digital visualization.	3.92	0.51	Agree
…helps me apply learned concepts more effectively.	4.01	0.58	Agree
…supports the application of mathematical principles in order to solve problems.	4.31	0.64	Strongly Agree
…strengthens my critical thinking through guided digital exercises.	4.17	0.60	Agree
Weighted Mean	4.14		
SD	0.61		
Verbal Interpretation	High		

The findings show that students recognize opportunities provided by digital tools to deepen comprehension and connect concepts to practical applications, and this suggests that the development of conceptual understanding is consistently supported, though slightly less emphasized in areas such as visualization of abstract ideas. Hence, the results imply that digital tools help students construct knowledge, improve problem-solving skills, and engage in higher-order thinking, thereby fostering meaningful learning in mathematics.

The weighted mean of 4.14 with a standard deviation of 0.61 was verbally interpreted as High, indicating that the use of digital tools substantially supports the development of conceptual understanding. This means that students frequently experience activities that enhance comprehension, application, and critical thinking in mathematics.

Table 8 presents the level of students' learning development in mathematics in terms of task completion. It includes the statements together with their corresponding mean, standard deviation, remarks, and verbal interpretation.

Table 8. Level of Learning Development in Mathematics in Terms of Task Completion

STATEMENTS The use of digital tools…	MEAN	SD	REMARKS
…enables me to complete assigned activities efficiently.	4.28	0.56	Strongly Agree
…encourages me to submit homework and class task on time.	4.09	0.70	Agree
…supports independent practice on a given exercises.	4.23	0.53	Strongly Agree
…helps me manage my workload effectively.	4.05	0.61	Agree
…guides me to complete the task independently.	4.19	0.54	Agree
Weighted Mean	4.17		
SD	0.59		
Verbal Interpretation	High		

The results show that these statements were rated Agree or Strongly Agree, indicating that students perceive digital tools as effective in helping them complete activities efficiently, manage workloads, and practice independently. This suggests that students are regularly guided to finish assigned tasks on time and develop self-regulated learning habits through the use of digital tools.

The findings show that students recognize opportunities provided by digital tools to engage with tasks actively and manage their responsibilities, and this suggests that task completion is consistently supported, though slightly less emphasized in areas such as time management. Thus, the results imply that digital tools promote motivation, persistence, and independent practice, contributing to productive engagement in mathematics.

The weighted mean of 4.17 with a standard deviation of 0.59 was verbally interpreted as High, indicating that the use of digital tools substantially supports task completion in mathematics instruction. This means that students frequently engage in activities that encourage responsibility, focus, and independent work.

Table 9 represents the level of students' learning development in mathematics in terms of engagement.

Table 9. Level of Learning Development in Mathematics in Terms of Engagement

STATEMENTS The use of digital tools…	MEAN	SD	REMARKS
…helps me focus more closely to Mathematics lessons.	4.44	0.62	Strongly Agree
…makes me appreciate Mathematics classes more.	4.28	0.53	Strongly Agree
…helps me actively participate in the lesson.	4.19	0.61	Agree
…brings me joy in solving Mathematics problems.	4.19	0.59	Agree
…contributes to classroom discussions.	4.17	0.60	Agree
Weighted Mean	4.25		
SD	0.59		
Verbal Interpretation	Very High		

The findings revealed that learners' development in Mathematics in terms of engagement was at a very high level through the use of digital tools. This implies that digital tools helped learners become more attentive, interested, and involved during Mathematics lessons. Through technology-supported activities, learners were encouraged to focus on the lesson, appreciate Mathematics classes, and take part in meaningful classroom interactions.

The level of learners' learning development in Mathematics in terms of engagement obtained a weighted mean of 4.25 and a standard deviation of 0.59, which was verbally interpreted as very high among the respondents. This means that students frequently experience lessons that encourage concentration, interaction, and enjoyment. This suggests that the use of digital tools positively supported learners' engagement by increasing their focus, interest, participation, enjoyment in solving problems, and contribution to classroom discussions.

Table 10 represents the level of students' learning development in mathematics in terms of motivation. This also includes the statements, the mean and the standard deviation, and the remarks and verbal interpretation

The findings revealed that learners' development in Mathematics in terms of motivation was at a very high level

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through the use of digital tools. This indicates that digital tools encouraged learners to become more interested, confident, and committed to learning Mathematics. By making lessons more engaging and supportive, digital tools helped learners maintain their willingness to participate in learning activities and face mathematical challenges.

Table 10. Level of Learning Development in Mathematics in Terms of Motivation

STATEMENTS The use of digital tools…	MEAN	SD	REMARKS
...makes me show increased interest in learning Mathematics.	4.35	0.65	Strongly Agree
…builds confidence in our Mathematics lessons.	4.25	0.62	Strongly Agree
…attempts more challenging problems.	4.21	0.55	Strongly Agree
…sustains my motivation in our lessons.	4.21	0.53	Strongly Agree
...commits to studying Mathematics.	4.23	0.61	Strongly Agree
Weighted Mean	4.25		
SD	0.59		
Verbal Interpretation	Very High		

The level of learners' learning development in Mathematics in terms of motivation obtained a weighted mean of 4.25 and a standard deviation of 0.59, which was verbally interpreted as very high among the respondents. This implies that the use of digital tools effectively strengthened learners' interest in Mathematics, improved their confidence during lessons, encouraged them to attempt more challenging problems, and supported their commitment to studying the subject.

Students' Performance in Mathematics

In this study, refers to a person's demonstrated skill, proficiency, and understanding in using mathematical concepts to solve problems, often assessed through tests or complex tasks requiring formulation, application, and interpretation of math in real-world contexts.

The level of students' performance in Mathematics in terms of formative and summative tests was statistically analyzed using frequency and percentage distribution. Through this analysis, the researcher was able to describe the students' overall achievement and determine the extent of their learning development in Mathematics after the use of digital tools in instruction.

Table 11 presents the level of students' performance in mathematics in terms of formative test, including the distribution of scores with their corresponding frequency, percentage, and descriptive equivalent.

The results were such that all the students n=73 or 100% of the respondents received scores that placed them in the outstanding level (9–10). No student received a score in the very satisfactory, satisfactory, fairly satisfactory or needs improvement levels. Therefore, all students showed excellence in the formative test and demonstrated mastery of the mathematical concepts and skills being measured.

The weighted mean was 9.31 with a standard deviation of 0.25, indicating that, on average, student performance in the formative test was at the outstanding level. The small standard deviation of 0.25 demonstrates the scores of all 73 students were highly consistent with very low variability based on the scores of the various students. This means that all students received similar high scores, resulting in a high level of achievement across the group.

Table 11. Level of Students' Performance in Mathematics in Terms of Formative Test

Scores	Frequency	Percentage	Descriptive Equivalent
9-10	73	100.00%	Outstanding
7-8	0	0.00%	Very Satisfactory
5-6	0	0.00%	Satisfactory
3-4	0	0.00%	Fairly Satisfactory
1-2	0	0.00%	Needs Improvement
Total	73	100.00%	
Weighted Mean			9.31
SD			0.25
Descriptive Equivalent			Outstanding

In summary, students demonstrated outstanding achievement in mathematics on the basis of the formative test. Since all students were rated at the outstanding level, this means that the students gained a strong understanding of the lessons taught and were able to apply mathematical concepts. It is also indicate that the instructional approaches used in conjunction were effective for the students' learning and contributed to the overall performance of all the students being high in mathematics.

Table 12 presents the level of students' performance in mathematics in terms of summative test, including the distribution of scores with their corresponding frequency, percentage, and descriptive equivalent.

Table 12. Level of Students' Performance in Mathematics in Terms of Summative Test

Scores	Frequency	Percentage	Remarks
41-50	37	50.68%	Outstanding
31-40	34	46.58%	Very Satisfactory
21-30	2	2.74%	Satisfactory
11-20	0	0.00%	Fairly Satisfactory
1-10	0	0.00%	Needs Improvement
Total	73	100.00%	
Weighted Mean			41.30
SD			5.08
Descriptive Equivalent			Outstanding

Based on the results, the majority of the 73 students participated in the study, or 50.68% of them received their scoring results in the category of Outstanding (41 - 50). Additionally, a majority of 34 students (46.58%) received results that were categorized in the Very Satisfactory (31 - 40) area, while 2 students (2.74%) received their scores in the Satisfactory (21 - 30) level category. No students were recorded in the Fairly Satisfactory or the Needs Improvement categories. Essentially, this shows that nearly all of the students that took the summative test scored at very high levels and more than half of them reached the top performance category.

The weighted mean score of 41.30 with an associated standard deviation (SD) of 5.08 suggests that the overall performance of all students on their summative test was at an

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outstanding level. The moderate standard deviation indicates that while most students received high scores; there was variability in classroom performance. However, since there was relatively little spread between scores, most students were able to demonstrate a consistent level of strong mastery of the concepts and skills assessed in mathematics.

In summary, these results indicate that students performed at a very good level in mathematics as demonstrated through their summative test. The majority of students achieved Outstanding and Very Satisfactory results demonstrate that they have successfully achieved an excellent understanding of what they learned and could use this knowledge to demonstrate mathematical concepts in more complex ways to be evaluated. These results demonstrate that the instructional strategies that were utilized, as well as digital tools used for mathematics instruction, were able to greatly impact student performance and maintain high levels of achievement.

These findings suggest that digital tools play an important role in improving students' performance in major exams by helping them review lessons, strengthen understanding, and increase test scores.

Test of Significant Difference between the Students' Performances in Mathematics in terms of formative test and summative test

The significant difference between the students' performance in mathematics in terms of formative test and summative test was treated statistically using Real Statistics Data Analysis Tools using the T-Test for two paired samples.

Table 13 shows the test of significant difference between the students' performance in mathematics in terms of formative and summative assessments.

Table 13. Test of Significant Difference between the Learners' Performance in Mathematics in terms of Formative Test and Summative Test

Test	Mean	Mean Difference	t-value	p-value	Cohen's d
Formative	93%	10%	11.46	<.001	0.80 (Large)
Summative	83%				

df = 28; **Significant at .01 level; Cohen's d: 0.20 (Small); 0.50 (Medium); 0.80 (Large)

The table shows the mean scores, mean difference, t-value, p-value, and Cohen's d to determine whether a statistically significant difference exists between the two types of assessments.

The results revealed that the average score of students on their formative assessment test was higher (M=93%) than the average score on their summative assessment (M=83%). Thus, there was a 10% average difference in scores between the two types of assessments indicating that students scored significantly better on the formative assessment than they did on the summative assessment.

Results from t-test analysis indicating t(28)=11.46 and p<.001 demonstrate that there is an important statistical difference between the two grades with respect to the type of assessment was performed.

The result of the effect size calculations (Cohen's D=0.80) demonstrates a large effect size between grade level on the two types of assessments. The large effect size indicates that although the difference in performance between the two assessments may be statistically significant, it also has practical significance.

In summary, the overall results demonstrated that performance on the formative assessment was better than performance on the summative assessment for children in Mathematics. The difference in performance is statistically significantly, and the size of the difference would suggest the method of assessment used has had a large impact on the children's performance.

Test of Significant relationship between Integrating Digital Tools in Mathematics Instruction and the Learners' Learning Development in Mathematics

To test the significant relationship between Integrating Digital Tools in Mathematics Instruction and the Learners' Learning Development in Mathematics in terms of conceptual understanding, task completion, engagement and motivation, was treated statistically using Jamovi 2.3.28 using the Pearson correlation coefficient.

Table 14 shows the relationship between integrating digital tools in mathematics instruction and the learners' learning development in mathematics in terms of conceptual understanding, task completion, engagement, and motivation, using the Pearson correlation coefficient.

The results show that employing a wide range of digital technologies and innovative educational tools for teaching mathematics has demonstrated statistically significant and positive correlations across multiple types of student learning outcomes, including academic performance, problem-solving abilities, student engagement, critical thinking skills, and overall learning motivation.

Table 14. Test of Significant relationship between Integrating Digital Tools in Mathematics Instruction and the Learners' Learning Development in Mathematics

Integrating Digital Tools in Mathematics Instruction	Learners' Learning Development in Mathematics			
	Conceptual Understanding	Task Completion	Engagement	Motivation
Interactivity:	0.34**	0.26*	0.16	0.25*
Pearson	0.003	0.023	0.177	0.031
Correlation	73	73	73	73
Visualization:	0.25*	0.24*	0.26*	0.32**
Pearson	0.032	0.038	<.027	0.005
Correlation	73	73	73	73
Accessibility	0.41***	0.41***	0.37***	0.47***
:Pearson	<.001	<.001	<.001	<.001
Correlation	73	73	73	73
Adaptivity:	0..54***	0.21	0.29*	0.30*
Pearson	<.001	0.067	0.012	0.010
Correlation	73	73	73	73
Formative:	0.23	0.36**	0.24*	0.30***
Pearson	0.05	0.002	0.036	0.010
Feedback	73	73	73	73
Correlation				
Collaborative:	0.45***	0.28*	0.27*	0.17
Pearson	<.001	0.015	0.019	0.146
Features	73	73	73	73
Correlation				

Note: *p<.05, ** p<.01, ***p<.001

The interactive showed statistically significant, but weak correlations with the entire student learning dimensions for conceptual understanding (r = 0.34, p = 0.003), task

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completion (r = 0.26, p = 0.023) and motivation (r = 0.25, p = 0.031), while the correlation with engagement (r = 0.16, p = 0.177) was not statistically significant. As a result of this, educators can use interactive digital tools as one means of enhancing student acquisition of conceptual mathematics knowledge as well as increasing their motivation to complete assigned tasks.

In addition, visual representations demonstrate positive, statistically significant relationships to all student learning variables. However, there are only weak correlations for both conceptual understanding (r = 0.25, p = 0.032), task completion (r = 0.24, p = 0.038) and engagement (r = 0.26, p < 0.027), and moderate relationships for motivation (r = 0.32, p = 0.005). These results suggest that digital visualization tools can assist students to develop their understanding of mathematical concepts, stay engaged, and complete tasks more efficiently through the use of visual representation.

Accessibility shows consistent and statistically reliable positive correlations with each of the four indicators of student learning growth. The relationship between accessibility and conceptual understanding (r = 0.41, p < 0.001), task completion (r = 0.41, p < 0.001), engagement (r = 0.37, p < 0.001), and motivation (r = 0.47, p < 0.001) were moderate, indicating that as students have greater access to digital tools, their mathematical ability will improve.

In regard to adaptivity, there was a moderate statistically significant positive correlation between adaptivity and conceptual understanding (r = 0.54, p < 0.001). Additionally, there were moderate statistically significant positive correlations for engagement (r = 0.29, p = 0.012) and motivation (r = 0.30, p = 0.010), while the relationship with task completion (r = 0.21, p = 0.067) was not statistically significant. These results show that the use of adaptive digital tools that are customized to the learning needs of students have a significant impact on their conceptual understanding of mathematics and will also increase their engagement and motivation.

Formative feedback was found to have significant positive correlations with task completion (r = 0.36, p = 0.002), engagement (r = 0.24, p = 0.036), and motivation (r = 0.30, p = 0.010). The relationship between formative feedback and conceptual understanding (r = 0.23, p = 0.05) was not statistically significant. These results indicate that using digital tools to provide immediate feedback to students will increase the likelihood of them completing tasks, being engaged, and feeling motivated when learning mathematics.

The results show a statistically significant positive correlation between collaborative features and learners' conceptual understanding (r = 0.45, p < 0.001), completion of tasks (r = 0.28, p = 0.015), and engagement (r = 0.27, p = 0.019). There is, however, no statistically significant relationship between collaborative features and motivation (r = 0.17, p = 0.146). Therefore, the findings implies that using digital tools that facilitate collaboration can improve learner understanding of mathematics, as well as promote students' engagement and active participation in completing mathematical tasks.

In summary, this implies that there is a positive correlation between digital tool usage and development of learners' mathematical learning outcomes. While most relationships are either weak or moderate in strength, there were numerous statistically significant relationships among the variables studied. This indicates that proper utilization of digital tools, on the parts of students and teachers, particularly in regard to accessibility, adaptability, visualization, and collaboration, will lead to improvement across multiple aspects of learners' conceptual understanding and engagement, as well as completion of tasks and motivation with respect to mathematics as a subject area.

The findings on the relationship between digital tool integration and learners' Mathematics development are supported by Chiu (2022), who found that interactive digital tools enhance learners' participation, interest, and engagement in Mathematics learning. Similarly, Alqahtani and Rajkhan (2020) reported that technology-supported learning environments foster active participation, deeper understanding, and critical thinking among students. Therefore, the significant positive relationships identified in the study suggest that integrating digital tools effectively supports learners' conceptual understanding, task completion, engagement, and motivation in Mathematics, contributing to improved overall learning outcome.

Test of Significant Effect of Integrating Digital Tools in Mathematics Instruction and the Students' Performance in Mathematics

The significant effect of Integrating Digital Tools in Mathematics Instruction and the Students' Performance in Mathematics in terms of formative and summative test was treated statistically using Real Statistics Data Analysis Tools using multiple regression analysis.

Table 15. Regression Analysis on the Integrating Digital Tools in Mathematics Instruction on the Students' Performance in Mathematics in Terms of Formative and Summative Test

Coefficients[a]

	Formative Test			
	Unstandardized Coefficients			
Model	B	Std. Error	T	Sig.
(Constant)	5.26	0.38	13.77	<.001
Interactivity	0.09	0.07	1.28	0.203
Visualization	-0.14	0.06	-2.26	0.027*
Accessibility	-0.01	0.07	-0.17	0.868
Adaptivity	0.08	0.07	1.18	0.243
Formative Feedback	-0.04	0.07	-0.53	0.596
Collaborative Features	-0.05	0.06	-0.91	0.367
	Summative Test			
	Unstandardized Coefficients			
Model	B	Std. Error	T	Sig.
(Constant)	8.10	1.77	4.59	<.001
Interactivity	-1.03	0.32	-3.24	0.002**
Visualization	0.16	0.28	0.58	0.567
Accessibility	-0.08	0.30	-0.25	0.806
Adaptivity	0.61	0.32	1.89	0.063
Formative Feedback	-0.27	0.32	-0.86	0.394
Collaborative Features	-0.22	0.26	-0.83	0.407

Table 15 represents the regression analysis on the significant effect of integrating digital tools in mathematics

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instruction on the students' performance in mathematics in terms of formative and summative tests. Specifically, the dimensions of interactivity, visualization, accessibility, adaptivity, formative feedback, and collaborative features were examined as predictor variables of students' mathematics performance.

Results of the formative test indicated that only visualization was a significant predictor of student achievement, as determined by the following regression: B = -0.14, t = -2.26, p = <0.027. By contrast, interactivity, accessibility, adaptability, formative feedback, and collaboration were all determined not to have significant effects on student performance regarding their integration of digital tools.

In the summative test, only interactivity was a statistically significant predictor of students' achievement according to the following regression equation: B = -1.03, t = -3.24 p = <0.002. Conversely, visualization, accessibility, adaptability formative feedback, and collaborative features were shown not to significantly affect students' performance in mathematics in terms of summative test.

The negative regression coefficients found for visualization on the formative test and interactivity on the summative test indicate an inverse statistical correlation when the effects of other variables are accounted for. Nevertheless, these coefficients need to be interpreted with caution since they may indicate overlap among predictor variables instead of indicating that the dimensions of these two areas impede student performance.

In summary, the regression analysis indicates that certain elements of the use of digital technologies in Math instruction have a significant effect on students' performance in Math. The effect of using visualization tools significantly predicted the students' formative test scores, while the effect of using interactive tools significantly predicted the students' summative test scores. On the other hand, the other dimensions (accessibility, adaptivity, formative feedback and collaborating features) did not independently predict the students' performance. Therefore, the use of visual representations and interactive features in a digital tool has been determined to be a key factor that positively contributes to enhancing students' understanding and success in Math.

The regression results are consistent with studies showing that specific features of digital tools can influence learners' Mathematics performance. Joshi (2025) found that digital learning resources improve Mathematics achievement by providing interactive activities, visualization, and individualized learning experiences. Similarly, Sabrun (2025) reported that interactive applications and instructional videos strengthen students' understanding of mathematical concepts and improve their test performance. These studies support the finding that visualization and interactivity significantly predict students' formative and summative test performance. However, the negative coefficients in the present study should be interpreted carefully, since they show an inverse predictive relationship after controlling for the other digital-tool dimensions.

IV. Conclusion and Recommendations

A significant difference is observed between learners' performance in the formative and summative tests, leading to the rejection of the null hypothesis. This indicates that learners perform better in the formative test, suggesting that regular practice, immediate feedback, and continuous learning support contribute to improved performance in Mathematics.

The integration of digital tools in Mathematics instruction showed a significant relationship with learners' learning development, leading to the rejection of the null hypothesis. This indicates that digital tools positively influenced learners' conceptual understanding, task completion, engagement, and motivation. However, since the relationship ranged from weak to moderate, other factors may also contribute to learners' development.

Almost all indicator of integrating digital tools in Mathematics Instruction do not show significant effect in learners' performance in terms of Formative and Summative test, leading to acceptance of the null hypothesis. This means that the integration of digital tools alone may not directly improve learners' performance in formative and summative assessments. This suggests that other factors, such as teaching strategies, learner motivation, study habits, and classroom environment, also play an important role in students' academic achievement.

In the formulated conclusions from the findings, it was recommended that:

School administrators may strengthen the provision of digital resources, including devices, internet access, and educational software, to support the effective integration of digital tools in Mathematics instruction.

Mathematics teachers may continuously enhance their competencies in integrating digital tools by attending relevant trainings and workshops, as well as adopting innovative and learner-centered teaching strategies that maximize interactivity and engagement.

Guidance and academic support programs may be developed to help learners improve their digital literacy and maximize the educational benefits of digital learning tools.

Students may be encouraged to actively utilize digital tools for practice, exploration, and independent learning to further improve their understanding and performance in Mathematics.

Future researchers may conduct similar studies involving larger populations, different grade levels, or additional variables such as problem-solving skills, critical thinking, and metacognitive awareness to further examine the impact of digital tool integration in education.

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