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Learning Mathematics Through Mobile Applications: Examining Use and Effectiveness among Grade 10 Students

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ABSTRACT

This study examined the extent of use and perceived effectiveness of mobile learning applications (MLAs) and their relationship with mathematics academic performance among Grade 10 students at Dr. Cecilio Putong National High School–Junior High School during School Year 2025–2026. A quantitative descriptive-correlational design was employed. Through stratified random sampling, 271 students were selected from a population of 842. Data were collected using a researcher-developed, content-validated questionnaire and the students' official final grades in Mathematics. Frequency counts and percentages identified commonly used applications and grade distributions; weighted means described extent of use and perceived effectiveness; and Pearson's product-moment correlation tested relationhips among the variables. Khan Academy was the most commonly used application, followed by Quizizz and Desmos. Overall use was high (grand weighted mean = 2.66), with level of independence receiving the highest dimension mean (2.73). Students rated MLAs as effective in supporting mathematical literacy (grand mean = 2.93), particularly for solution verification and error correction (3.05). Most respondents achieved Very Satisfactory or Outstanding grades. Extent of MLA use had a statistically significant, very weak positive relationship with final Mathematics grades ($r = 0.163$, $p = 0.007$). Perceived effectiveness also had a statistically significant positive relationship with final Mathematics grades ($r = 0.237$, $p < 0.001$). The findings suggest that mobile applications can complement mathematics instruction and independent practice, but should not be treated as the sole determinant of academic achievement. The study recommends a proposed action plan to promote purposeful and curriculum-aligned integration of mobile learning applications in mathematics instruction

Keywords: *mobile learning applications, mathematical literacy, extent of use, perceived effectiveness, mathematics academic performance, Dr. Cecilio Putong National High School-Junior High School (DCPNHS-JHS)*

INTRODUCTION

The rapid advancement of digital technology has transformed teaching and learning, creating opportunities for more flexible, interactive, and learner-centered educational experiences. In mathematics education, mobile learning applications provide students with access to instructional materials, interactive exercises, visual representations, and immediate feedback that can support mathematical understanding and problem-solving. However, the availability and frequent use of these digital tools do not automatically guarantee meaningful learning outcomes. Students may use applications to practice mathematical procedures, explore

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concepts, or verify answers, but the extent to which these activities contribute to mathematical literacy and academic performance remains an important concern.

At the global level, mobile learning applications have been recognized as supplementary resources that can promote student participation and provide opportunities for independent learning through interactive activities and timely feedback (UNESCO, 2013). Nevertheless, research indicates that the educational benefits of mobile technology depend on how these tools are integrated into instruction and used to achieve specific learning objectives (Sung et al., 2016). Mathematical literacy, which involves understanding, applying, and interpreting mathematics in real-life situations, requires more than the ability to obtain correct answers. Consequently, examining both the extent of application use and students' perceptions of its effectiveness is essential to understanding the potential contribution of mobile technology to mathematics learning.

Across the Asian region, mobile-assisted learning has increasingly been explored as a means of supporting digital learning and developing twenty-first-century competencies Churchill et al. (2018). Despite its potential to improve motivation and engagement, its effectiveness may be influenced by factors such as teacher guidance, access to digital resources, and students' learning circumstances (Kao et al., 2020). These considerations highlight the need to examine mobile learning within specific educational settings rather than assuming that similar patterns of technology use will produce equivalent outcomes across different populations (OECD, 2017).

In the Philippines, concerns about mathematical literacy make this investigation particularly relevant. The Programme for International Student Assessment (PISA) 2022 results showed that Filipino students obtained an average mathematics score of 355, compared with the OECD average of 472. Approximately 84% of Filipino 15-year-old students performed below Level 2 proficiency, indicating difficulties in demonstrating foundational mathematical competencies (OECD, 2023). Although the Department of Education has promoted information and communications technology integration to support teaching and learning (DepEd, 2019), further investigation is needed to understand whether and how students' use of mobile learning applications relates to their mathematics learning and academic performance (Barrot et al., 2021).

At the local level, the need for contextual evidence is evident in the reported mathematics performance indicators for Tagbilaran City and Bohol, with National Achievement Test mean percentage scores of 78.37% and 80.15%, respectively (PPDO Bohol, 2023). At Dr. Cecilio Putong National High School–Junior High School, Grade 10 students use mobile learning applications for mathematics-related activities; however, the extent of their use, their perceived effectiveness in developing mathematical literacy, and their relationships with students' mathematics grades require systematic examination. Addressing this empirical and population gap, the present study examined the commonly used applications, the extent of their use, their perceived effectiveness, and students' mathematics academic performance during School Year 2025–2026. It also investigated the relationships between application use, perceived effectiveness, and academic performance. The findings served as the basis for a proposed action plan to support the purposeful integration of mobile learning applications into mathematics instruction.

Research Questions

This study assessed the extent of use of mobile learning applications, the effectiveness of these applications in developing mathematical literacy, and the mathematics academic performance of Grade 10 students in Dr. Cecilio Putong National High School-Junior High School for SY 2025–2026 as a basis for an action plan.

Specifically, this study sought to answer the following queries:

1. What mobile learning applications are commonly used by the respondents?
2. As perceived by the respondents, what is their extent of use of mobile learning applications for Mathematics in terms of:
   2.1 types of learning tasks accomplished using mobile applications;
   2.2 integration of mobile applications with classroom activities; and
   2.3 level of independence when using mobile applications for learning Mathematics?

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3. What is the perceived level of mobile learning application effectiveness in developing students' mathematical literacy among the respondents in terms of:
   3.1 accuracy and efficiency in solving mathematical tasks;
   3.2 ability to explore mathematical concepts through interactive features; and
   3.3 capacity to check, verify, and correct mathematical solutions?
4. What is the level of Mathematics academic performance of the respondents based on their final grade?
5. Is there a significant relationship between the respondents' level of Mathematics academic performance and:
   5.1 the extent of use of mobile learning applications; and
   5.2 the effectiveness of mobile learning applications?
6. Based on the findings, what action plan may be proposed?

Literature Review

Mobile Learning Applications in Mathematics Education

The integration of mobile technology into mathematics education has expanded opportunities for learners to access instructional materials, practice mathematical procedures, and explore concepts beyond the traditional classroom. Mobile learning applications provide features such as video tutorials, interactive exercises, graphical representations, automated feedback, and problem-solving assistance. These functions allow students to review lessons at their own pace and obtain supplementary support when encountering mathematical difficulties. Tang et al. (2023), in their review of empirical research on mobile learning in mathematics education, highlighted the growing role of mobile technologies in supporting mathematics learning while emphasizing the importance of examining how these tools are used in educational settings.

The educational value of mobile applications, however, depends on the quality of the learning activities and the manner in which technology is integrated into instruction. Sung et al. (2016) reported positive learning outcomes associated with the integration of mobile devices in teaching and learning, although the effects varied according to instructional design and implementation. Similarly, Cheung and Slavin (2013) examined the effects of educational technology on mathematics achievement and emphasized the importance of using technology to support organized learning activities. These findings suggest that mobile applications are most appropriately viewed as supplementary instructional resources rather than substitutes for teacher guidance and mathematical reasoning.

Extent of Mobile Learning Application Use

The extent of mobile learning application use concerns how frequently and for what purposes students engage with digital tools when learning mathematics. These purposes may include searching for formulas and definitions, watching instructional videos, practicing mathematical procedures, checking answers, exploring graphs, and completing classroom or homework activities. Mobile applications may also support independent learning by allowing students to review lessons and work through mathematical problems outside scheduled class hours.

Nevertheless, frequency of use alone does not establish the quality of learning. Students may use applications to understand procedures and evaluate their solutions, while others may depend on them primarily to obtain answers. The distinction is important because meaningful mathematical learning requires learners to interpret problems, select appropriate strategies, explain procedures, and assess whether their answers are reasonable. Research on educational technology indicates that learning outcomes depend not only on access to digital tools but also on how these tools are incorporated into purposeful instructional activities (Sung et al., 2016).

In the Philippine context, Insorio and Olivarez (2021), Insorio and Macandog (2022), and Etcuban and Pantinople (2018), provide relevant local perspectives on the use of digital tools in secondary mathematics learning. Their work supports examining how learners use technology for mathematical tasks and solution

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checking. These considerations inform the present study's assessment of application use in terms of mathematical tasks accomplished, integration with classroom activities, and students' level of independence.

Perceived Effectiveness and Mathematical Literacy

Mathematical literacy involves using mathematical knowledge to formulate, employ, and interpret mathematics in different situations. Developing mathematical literacy therefore requires more than memorizing formulas or obtaining correct answers. Learners must also understand mathematical relationships, interpret representations, solve problems, and apply their knowledge in meaningful contexts. The Organisation for Economic Co-operation and Development (OECD, 2023) emphasize the importance of mathematical reasoning and the application of mathematics in real-world situations in its discussion of PISA 2022 results.

Mobile learning applications may support these competencies through immediate feedback, interactive visualizations, step-by-step demonstrations, and opportunities for repeated practice. Such features can help learners identify errors, review procedures, and explore relationships among mathematical concepts. Cheung and Slavin (2013) found that educational technology can contribute to mathematics achievement, although outcomes depend on the characteristics of the intervention and the learning environment.

For the present study, perceived effectiveness refers to students' assessments of how useful mobile applications are in supporting mathematical learning. This construct is examined through three dimensions: accuracy and task efficiency, interactive concept exploration, and solution verification and error correction. These dimensions distinguish the practical assistance students receive when completing mathematical tasks from the conceptual opportunities provided by interactive tools and the support available for evaluating their solutions.

It is important to distinguish perceived effectiveness from objectively demonstrated improvement in mathematical literacy. Students' favorable evaluations indicate that they consider applications helpful, but such perceptions do not independently establish that their mathematical competence has improved. Examining perceived effectiveness alongside students' mathematics grades can provide additional evidence about how students' experiences with mobile learning applications relate to academic performance.

Mobile Learning Applications and Mathematics Academic Performance

Academic performance provides an additional indicator for examining students' mathematics learning. Final grades reflect students demonstrated performance under the assessment practices and grading requirements of their school. When considered alongside information about technology use, these grades can help researchers determine whether patterns of application use and perceived usefulness are associated with differences in academic outcomes.

Cheung and Slavin (2013) reported that educational technology interventions can positively affect mathematics achievement, while also showing the need to consider the nature and implementation of the intervention. In the Philippine setting, studies cited in the thesis, including Capuno et al. (2019) and De Las Peñas et al. (2024), discuss the use of mobile applications and technology-supported activities in mathematics instruction. These studies provide a local basis for investigating how digital tools may support mathematical understanding and performance when learning activities are appropriately designed.

However, associations between technology use and academic performance should not automatically be interpreted as evidence of causation. Students who achieve higher grades may differ in their study habits, motivation, access to devices, prior knowledge, or use of other learning resources. Similarly, students may report applications as effective because they help them complete tasks more efficiently, even when the relationship with broader mathematical competence is less direct. A correlational investigation is therefore appropriate for determining whether the extent of application use and perceived effectiveness are significantly related to students' mathematics grades without claiming that application use alone causes higher achievement.

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Behaviorism Theory

Skinner's (1958) behaviorist perspective explains the role of reinforcement and feedback in learning. Mobile applications may provide immediate responses, scores, progress indicators, and repeated practice opportunities that encourage students to continue engaging with mathematical tasks. Gamified applications may also use points and achievement indicators to sustain participation. Kapp (2012) discusses the application of game-based and gamification principles in instructional settings. Within the present study, this perspective helps explain why students may repeatedly use applications for practice and solution checking.

Social Learning Theory

Bandura's (1977) Social Learning Theory emphasizes learning through observation and the influence of models on behavior. Mathematics applications may present worked examples, video demonstrations, and explanations that students can observe and apply when solving similar problems. These resources may help learners understand mathematical procedures, particularly when they can review demonstrations at their own pace. This theory supports examining how students use applications to access explanations and develop greater independence in mathematical tasks.

Constructivist and Social Constructivist Perspectives

Piaget's (1952) constructivist perspective emphasizes the active construction of knowledge, while Vygotsky (1978) highlights the importance of social interaction and guided learning. Interactive mathematical tools may allow learners to manipulate graphs, test mathematical relationships, and observe how changes in values affect outcomes. Such activities can provide opportunities for exploration and conceptual understanding. Guided explanations and teacher-supported activities can further help students connect their discoveries with formal mathematical concepts.

Cognitive Theory of Multimedia Learning

Mayer's (2005) work on multimedia learning explains how learners process information presented through words and visual representations. Mobile applications that combine explanations, diagrams, graphs, and demonstrations may help students interpret mathematical information when the presentation is appropriately designed. However, multimedia features are not automatically beneficial; poorly organized or excessive information may distract learners. This perspective is relevant to the study's examination of interactive concept exploration and the perceived usefulness of visual and instructional features.

Digital Learning and Situated Learning Perspectives

Siemens (2005) and Downes (2007) discuss connectivist approaches to learning in digitally connected environments, where knowledge development involves accessing and forming connections among information sources. Lave and Wenger (1991), through Situated Learning Theory, emphasize the relationship between learning and participation in meaningful activities and contexts. Together, these perspectives help frame mobile applications as resources through which students access mathematical explanations, practice skills, and connect classroom learning with tasks beyond school. Their usefulness depends on whether students engage critically with the information and apply it to meaningful mathematical problems.

Legal and Policy Context

Republic Act No. 10533, or the Enhanced Basic Education Act of 2013, provides the statutory framework for the K to 12 Basic Education Program. Its emphasis on a learner-centered, relevant, and responsive curriculum provides a broad basis for considering supplementary resources that support the development of mathematical knowledge and skills.

DepEd Order No. 42, s. 2016, on the Policy Guidelines on Daily Lesson Preparation for the K to 12 Basic Education Program, provides guidance for instructional planning and the alignment of teaching activities with

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learning objectives. In this context, mobile applications may be incorporated into lessons when their functions support the intended competencies and the needs of learners.

DepEd Order No. 12, s. 2020, which adopted the Basic Education Learning Continuity Plan for School Year 2020–2021 in response to the COVID-19 public health emergency, also reflects the Department of Education's use of alternative learning delivery arrangements and learning resources to sustain educational access. Although this issuance addressed a specific emergency context, it provides relevant background on the role of flexible and technology-supported learning arrangements.

More recently, DepEd Order No. 10, s. 2024, concerning the implementation of the MATATAG Curriculum, provides the curriculum-policy context for strengthening foundational competencies and improving the quality of basic education. For the present study, these policies offer a basis for considering mobile learning applications as supplementary resources that should be selected and used in alignment with curriculum standards, lesson objectives, and students' learning needs. They do not, by themselves, establish that any particular application is effective; that question requires empirical investigation.

Synthesis and Research Gap

The literature indicates that mobile learning applications can provide opportunities for mathematical practice, independent study, immediate feedback, and interactive exploration. Theoretical perspectives explain how reinforcement, observation, active knowledge construction, multimedia representations, digital connections, and meaningful learning activities may contribute to students' learning experiences. Related research also suggests that educational technology can support mathematics achievement when its use is appropriately designed and integrated into instruction.

Nevertheless, the benefits of mobile learning applications cannot be inferred from their availability or frequency of use alone. Students may use applications for different purposes, and their perceptions of usefulness may not correspond directly to measurable academic outcomes. The distinction between application use, perceived effectiveness, and mathematics grades therefore warrants separate examination. The reviewed literature also highlights the importance of considering the instructional setting, access to digital resources, and the role of teacher guidance when interpreting the contribution of mobile technology to mathematics learning.

Within the local context, the thesis identifies a need for school-level evidence concerning Grade 10 students at Dr. Cecilio Putong National High School–Junior High School. Specifically, information is needed on which mobile learning applications students commonly use, how extensively they use them for mathematical tasks and classroom-related activities, how effective they perceive the applications to be in supporting mathematical literacy, and how these measures relate to their mathematics grades. The present study addresses this empirical and population gap through a descriptive-correlational investigation conducted during School Year 2025–2026. By examining these variables together, the study provides context-specific evidence that can inform a proposed action plan for the purposeful integration of mobile learning applications into mathematics instruction.

METHODS

Research Design

This research employed a quantitative research approach utilizing a cross-sectional, descriptive–correlational research design. A descriptive-correlational design is a non-experimental methodology aimed at describing existing characteristics of a population and systematically determining the extent, direction, and strength of relationships between two or more variables as they naturally occur, without any form of experimental manipulation or behavioral alteration (Creswell & Creswell, 2018). According to Fraenkel, Wallen, and Hyun (2012, as cited in Ismail & Nur, 2018), correlational research examines the extent to which two or more variables are related as they naturally occur. In this study, the design was operationalized by cross-sectionally measuring the data on the respondents' profile, usage patterns, and academic performance at a single point in time during the School Year 2025–2026.

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According to Babbie (2020), cross-sectional survey designs are highly efficient for gathering data from a large sample size, making it ideal for examining the prevailing experiences of Grade 10 students. Because the study explicitly aims to uncover the natural relationship between mobile application engagement and actual academic achievement rather than establishing a causal link through artificial laboratory intervention, an experimental setup would be both impractical and disruptive to the school's natural instructional flow. Furthermore, employing an explanatory correlational framework directly accommodates the complex, multi-faceted nature of educational variables, allowing the researcher to determine if extensive use and high perceived effectiveness co-occur with superior academic performance.

The descriptive component was used to identify the mobile learning applications commonly used by the respondents, determine the extent of their use, assess students' perceptions of their effectiveness, and describe the respondents' mathematics grades. The correlational component was used to determine whether significant relationships existed between the extent of mobile learning application use, perceived effectiveness, and mathematics grades. This design was appropriate because the study examined existing practices and relationships among variables without manipulating students' use of mobile learning applications or establishing causal effects.

Respondent /Participants

The respondents were Grade 10 students of Dr. Cecilio Putong National High School–Junior High School during School Year 2025–2026. The study population consisted of 842 Grade 10 students, from which a sample of 271 respondents was selected through stratified random sampling. This sampling technique was used to ensure representation from the relevant student groups or strata within the population. The selected respondents provided information regarding their use of mobile learning applications, their perceptions of the applications' effectiveness in mathematics learning, and their mathematics academic performance. Their participation provided the data needed to describe the use of mobile learning applications and examine its relationship with mathematics grades.

Table 1. *Distribution of Respondents n = 271*

Grade 10 Section	Male	%	Female	%	Total	%
SP Science	4	1.48	4	1.48	8	2.96
SP Foreign Language	2	0.74	4	1.48	6	2.22
SP Sports	5	1.85	4	1.48	9	3.33
SP Arts	5	1.85	10	3.69	15	5.54
Newton	8	2.95	5	1.85	13	4.80
Ampere	8	2.95	5	1.85	13	4.80
Boyle	7	2.58	5	1.85	12	4.43
Aristotle	7	2.58	6	2.21	13	4.79
Copernicus	7	2.58	5	1.85	12	4.43
Archimedes	6	2.21	7	2.58	13	4.79
Chadwick	6	2.21	7	2.58	13	4.79
Galileo	4	1.48	10	3.69	14	5.17
Einstein	3	1.11	12	4.43	15	5.54
Faraday	7	2.58	6	2.21	13	4.79
Mendel	7	2.58	6	2.21	13	4.79
Marconi	7	2.58	5	1.85	12	4.43
Linnaeus	7	2.58	6	2.21	13	4.79
Hertz	6	2.21	7	2.58	13	4.79
Darwin	7	2.58	6	2.21	13	4.79
Edison	6	2.21	7	2.58	13	4.79
Dalton	7	2.58	5	1.85	12	4.43

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Curie	7	2.58	6	2.21	13	4.79
Total	133	49.08	138	50.92	271	100.00

Instruments of the Study

The primary research instrument was a researcher-made survey questionnaire designed to gather information about the respondents' use and perceived effectiveness of mobile learning applications in mathematics. The questionnaire covered the mobile learning applications commonly used by students and the extent of their use in terms of mathematical tasks, classroom integration, and independent learning. It also examined perceived effectiveness in terms of accuracy and task efficiency, interactive concept exploration, and solution verification and error correction.

The respondents' mathematics grades served as the measure of academic performance. These grades were used to describe the respondents' achievement levels and examine the relationship between academic performance and the two principal study variables: extent of mobile learning application use and perceived effectiveness.

The questionnaire responses and mathematics grades were organized for quantitative analysis. The specific procedures for establishing the instrument's validity and reliability should be reported according to the validation, pilot testing, or reliability assessment actually conducted in the thesis.

Procedure

The study focused on Grade 10 students of Dr. Cecilio Putong National High School–Junior High School during School Year 2025–2026. The research process involved identifying the target population, selecting the respondents through stratified random sampling, gathering the required data, and preparing the responses for statistical analysis.

The questionnaire was administered to the selected respondents to collect information about their use of mobile learning applications and their perceptions of the applications' effectiveness in mathematics learning. The respondents' mathematics grades were also obtained for the assessment of academic performance, subject to the necessary school authorization and applicable privacy requirements. After data collection, the responses and grades were organized, coded, and checked for completeness and consistency before statistical treatment. The resulting dataset was then analyzed according to the research questions concerning application use, perceived effectiveness, academic performance, and the relationships among these variables.

Data Analysis

The collected data were analyzed using descriptive and inferential statistical techniques appropriate to the research questions.

Frequency counts and percentages were used to identify the mobile learning applications commonly used by the respondents and describe the distribution of their mathematics grades. Weighted means and standard deviations were used to determine the extent of mobile learning application use across mathematical tasks, classroom integration, and independent learning, as well as perceived effectiveness across accuracy and task efficiency, interactive concept exploration, and solution verification and error correction.

Pearson's product-moment correlation coefficient was used to examine the relationships between the extent of mobile learning application use and mathematics grades, and between perceived effectiveness and mathematics grades. The statistical significance of the relationships was evaluated using the corresponding p-values. The findings were interpreted according to the study's research questions and the appropriate descriptive interpretations of the computed results.

The analysis showed a significant but very weak positive relationship between the extent of application use and mathematics grades ($r = 0.163$, $p = 0.007$). A significant positive relationship was also found between perceived effectiveness and mathematics grades ($r = 0.237, p < 0.000$). These results indicate associations between the variables but do not establish that mobile learning application use caused higher mathematics grades.

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Ethical Considerations

Ethical considerations were observed in conducting the study and handling the information provided by the respondents. The research involved Grade 10 students; therefore, appropriate school authorization and the applicable consent and assent procedures for participants who were minors were necessary before data collection. Participation should be voluntary, and respondents should be informed about the purpose of the study, the information being collected, and the intended academic use of the findings.

Confidentiality and privacy were important considerations throughout the research process. Information obtained from the questionnaire and students' mathematics grades was to be handled responsibly and used only for the purposes authorized for the study. Student names and other directly identifying information should not appear in the research report, and access to records should be limited to authorized persons. Data should be stored securely and reported in aggregate form to help prevent the identification of individual respondents.

The study should also comply with applicable school policies and the Philippine Data Privacy Act of 2012 (Republic Act No. 10173), particularly in relation to the collection, use, storage, and disclosure of students' personal information. These safeguards help protect the rights and welfare of the respondents and support the responsible conduct of educational research.

RESULTS AND DISCUSSION

This section presents the findings according to the study's research questions. To compare the mean and find out the significance between variables, pearson product correlation was computed using IBM SPSS 26.0.

Table 2. *Distribution of the Respondents' Commonly Used Mobile Learning Applications*

Mobile Learning Application	Frequency (*f*)	Percentage (%)	Rank
Khan Academy	157	59.93	1
Quizizz	89	32.84	2
Desmos	88	32.47	3
Gauthmath	80	29.52	4
Kahoot	65	23.99	5
Photomath	57	21.03	6
Mathway	23	8.49	7
Microsoft Math Solver	13	4.80	8
GeoGebra	11	4.06	9
Symbolab	7	2.58	10
Wolfram Alpha	3	1.11	11
N= 271			

Note: Multiple Responses.

The empirical data in Table 2 reveal that Khan Academy was identified as the most commonly used mobile learning application, capturing the top rank among the respondents (f =157, 59.93%). This is followed closely by Quizizz at Rank 2 (f = 89, 32.84%) and Desmos at Rank 3 (f = 88, 32.47%). Conversely, highly specialized computation systems occupy the bottom tiers, with Symbolab with a frequency of 7 which is 2.58% of the total respondents and Wolfram Alpha with a frequency of 3 which is 1.11% of the total respondents emerging as the least frequently utilized tools. Based on these results, it shows that the students are more preferred in using mobile learning applications that have organized learning lessons and game-based review activities compared to those applications that are mainly used for algebraic calculations and solving complicated mathematical problems. The presence of applications with different functions also highlights the need for teachers to help students select tools that match the lesson objectives rather than relying on application use alone.

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Respondents' Perceived Extent of Use of Mobile Learning Applications for Mathematics

This part presents the findings on the respondents perceived extent of use of mobile learning applications for Mathematics. It includes Tables 3 to 6, which provide essential information about how students use mobile applications in accomplishing mathematical tasks, integrating applications into classroom activities, and learning independently. These tables were utilized to describe the respondents' patterns of application use and summarize their overall perceived extent of using mobile learning applications in learning Mathematics.

Table 3. *Respondents' Perceived Extent of Use of Mobile Learning Applications for Mathematics in Terms of Types of Learning Task Accomplished*

Indicators	WM	SD	Interpretation
1. Completing homework and math worksheets	2.63	0.84	High Extent
2. Searching formulas and definitions	3.04	0.79	High Extent
3. Solving graphing or geometry-related tasks	2.82	0.88	High Extent
4. Reviewing and practicing before quizzes	2.87	0.92	High Extent
5. Downloading notes, math files, or modules	2.59	1.03	High Extent
6. Playing math games to reinforce concepts	2.17	1.01	Low Extent
Aggregate Weighted Mean	2.69		High Extent
Aggregate Standard Deviation		0.91	

Legend: 3.21 – 4.00 Very High Extent, 2.41 – 3.20 High Extent, 1.61 – 2.40 Low Extent, 1.00 – 1.60 Very Low Extent

The result in Table 3 indicates that the respondents used mobile learning applications to a high extent in accomplishing various mathematics-related learning tasks, as evidenced by the aggregate weighted mean of 2.69 and standard deviation of 0.91. Searching for mathematical formulas and definitions obtained the highest weighted mean of 3.04 (SD = 0.79), interpreted as High Extent, while playing mathematics games to reinforce concepts received the lowest weighted mean of 2.17 (SD = 1.01), interpreted as Low Extent. These findings suggest that students primarily utilized mobile applications for academic purposes, particularly accessing mathematical information, reviewing lessons, and completing school requirements, rather than engaging in game-based learning activities. This result is consistent with Tang et al. (2023), who highlighted the role of mobile learning in supporting mathematical practice and access to instructional content, and with Insorio and Macandog (2022), who discussed the use of mobile learning tools among Filipino secondary students for reviewing lessons and accomplishing academic tasks.

Table 4. *Respondents' Perceived Extent of Use of Mobile Learning Applications for Mathematics in Terms of Integration with Classroom Activities*

Indicators	WM	SD	Interpretation
1. Using mobile apps during class activities	2.59	1.09	High Extent
2. Joining live gamified quizzes during class	2.08	1.06	Low Extent
3. Collaborating with peers on math tasks	2.35	0.98	Low Extent
4. Checking class announcements and tasks	3.32	0.90	Very High Extent
5. Discussing coursework with classmates	2.64	1.02	High Extent
6. Following along during teacher demonstrations	2.40	0.98	Low Extent
Aggregate Weighted Mean	2.56		High Extent
Aggregate Standard Deviation		1.01	

Legend: 3.21 – 4.00 Very High Extent, 2.41 – 3.20 High Extent, 1.61 – 2.40 Low Extent, 1.00 – 1.60 Very Low Extent

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The result in Table 4 indicates that the respondents integrated mobile learning applications into mathematics classroom activities to a high extent, with an aggregate weighted mean of 2.56 and standard deviation of 1.01. Checking class announcements and tasks obtained the highest weighted mean of 3.32 (SD = 0.90), interpreted as Very High Extent, whereas participating in live gamified quizzes received the lowest weighted mean of 2.08 (SD = 1.06), interpreted as Low Extent. Similarly, collaborating with peers on mathematical tasks (WM = 2.35, SD = 0.98) and following teacher demonstrations (WM = 2.40, SD = 0.98) were also interpreted as Low Extent. These findings indicate that students more frequently used mobile applications for accessing academic information and managing school-related tasks than for participating in interactive classroom activities. This observation agrees with Insorio and Olivarez (2021), who emphasized the use of mobile learning applications for independent study and academic support, and Etcuban and Pantinople (2018), who highlighted the value of integrating mobile applications as supplementary tools in mathematics instruction.

Table 5. *Respondents' Perceived Extent of Use of Mobile Learning Applications for Mathematics in Terms of Level of Independence*

Indicators	WM	SD	Interpretation
1. Exploring new math topics independently	2.67	0.90	High Extent
2. Resolving minor technical issues unassisted	2.71	2.02	High Extent
3. Finding and downloading study apps	2.80	0.90	High Extent
4. Following app guides and video tutorials	2.83	0.90	High Extent
5. Managing self-paced study schedules	2.65	0.96	High Extent
6. Selecting appropriate apps for specific tasks	2.70	0.98	High Extent
Aggregate Weighted Mean	2.73		High Extent
Aggregate Standard Deviation		1.11	

Legend: 3.21 – 4.00 Very High Extent, 2.41 – 3.20 High Extent, 1.61 – 2.40 Low Extent, 1.00 – 1.60 Very Low Extent

The result in Table 5 indicates that the respondents demonstrated a high extent of independence in using mobile learning applications for mathematics, as reflected by the aggregate weighted mean of 2.73 and standard deviation of 1.11. Following application guides and video tutorials obtained the highest weighted mean of 2.83 (SD = 0.90), followed by finding and downloading study applications, with a weighted mean of 2.80 (SD = 0.90). Meanwhile, managing self-paced study schedules received the lowest weighted mean of 2.65 (SD = 0.96), although it was still interpreted as High Extent. These findings suggest that students could independently access digital learning resources, follow instructional guidance, and use available applications to support their mathematics learning. However, the comparatively lower rating for managing study schedules indicates that opportunities remain to strengthen students' self-regulation and time-management skills. This finding is consistent with Tang et al. (2023), who discussed how mobile learning supports independent and self-paced learning, and Insorio and Olivarez (2021), who reported the use of mobile applications by Filipino secondary students for independent mathematics practice. Their findings suggest that these mobile apps can support mathematics learning during modular distance education.

Table 6. *Summary of the Respondents' Perceived Extent of Use of Mobile Learning Applications for Mathematics*

Indicators	AWM	ASD	Interpretation
1. Types of Learning Task Accomplished	2.69	0.91	High Extent
2. Integration with Classroom Activities	2.56	1.01	High Extent
3. Level of Independence	2.73	1.11	High Extent
Grand Weighted Mean	2.66		High Extent
Grand Standard Deviation		1.01	

Legend: 3.21 – 4.00 Very High Extent, 2.41 – 3.20 High Extent, 1.61 – 2.40 Low Extent, 1.00 – 1.60 Very Low Extent

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The result in Table 6 indicates that the overall perceived extent of use of mobile learning applications among the respondents was high, obtaining a grand weighted mean of 2.66 and a grand standard deviation of 1.01. Among the three dimensions, level of independence ranked first, with an aggregate weighted mean of 2.73 (ASD = 1.11), followed by types of learning tasks accomplished, with 2.69 (ASD = 0.91), and integration with classroom activities, with 2.56 (ASD = 1.01). Although all three dimensions were interpreted as High Extent, the results show that students more frequently used mobile applications to manage their individual learning and accomplish academic tasks than to participate in interactive classroom activities. This suggests that mobile learning applications primarily functioned as supplementary resources for independent study rather than as fully integrated components of classroom instruction. These findings align with Deci and Ryan's (1985) Self-Determination Theory, which emphasizes learner autonomy, and Tang et al. (2023), who described the potential of mobile learning to support self-paced mathematics learning and independent practice.

Perceived Effectiveness of Mobile Learning Applications in Developing Mathematical Literacy

This part presents the findings on the perceived effectiveness of mobile learning applications in developing students' mathematical literacy. It includes Tables 7 to 10, which provide information on the different aspects of application effectiveness, particularly accuracy and efficiency in solving mathematical tasks, interactive concept exploration, and solution verification and error correction. These tables were used to describe how the respondents perceived the usefulness of mobile learning applications in supporting their mathematics learning and accomplishing mathematical tasks.

Table 7. *Perceived Level of Mobile Learning Application Effectiveness in Developing Mathematical Literacy Among the Respondents in Terms of Accuracy and Task Efficiency in Solving Mathematical Tasks*

Indicators	WM	SD	Interpretation
1. Ensuring answer accuracy	2.95	0.80	Effective
2. Saving calculation time	3.02	0.81	Effective
3. Breaking down complex problems	2.96	0.90	Effective
4. Completing mathematical tasks faster	3.10	0.85	Effective
5. Reducing computational errors	2.82	0.85	Effective
6. Providing structured step-by-step solutions	2.97	0.84	Effective
Aggregate Weighted Mean	2.97		Effective
Aggregate Standard Deviation		0.84	

Legend: 3.21 – 4.00 Highly Effective, 2.41 – 3.20 Effective, 1.61 – 2.40 Slightly Effective, 1.00 – 1.60 Not Effective at All

The result in Table 7 indicates that mobile learning applications were perceived as effective in developing mathematical literacy in terms of accuracy and task efficiency, with an aggregate weighted mean of 2.97 and standard deviation of 0.84. Completing mathematical tasks faster obtained the highest weighted mean of 3.10 (SD = 0.85), followed by saving calculation time, with 3.02 (SD = 0.81). In contrast, reducing computational errors received the lowest weighted mean of 2.82 (SD = 0.85), although it was still interpreted as Effective. These findings suggest that students particularly valued mobile applications for improving the efficiency of mathematical work and completing learning activities within a shorter period. However, the relatively lower rating for error reduction indicates that using these applications does not necessarily eliminate computational mistakes. This finding is consistent with Etcuban and Pantinople (2018), who discussed the usefulness of mobile learning applications in supporting mathematics problem-solving, and with Sung et al. (2016), whose meta-analysis reported positive effects of mobile technology integration on student learning outcomes.

Table 8. *Perceived Level of Mobile Learning Application Effectiveness in Developing Mathematical Literacy Among the Respondents in Terms of Interactive Concept Exploration*

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Indicators	WM	SD	Interpretation
1. Visualizing graph changes dynamically	2.66	0.85	Effective
2. Exploring 3D shapes and spatial figures	2.60	0.93	Effective
3. Testing rules via interactive charts	2.77	0.84	Effective
4. Connecting math to real-world applications	2.94	0.87	Effective
5. Engaging through gamified challenges	2.83	0.90	Effective
6. Manipulating interactive visual elements	2.74	0.87	Effective
Aggregate Weighted Mean	2.76		Effective
Aggregate Standard Deviation		0.88	

Legend: 3.21 – 4.00 Highly Effective, 2.41 – 3.20 Effective, 1.61 – 2.40 Slightly Effective, 1.00 – 1.60 Not Effective at All

The result in Table 8 indicates that mobile learning applications were perceived as effective in supporting interactive concept exploration, obtaining an aggregate weighted mean of 2.76 and standard deviation of 0.88. Connecting mathematics to real-world applications received the highest weighted mean of 2.94 (SD = 0.87), followed by engaging through gamified challenges, with 2.83 (SD = 0.90). Conversely, exploring three-dimensional shapes and spatial figures obtained the lowest weighted mean of 2.60 (SD = 0.93), although it remained within the Effective category. These findings suggest that students recognized the value of mobile applications in connecting mathematical concepts to practical situations and providing engaging learning experiences. Nevertheless, the comparatively lower rating for exploring three-dimensional figures indicates an opportunity to strengthen students' exposure to interactive geometry and spatial visualization activities. This result is consistent with Mayer (2009), who emphasized the instructional value of combining visual and verbal representations, and Tang et al. (2023), who discussed the contribution of interactive digital features to students' understanding and engagement in mathematics.

Table 9. *Perceived Level of Mobile Learning Application Effectiveness in Developing Mathematical Literacy Among the Respondents in Terms of Solution Verification and Error Correction*

Indicators	WM	SD	Interpretation
1. Verifying handwritten answers	3.18	0.80	Effective
2. Pinpointing solution errors	3.14	0.83	Effective
3. Learning self-correction via step-by-step guides	3.15	0.79	Effective
4. Gauging understanding with instant feedback	2.87	0.86	Effective
5. Exploring alternative solution methods	3.03	0.86	Effective
6. Boosting submission confidence	2.90	0.88	Effective
Aggregate Weighted Mean	3.05		Effective
Aggregate Standard Deviation		0.84	

Legend: 3.21 – 4.00 Highly Effective, 2.41 – 3.20 Effective, 1.61 – 2.40 Slightly Effective, 1.00 – 1.60 Not Effective at All

The result in Table 9 indicates that mobile learning applications were perceived as effective in helping students verify mathematical solutions and correct errors, with an aggregate weighted mean of 3.05 and standard deviation of 0.84. Verifying handwritten answers obtained the highest weighted mean of 3.18 (SD = 0.80), followed by learning self-correction through step-by-step guides, with 3.15 (SD = 0.79), and pinpointing solution errors, with 3.14 (SD = 0.83). In comparison, gauging understanding through immediate feedback received the lowest weighted mean of 2.87 (SD = 0.86), although it was still interpreted as Effective. These findings indicate that students particularly valued mobile applications for checking manually solved problems, identifying mistakes, and reviewing the procedures used to obtain answers. The results further suggest that these applications can support independent monitoring of mathematical work, although their feedback features may require more deliberate instructional integration. This finding agrees with Etcuban and Pantinople (2018), who discussed the usefulness of immediate feedback in mathematics learning, and Insorio and Macandog (2022), who highlighted students' use of mobile applications to help students understand mathematical concepts and procedure, and to check mathematical solutions and review problem-solving procedures.

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Table 10. *Summary of the Perceived Level of Mobile Learning Application Effectiveness in Developing Mathematical Literacy Among the Respondents*

Indicators	AWM	ASD	Interpretation
1. Accuracy and Task Efficiency	2.97	0.84	Effective
2. Interactive Concept Exploration	2.76	0.88	Effective
3. Solution Verification and Error Correction	3.05	0.84	Effective
Grand Weighted Mean	2.93		Effective
Grand Standard Deviation		0.85	

Legend: 3.21 – 4.00 Highly Effective, 2.41 – 3.20 Effective, 1.61 – 2.40 Slightly Effective, 1.00 – 1.60 Not Effective at All

The result in Table 10 indicates that mobile learning applications were generally perceived as effective in developing mathematical literacy, obtaining a grand weighted mean of 2.93 and grand standard deviation of 0.85. Among the three dimensions, solution verification and error correction obtained the highest aggregate weighted mean of 3.05 (ASD = 0.84), followed by accuracy and task efficiency, with 2.97 (ASD = 0.84), while interactive concept exploration received the lowest aggregate mean of 2.76 (ASD = 0.88). Despite these differences, all dimensions were interpreted as Effective, indicating that students perceived mobile applications as helpful in checking answers, correcting mistakes, completing mathematical tasks efficiently, and exploring mathematical concepts. The findings suggest that students particularly recognized the practical benefits of mobile applications in verifying solutions and improving the efficiency of their mathematical work. This result is consistent with Mayer (2009), who emphasized the role of well-designed multimedia instruction in supporting learning, and Sung et al. (2016), whose findings indicated that integrating mobile devices into educational activities can positively influence learning performance.

Table 11. *Level of Mathematics Academic Performance Among Respondents in Terms of their Final Grades*

Final Grade Range	Descriptive Rating	Frequency (*f*)
90 – 100	Outstanding	92
85 – 89	Very Satisfactory	104
80 – 84	Satisfactory	54
75 – 79	Fairly Satisfactory	21
Below 75	Did Not Meet Expectations	0
		N= 271

The result in Table 11 indicates that the mathematics academic performance of the 271 respondents was generally favorable, with most students classified under the Very Satisfactory and Outstanding categories. Specifically, 104 students (38.38%) obtained final grades of 85–89, interpreted as Very Satisfactory, while 92 students (33.95%) attained grades of 90–100, interpreted as Outstanding. Meanwhile, 54 students (19.93%) were classified as Satisfactory, and 21 students (7.75%) were classified as Fairly Satisfactory. Notably, none of the respondents fell under the Did Not Meet Expectations category. These findings indicate that a substantial majority of the respondents achieved high levels of mathematics academic performance during the school year. However, the presence of students in the Satisfactory and Fairly Satisfactory categories suggests the need for continued instructional support to address differences in learning needs and mathematical proficiency. This finding is consistent with Fabian et al. (2018), who discussed the potential of digital technology integration to support mathematics learning, and Insorio and Macandog (2022), who examined mobile learning applications as supplementary tools for improving students' mathematical skills and academic performance.

Relationship Between Mobile Learning Application Use, Perceived Effectiveness, and Mathematics Academic Performance

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This part presents the results of the correlation analysis examining the relationships between mobile learning application use, perceived effectiveness, and the mathematics academic performance of the respondents. It includes Tables 12 and 13, which provide the correlation coefficients and significance values used to determine whether significant relationships exist between the extent of mobile learning application use and mathematics grades, as well as between perceived effectiveness of mobile learning applications and mathematics grades. These results were used to test the null hypotheses and establish the nature and strength of the relationships among the study variables.

Table 12. *Test of Significance of Relationship Between the Respondents' Level of Mathematics Academic Performance and The Extent of Use of Mobile Learning Applications*

Final Mathematics Grade	Pearson r Correlation	Sig. (2-tailed)	Magnitude	Direction	Decision	Relationship
Extent of Use of Mobile Learning Applications	0.163	0.007	Very Weak Correlation	Positive	Reject H_0	Significant

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

The result in Table 12 indicates that there was a statistically significant positive relationship between the respondents' mathematics academic performance and their extent of use of mobile learning applications, as reflected by Pearson's correlation coefficient of (r = 0.163) and a significance value of (p = 0.007). Since the computed p-value was lower than the 0.05 level of significance, the null hypothesis was rejected. However, the correlation was very weak, indicating that although greater use of mobile learning applications was associated with higher mathematics grades, the relationship was limited in strength. This suggests that the frequency and extent of application use alone may not adequately explain students' academic performance, which may also be influenced by instructional quality, study habits, prior knowledge, and other learning-related factors. This finding is consistent with Davis (1989), whose Technology Acceptance Model emphasizes the importance of perceived usefulness in technology adoption, and Sung et al. (2016), who reported positive learning outcomes associated with mobile technology integration. Nevertheless, the correlational result does not establish that greater application use directly causes higher mathematics grades.

Table 13. *Test of Significance of Relationship Between the Respondents' Level of Mathematics Academic Performance and The Effectiveness of Mobile Learning Applications*

Final Mathematics Grade	Pearson r Correlation	Sig. (2-tailed)	Magnitude	Direction	Decision	Relationship
Effectiveness of Mobile Learning Applications	0.237	0.000	Weak Correlation	Positive	Reject H_0	Significant

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

The result in Table 13 indicates that there was a statistically significant positive relationship between the respondents' mathematics academic performance and their perceived effectiveness of mobile learning applications, with a Pearson correlation coefficient of (r = 0.237) and a reported significance value of (p = 0.000). Since the reported p-value was below the 0.05 level of significance, the null hypothesis was rejected. The weak positive correlation suggests that students who perceived mobile learning applications as more effective also tended to obtain higher mathematics grades. Compared with the relationship reported in Table 11, this correlation was stronger, suggesting that students' perceptions of the usefulness of these applications may be more closely associated with their academic performance than their extent of use alone. This finding is consistent with Mayer

(2009), who emphasized the value of appropriately designed multimedia learning materials, and Maleniza (2022), who examined the contribution of mathematics-focused mobile applications to students' mathematical proficiency. However, the result establishes an association rather than a causal effect, indicating that mobile learning applications should complement effective teaching and students' active engagement in mathematics learning.

CONCLUSION

The study concluded that Khan Academy was the most commonly used mobile learning application among Grade 10 students, followed by Quizizz, Desmos, and Gauthmath, while Symbolab and Wolfram Alpha were among the least used. The respondents demonstrated a high extent of mobile learning application use, with an overall weighted mean of 2.66, and generally perceived these applications as effective in supporting mathematics learning, with an overall mean of 2.93. In terms of academic performance, 72.32% of the respondents obtained grades classified as Very Satisfactory or Outstanding. Correlation analysis revealed a significant but very weak positive relationship between the extent of mobile learning application use and mathematics grades (r = 0.163, p = 0.007), while perceived effectiveness had a significant positive relationship with mathematics grades (r = 0.237, $p < 0.001$). These findings indicate that both application use and perceived effectiveness were associated with students' mathematics academic performance, although the relationships do not establish causation. The results provide a basis for proposing an action plan to promote the purposeful and curriculum-aligned integration of mobile learning applications in mathematics instruction.

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