International Journal on Science and Technology (IJSAT)

E-ISSN: 2229-7677 ● Website: www.ijsat.org ● Email: editor@ijsat.org

Learners' Practices on Khan Academy Platform and Their Skills Proficiency in Mathematics

Zyrine P. Manto[1], Dr. Gina F. Labitad[2]

[1]Teacher I, [2]Education Program Supervisor

ABSTRACT

Learners' engagement with the Khan Academy platform and their skills proficiency in mathematics play an important role in improving conceptual understanding, problem-solving, and mathematical reasoning in technology-supported learning environments. However, results from the 2022 Program for International Student Assessment revealed continuing difficulties in Mathematics among Filipino learners, highlighting the need for digital learning approaches. This study examined the relationship between learners' practices on the Khan Academy platform and their skills proficiency in mathematics among Grade 8 learners, based on their Grade 7 engagement during the school year 2024–2025. Specifically, it identified learners' level of platform practices, determined their mathematics skills proficiency, and examined the relationship between these variables. A descriptive-correlational research design was used involving 200 Grade 8 learners from five public secondary schools in Misamis Oriental, selected through purposive sampling. Data were gathered using a researcher-made questionnaire and a Mathematics proficiency test and were analyzed using mean, standard deviation, and Pearson Product-Moment Correlation Coefficient.

Findings showed that learners demonstrated a practiced level of engagement with the Khan Academy platform, with proficiency tracking obtaining the highest mean. Their mathematics skills proficiency was described as approaching proficiency, with reasoning receiving the highest mean and data analysis rated as developing. Results further revealed significant positive relationships between platform practices and mathematics skills proficiency. The study concluded that engagement with the Khan Academy platform is significantly associated with mathematics skills proficiency. School heads, teachers, learners, and future researchers may strengthen strategies that effectively support platform integration and improved mathematics learning outcomes among learners.

Keywords: practices on Khan Academy platform, skills proficiency in Mathematics

1. INTRODUCTION

Background of the Study

Digital learning platforms have transformed Mathematics instruction by providing flexible and personalized learning. Khan Academy offers structured video lessons, interactive exercises, and mastery-based progression that allow learners to study at their own pace, revisit difficult topics, and address learning gaps (Khan Academy Philippines, 2023).

The need for such interventions is evident in the Philippines, where the 2022 PISA results placed the country among the bottom six globally, with most Filipino students failing to reach basic Mathematics proficiency (OECD, 2023). Khan Academy provides interactive lessons, personalized feedback, and progress tracking that may support learners, particularly those in under-resourced and remote areas.

Khan Academy Philippines, Inc. was launched in August 2023 and piloted in 34 schools during SY 2023–2024.
A Memorandum of Agreement with DepEd was signed on August 2, 2024. By SY 2024–2025, implementation expanded to 373 partner schools, reaching approximately 130,503 learners and 1,515 teachers. The platform provides MATATAG-aligned content, Khanmigo as an AI-supported learning assistant, and real-time dashboard insights for teachers (Department of Education, 2025; Khan Academy, 2024).

Policy support includes Division Memorandum No. 045, s. 2025 on onboarding and training and DepEd Memorandum No. 002, s. 2025 on assessments in English, Science, and Mathematics. These initiatives are anchored in Republic Act 10533, which promotes learner-centered and technology-integrated education.

Despite international recognition, Khan Academy's effectiveness in local settings such as Misamis Oriental remains underexplored. Its video lessons, interactive exercises, and mastery tracking therefore require empirical examination.
Khan Academy promotes active, self-paced learning through structured pathways, immediate feedback, repeated practice, and progress monitoring. These features may help learners identify gaps, monitor development, and improve Mathematics proficiency.

Philippine studies provide encouraging evidence. Grade 7 learners in Sarangani rated Khan Academy 4.22/5 for positive impact on Mathematics learning and 4.48/5 for improving their overall learning experience (Khan Academy, 2023). Cerrado and Errabo (2020) also found that it supported reading comprehension in solving mathematical word problems.

Thus, the study may provide useful evidence for educators, school leaders, and policymakers in determining whether Khan Academy should be more broadly integrated into instruction and whether implementation or teacher training should be strengthened.

Literature and Related Studies
Digital learning platforms offer innovative approaches to Mathematics education. This review focuses on Khan Academy's utilization, accessibility, prerecorded video lesson presentation, practice exercises, and proficiency tracking and their relationship with Mathematics skills proficiency.

Learners' Practices on Khan Academy Platform

Khan Academy supports self-paced and learner-centered learning, with students using it to reinforce lessons, review difficult topics, prepare for assessments, replay videos, complete exercises, monitor progress, and develop mastery. These practices reflect autonomous and flexible learning behaviors.

Fiorella and Mayer (2021) found that well-designed instructional videos improve mathematical understanding and learner engagement, supporting their use as supplementary learning resources.

Utilization

Learners use Khan Academy to review lessons, watch videos, complete exercises, revisit difficult topics, and prepare for tests. A study of approximately 350,000 Grades 3–8 students found about 20% more growth than expected among Khan Academy users on the MAP Growth Assessment (Murphy et al., 2021). Similarly, a SY 2020–2021 study of more than 180,000 students in 649 schools found that users of MAP Accelerator achieved scores 19% higher than expected, with improvements across grade levels and student groups (Khan Academy & NWEA, 2021).

Accessibility

Accessibility involves not only availability but learners' meaningful participation in digital activities such as watching videos, completing exercises, and engaging with assigned tasks. OECD (2021) reported that active engagement with digital resources is associated with better academic outcomes, while limited engagement is associated with lower improvement. Thus, accessibility is treated as an independent variable because it influences learners' interaction with Khan Academy and Mathematics proficiency.

Prerecorded Video Lesson Presentation

Khan Academy's prerecorded videos provide step-by-step explanations and guided practice that learners can revisit at their own pace. Their structured, visual, and self-paced nature supports independent learning and

Mathematics mastery.

A quasi-experimental study in Bayelsa State, Nigeria, found that Junior Secondary School II students taught through Khan Academy videos performed significantly better than those taught traditionally (Diri, 2023). Another study found that video-based instruction improved students' performance, self-concept, and confidence in solving Mathematics problems (Fiorella & Mayer, 2021). Thus, prerecorded video lesson presentation is included as an independent variable because it may influence understanding, confidence, and performance.

Practice Exercises

Khan Academy practice exercises allow learners to apply and reinforce mathematical concepts through problem sets, feedback, and hints. WestEd (2021) found that teachers and students valued these exercises for supporting self-paced learning, immediate error correction, understanding of complex concepts, and confidence building.

These findings suggest that interactive practice and immediate feedback can enhance Mathematics understanding and performance.

Proficiency Tracking

Khan Academy's mastery system uses gradual challenges, continuous feedback, and progress indicators to help learners monitor improvement. This encourages persistence, self-monitoring, and continuous Mathematics learning.

A 2022–2023 analysis found that students using Khan Academy for 30–60 minutes weekly achieved learning gains over 40% higher than pre-pandemic growth expectations in certain grade levels, with mastery learning identified as a key factor (Khan Academy, 2024).

Research involving over 181,000 students across 99 school districts also found significant improvements in standardized Mathematics scores, particularly among historically under-resourced students (Koedinger, McLaughlin, & Kannan, 2022). Additionally, 84% of K–12 teachers surveyed by YouGov for Khan Academy considered mastery learning effective in addressing learning gaps (Khan Academy, 2022). These findings support Proficiency Tracking as an independent variable because it helps learners monitor progress, address gaps, and improve Mathematics proficiency.

Skills Proficiency in Mathematics

Mathematical skills proficiency among Grade 7 learners involves fluency, accuracy, and logical thinking, particularly in number sense, data analysis, and reasoning. Ngu and Phan (2024) describe mathematical proficiency through conceptual understanding, procedural fluency, strategic competence, adaptive reasoning, and productive disposition. Their findings emphasize instructional strategies that strengthen reasoning and problem-solving. Similarly, Cabuquin and Abocejo (2023) found a significant positive relationship between mathematics performance and overall academic achievement among 1,500 junior high school students, highlighting the importance of problem-solving, critical thinking, instructional quality, and learner engagement. These findings support the MATATAG curriculum's goal of developing analytical and independent learners.

Number Sense

Number sense involves understanding numerical relationships, computation, quantitative reasoning, and applying mathematical concepts in algebra, measurement, and geometry. Santos et al. (2022) found low number sense proficiency among many Grade 7 learners, particularly in estimation, mental computation, and numerical magnitude. Mathematical self-efficacy was positively related to performance, while visual learners obtained higher scores. The findings emphasize conceptual understanding, computational fluency, learner confidence, and varied instructional strategies.

Data Analysis

Data analysis involves organizing, interpreting, and evaluating numerical, tabular, and graphical information to make evidence-based decisions. Cababat and Pespeñan (2023) found varying analytical skills among 293 Grade 11 learners, with Academic Track students near proficient and TVL students at a developing level. Kadusale et al. (2024) found general competence in basic data analysis but moderate proficiency in complex statistical tasks. Both studies emphasize differentiated, practical, and scaffolded instruction to strengthen data interpretation and analysis.

Reasoning

Mathematical reasoning involves logical thinking, identifying relationships and patterns, drawing conclusions, justifying solutions, and selecting appropriate strategies. Bergqvist et al. (2024) found that reasoning is strongest when learners construct and justify mathematical claims, although classroom opportunities are often overlooked. Noves and Palomares (2024) found satisfactory mathematical literacy among Grade 10 learners, with inductive reasoning predicting problem-solving ability, while misconceptions and misapplied formulas caused errors. These findings emphasize deliberate reasoning activities and targeted remediation.

Objectives

This study examines the relationship between Khan Academy practices and mathematics skills proficiency among Grade 8 learners based on their Grade 7 practices and mathematics proficiency during SY 2024–2025. Specifically, it aims to:

1. determine the level of Khan Academy practices in terms of utilization, accessibility, prerecorded video lesson presentation, practice exercises, and proficiency tracking;
2. determine mathematics skills proficiency in terms of number sense, data analysis, and reasoning; and
3. determine the significant relationship between Khan Academy practices and mathematics skills proficiency.

Theoretical Framework

The study is anchored on Bandura's Social Cognitive Theory (1986), which explains learning through observational learning, self-efficacy, cognitive engagement, self-regulation, and environmental interaction.

Khan Academy's prerecorded video lessons support observational learning by modeling mathematical procedures. Practice exercises provide repeated practice, feedback, and guided learning that can strengthen self-efficacy and problem-solving. Proficiency tracking promotes goal-setting, motivation, continuous improvement, and mastery. Utilization reflects learners' active engagement with the platform, while accessibility represents environmental conditions that enable participation.

Thus, the study examines how utilization, accessibility, prerecorded video lessons, practice exercises, and proficiency tracking may influence mathematics proficiency through observational learning, self-efficacy, self-regulation, cognitive engagement, and environmental support.

Conceptual Framework

Anchored on DepEd Order No. 8, s. 2015 and informed by the Khan Academy platform dashboard, this study focuses on mathematics skills proficiency in number sense, data analysis, and reasoning through learner-centered, standards-based instruction and formative assessment. Khan Academy practices, namely utilization, accessibility, prerecorded video lesson presentation, practice exercises, and proficiency tracking, support personalized learning, while its dashboard provides real-time feedback and progress information for monitoring engagement and mastery (DepEd, 2015; Khan Academy, 2024).

Khan Academy was piloted in Philippine public schools during SY 2023–2024, involving 34 schools, 71 mathematics teachers, 3,250 students, and 600 parents. Learners used the platform for at least 30 minutes weekly through a blended-learning approach, while teachers used dashboard analytics to monitor progress and provide targeted feedback (Department of Education, 2024).

The platform provides mastery-based progression, diagnostic insights, gamified features, prerecorded lessons, and practice exercises that promote motivation and engagement. Studies indicate that frequent platform use is associated with greater mathematics growth (Khan Academy, 2023; Murphy et al., 2021). These features reflect Bloom's Mastery Learning Theory and DepEd's emphasis on formative assessment. The study assumes that learners' Khan Academy practices are related to their mathematics skills proficiency. Greater engagement, access to resources, practice opportunities, immediate feedback, and progress monitoring may strengthen mathematical understanding and skills.

Figure 1 illustrates the relationship between the study variables. The independent variables are utilization, accessibility, prerecorded video lesson presentation, practice exercises, and proficiency tracking, while the dependent variables are number sense, data analysis, and reasoning. The study determines whether a significant relationship exists between these variables, supporting a technology-based, learner-centered approach that promotes independent learning, timely feedback, curriculum alignment, and 21st-century mathematical competencies.

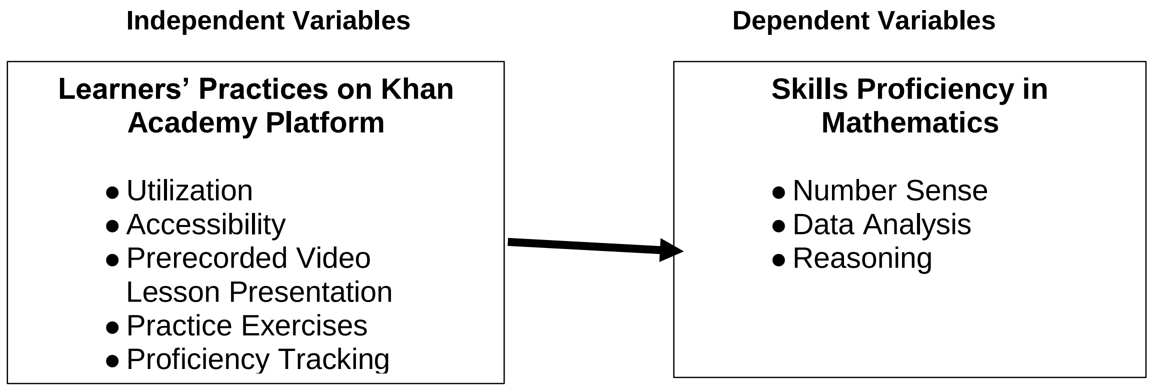

Figure 1. A Schematic Presentation Showing the Interplay between the Independent and Dependent Variables of the Study

Staten

The study aimed to examine the relationship between learners' practices on Khan Academy platform and their skills proficiency in Mathematics among Grade 8 learners based on their Grade 7 practices on the platform and skills proficiency in Mathematics during the School Year 2024 – 2025.

Specifically, the study sought to answer the following questions:

1. What is the respondents' level of practices on Khan Academy platform in terms of utilization, accessibility, prerecorded video lesson presentation, practice exercises and proficiency tracking?
2. What is the respondents' level of skills proficiency in Mathematics in terms of number sense, data analysis and reasoning?
3. Is there a significant relationship between the respondents' level of practices on Khan Academy platform and their level of skills proficiency in Mathematics?

Hypothesis

Problems 1 and 2 are hypotheses-free. Based on problem 3, the null hypothesis was tested at a 0.05 level of significance.

Ho1: There is no significant relationship between the respondents' level of practices on Khan Academy platform and their level of skills proficiency in Mathematics.

Significance of the Study

This study may contribute to improving Mathematics instruction through technology-enhanced learning platforms such as Khan Academy. By examining learners' engagement in terms of utilization, accessibility, prerecorded video lesson presentation, practice exercises, and proficiency tracking, it may provide insights for strengthening instruction, learner achievement, and competency-based Mathematics education.

School Heads. The study may provide insights into the relationship between Khan Academy engagement and proficiency in number sense, data analysis, and reasoning, supporting evidence-based decisions on instructional integration, resource allocation, learner support programs, and teacher professional development toward a mastery-oriented and digitally empowered learning environment.

Teachers. The findings may provide data on how Khan Academy engagement relates to mathematics proficiency, helping teachers refine strategies, implement differentiated and mastery-based instruction, and use the platform as a formative and supplementary tool for data-informed teaching and improved learner achievement.

Learners. The study emphasizes self-directed learning by showing how meaningful engagement through utilization, accessibility, prerecorded video lesson presentation, practice exercises, and proficiency tracking may strengthen study habits, conceptual mastery, and proficiency in number sense, data analysis, and reasoning.

Future Researchers. The study may serve as a reference for future investigations on technology-enhanced Mathematics education, digital pedagogy, and innovative competency-based learning models in the Philippine education system.

Scope and Limitations

This study examined the relationship between Khan Academy practices and Mathematics skills proficiency among 200 Grade 8 learners, based on their Grade 7 engagement during SY 2024–2025. Respondents were from the five public secondary schools in Misamis Oriental identified as Khan Academy-implementing schools under Division Memorandum No. 330, s. 2025. The study covered the first-level or early implementation of the platform. Tagoloan National High School was excluded because it was the researcher's current workstation to ensure impartiality and minimize potential bias.

The study focused on Khan Academy practices in terms of utilization, accessibility, prerecorded video lesson presentation, practice exercises, and proficiency tracking, and their relationship with Mathematics proficiency in number sense, data analysis, and reasoning.

The study was limited to selected public secondary schools and Grade 8 learners with prior Grade 7 Khan Academy engagement, limiting generalizability to other schools and grade levels. It did not account for teacher instructional methods, socioeconomic status, internet access and connectivity, and prior mathematical knowledge, which may affect performance. It also assessed current proficiency only and did not examine long-term outcomes such as knowledge retention or sustained mastery.

Despite these limitations, the study provides empirical evidence on digital engagement and Mathematics learning outcomes that may support educational policies, school implementation, and classroom strategies for improving Mathematics proficiency through Khan Academy.

2. METHODOLOGY

This section describes and justifies the research design, respondents, sampling procedure, and data gathering procedure. It also outlined the details of the study's instrument, scoring procedure, and statistical treatment employed.

Research Design

This study employed a descriptive-correlational research design to examine the relationship between learners' Khan Academy practices and Mathematics skills proficiency among public high school learners (Cohen et al., 2021). The descriptive component assessed platform practices in terms of utilization, accessibility, prerecorded video lesson presentation, practice exercises, and proficiency tracking, while Mathematics proficiency was measured through number sense, data analysis, and reasoning.

Researcher-developed instruments were used to assess learners' platform engagement and mathematical proficiency. The descriptive component examined how learners accessed and used Khan Academy, watched video lessons, completed exercises, and monitored mastery, while the correlational component determined the strength and direction of the relationship between these practices and Mathematics proficiency.
The design provided a structured basis for analyzing how digital learning practices relate to core mathematical competencies and for developing evidence-based recommendations to improve Mathematics instruction through targeted use of Khan Academy.

Study Setting

The study was conducted in five selected public secondary schools in Misamis Oriental, Region 10, Northern Mindanao, Philippines, officially identified as Khan Academy implementing schools: Lugait National High School, Naawan National High School, Mauswagon Integrated School, Laguindingan National High School, and Medina National Comprehensive High School.

The schools were purposively selected because of their active implementation of Khan Academy, ensuring that participants had meaningful exposure to its digital learning tools, including utilization, accessibility, prerecorded video lessons, practice exercises, and proficiency tracking. Although the schools varied in student demographics, technological resources, and instructional approaches, their common use of Khan Academy provided a consistent basis for examining its relationship with Mathematics proficiency in number sense, data analysis, and reasoning.

The schools reflected DepEd's efforts to integrate technology into Mathematics instruction by providing supplementary resources, self-paced activities, immediate feedback, and platform-generated data for monitoring learner progress and identifying instructional needs.

By focusing on five implementing public secondary schools during SY 2024–2025, the study maintained contextual relevance to Misamis Oriental's digital learning initiatives while providing a basis for examining the relationship between Khan Academy engagement and Mathematics skills proficiency. Overall, the setting represented diverse public-school contexts where technology-driven instruction could be examined in relation to learner outcomes.

Research Respondents

This study involved two hundred (200) Grade 8 students from five public secondary schools who had participated in the Khan Academy pilot implementation in Misamis Oriental as Grade 7 learners during the School Year 2024–2025. The respondents, who represented early secondary learners, provided a targeted context for analyzing how practices on Khan Academy platform related to students' proficiency in foundational mathematical domains, including number sense, data analysis, and reasoning.

The selection of respondents was based on their active engagement with the Khan Academy platform, including dimensions such as utilization, accessibility, interaction with prerecorded video lessons, completion of practice exercises, and use of the proficiency tracking system. This criterion ensured that the study accurately captured how varied forms of digital learning participation contributed to learners' proficiency in essential mathematical domains, specifically number sense, data analysis, and reasoning. The table below details the distribution of respondents across different schools.

Table A
Distribution of Respondents

School Code	Respondents
A	40
B	40
C	40
D	40
E	40
Total	**200**

Sampling Technique

The study employed purposive sampling to select 200 Grade 8 learners, with 40 respondents from each of five public secondary schools in Misamis Oriental implementing Khan Academy in Mathematics. Participants were selected based on their exposure to the platform during Grade 7 under its first-level implementation in SY 2024–2025.

Selection was based on learners' experience with Khan Academy practices, including utilization, accessibility, prerecorded video lesson presentation, practice exercises, and proficiency tracking, ensuring sufficient experience for examining their relationship with Mathematics proficiency in number sense, data analysis, and reasoning.

Teacher records, learning logs, and system-generated usage data were used to validate participant selection. Equal representation of 40 respondents per school provided balanced coverage of the participating schools and supported the validity and reliability of the findings.

Research Instrument
The study used a researcher-made questionnaire consisting of two parts to assess learners' Khan Academy practices and Mathematics skills proficiency among Grade 8 learners from Lugait National High School, Naawan National High School, Mauswagon Integrated School, Laguindingan National High School, and Medina National Comprehensive High School, based on their Grade 7 engagement during SY 2024–2025.

Part I assessed Khan Academy practices in five indicators: utilization, accessibility, prerecorded video lesson presentation, practice exercises, and proficiency tracking. It was anchored on Bandura's Social Cognitive Theory (1986) and measured learners' use of the platform, access to learning activities, engagement with video lessons, completion of exercises, and monitoring of progress and mastery.

Part II assessed Mathematics proficiency in number sense, data analysis, and reasoning. It was anchored on DepEd Order No. 8, s. 2015 and guided by the competency structure and mastery-based progression reflected in the Khan Academy dashboard. The dashboard served only as a reference for identifying skill domains and progression, not as a direct source of test items. Number sense covered computation and quantitative concepts in algebra, measurement, and geometry; data analysis covered organizing, interpreting, and analyzing data; and reasoning covered logical thinking and pattern recognition.

The instrument was developed through a review of related literature and theoretical frameworks and underwent expert validation and pilot testing to ensure accuracy, relevance, clarity, and appropriateness.

Validity and Reliability
The researcher-made questionnaire underwent content validation and pilot testing to establish validity and reliability. Mathematics education specialists evaluated the instrument and confirmed its alignment with the intended constructs and appropriateness for measuring Khan Academy practices and Mathematics skills proficiency.

A pilot test was conducted with 30 Grade 8 learners from Tagoloan National High School who were excluded from the actual respondents. The pilot test assessed the instrument's clarity, appropriateness, and effectiveness.

Reliability was determined using Cronbach's alpha, with a coefficient of 0.70 or higher considered acceptable. Based on expert feedback and pilot results, necessary revisions were made to improve item clarity and coherence. These procedures ensured that the instrument was valid and reliable for collecting meaningful data on Khan Academy practices and Mathematics skills proficiency.

Data Gathering Procedure
The researcher obtained approval from the school administrators and Department of Education before collecting data from 200 Grade 7 learners of the five selected schools. Respondents were oriented on the study's purpose, confidentiality, and voluntary participation before answering the survey questionnaire. The researcher personally administered and collected the questionnaires, addressed clarifications, and reviewed and organized the completed responses for analysis. All data were kept confidential, anonymous,

and used solely for research purposes.

Statistical Treatment of Data

The mean, standard deviation, and Pearson's Correlation Coefficient were used to analyze the data. The mean determined the extent of Khan Academy practices and Mathematics skills proficiency, the standard deviation measured response variability, and Pearson's correlation determined the strength and direction of their relationship.

Ethical Consideration

The study adhered to informed consent, confidentiality, voluntary participation, privacy, and respect for participants' rights and welfare. Necessary ethical clearance and school permissions were obtained, and respondents' information and responses were kept anonymous and used solely for research. The responsible use of AI was also observed in accordance with academic integrity and ethical research standards.

3. RESULTS AND DISCUSSION

This section presents and analyzes data from survey questionnaires given to respondents, aiming to examine the relationship between learners' practices on Khan Academy platform and skills proficiency in mathematics among Grade 8 learners based on their Grade 7 engagement with the platform during the school year 2024-2025.

Results

Problem 1. What is the respondents' level of practices on Khan Academy platform in terms of utilization, accessibility, prerecorded video lesson presentation, practice exercises and proficiency tracking?

Table 1

Distribution of Respondents' Level of Practices on Khan Academy Platform in Terms of Utilization

Indicators As a learner , ...	Mean	SD	Description
I use the Khan Academy platform to review past math lessons.	3.20	0.82	Most of the Time
I watch Khan Academy videos to better understand current math topics.	3.39	0.78	At all Times
I complete Khan Academy exercises that match our current math lessons.	3.16	0.82	Most of the Time
I use Khan Academy to study for upcoming math quizzes or tests.	2.83	0.91	Most of the Time
I access Khan Academy to get extra help with my math homework.	2.78	0.98	Most of the Time
I revisit difficult math topics using Khan Academy.	2.63	0.86	Most of the Time
I monitor my math progress using Khan Academy tools.	2.95	0.87	Most of the Time
I study math through the Khan Academy platform.	3.00	0.86	Most of the Time
I explore additional Khan Academy lessons even when they are not assigned.	2.48	0.94	Sometimes
I believe that using Khan Academy helps me do better in math.	3.45	0.77	At all Times
Overall	**2.98**	**0.86**	**Most of the time**

Legend:

3.26 – 4.00 – At All Times / Highly Practiced
2.51 – 3.25 – Most of the Time / Practiced
1.76 – 2.50 – Sometimes / Slightly Practiced
1.00 – 1.75 – Never / Not Practiced

Table 1 shows that learners' utilization of the Khan Academy platform had an overall mean of 2.98 (SD = 0.86), described as Most of the Time and interpreted as Practiced. This indicates that learners regularly use the platform for watching instructional videos, reviewing concepts, and completing assigned exercises, although their consistency varies. Some learners participate regularly, while others use it mainly when activities are required.

These findings agree with Vidergor and Ben-Amram (2020), who found that teacher-supported Khan Academy use improved learners' independence, motivation, and mathematics learning. Bond et al. (2021) likewise reported that consistent digital engagement supports participation and academic performance, while Kuhfeld et al. (2020) emphasized the importance of sustained instructional support in mathematics achievement.

The highest-rated indicator, “I believe that using Khan Academy helps me do better in math,” obtained a mean of 3.45 (SD = 0.77), described as At all Times and interpreted as Highly Practiced. This shows that learners strongly perceive Khan Academy as helpful to their mathematics performance and understanding. Khan Academy (2023) reported higher learning gains among regular users, while Bond et al. (2021) found improvements in achievement and self-efficacy through structured digital learning.

The lowest-rated indicator, “I explore additional Khan Academy lessons even when they are not assigned,” obtained a mean of 2.48 (SD = 0.94), described as Sometimes and interpreted as Slightly Practiced. This indicates limited independent exploration, as learners tend to prioritize assigned tasks. Aguilera-Hermida (2020) identified accessibility, motivation, and engagement as factors affecting online participation. Lim et al. (2021) and Martin et al. (2020) emphasized that analytics-informed strategies and intentional integration of digital tools can improve engagement. DepEd’s partnership with Khan Academy also supports structured implementation for accessibility and learner engagement among Filipino learners.

Table 2
Distribution of Respondents’ Level of Practices on Khan Academy Platform in terms of Accessibility

Indicators **As a learner, ..**	**Mean**	**SD**	**Description**
I watch Khan Academy math videos.	3.50	0.77	At all Times
I answer Khan Academy math practice questions.	3.44	0.75	At all Times
I use Khan Academy to review math topics before tests.	2.75	0.87	Most of the Time
I explore extra or advanced math lessons on Khan Academy.	2.70	0.90	Most of the Time
I complete entire Khan Academy math modules in one sitting.	2.62	0.86	Most of the Time
I use Khan Academy as part of our guided learning time.	3.18	0.87	Most of the Time
I also use Khan Academy outside of school.	2.78	0.96	Most of the Time
I revisit and repeat Khan Academy lessons to better understand difficult math topics.	2.91	0.88	Most of the Time
I use the progress tracker on Khan Academy to check how I'm doing in math.	2.65	0.98	Most of the Time
I stay focused and use my time well when learning math on Khan Academy.	3.08	0.87	Most of the Time
Overall	**2.96**	**0.87**	**Most of the Time**

Legend:

3.26 – 4.00 – At All Times / Highly Practiced

1.76 – 2.50 – Sometimes / Slightly Practiced

1.00 – 1.75 – Never / Not Practiced

2.51 – 3.25 – Most of the Time / Practiced

Table 2 shows that learners' accessibility to the Khan Academy platform had an overall mean of 2.96 (SD = 0.87), described as Most of the Time and interpreted as Practiced. This indicates that learners generally access the platform for mathematics activities, although their consistency and independence vary. These findings support Vidergor and Ben-Amram (2020) and Bond et al. (2021), who emphasized teacher guidance and structured digital access in sustaining learner engagement.

The highest-rated indicator, "I watch Khan Academy math videos," obtained a mean of 3.50 (SD = 0.77), described as At all Times and interpreted as Highly Practiced. This shows that videos are the most accessible and frequently used feature. Martin et al. (2020), Almaiah et al. (2020), and Khan Academy (2023) likewise emphasized the value of accessible digital and video-based resources in supporting engagement and mathematics learning.

The lowest-rated indicator, "I complete entire Khan Academy math modules in one sitting," obtained a mean of 2.62 (SD = 0.86), described as Most of the Time and interpreted as Practiced. This indicates that learners usually complete activities in shorter sessions rather than finishing entire modules at once, possibly due to time limitations and pacing preferences. This is consistent with van Merriënboer and Kirschner (2020), Lim et al. (2021), and Aguilera-Hermida (2020), who emphasized structured sessions, guided interaction, accessibility, and learner pacing in digital learning.

Table 3
Distribution of Respondents' Level of Khan Academy Platform Practices in terms of Prerecorded Video Lesson Presentation

Indicators As a learner ,...	Mean	SD	Description
I understand math concepts more clearly when I watch Khan Academy video lessons.	2.99	0.78	Most of the Time
I find Khan Academy video lessons easy to follow and learn from.	2.93	0.79	Most of the Time
I prefer learning math through Khan Academy video lessons rather than textbooks.	2.78	0.85	Most of the Time
I perform better on math quizzes and tests when I watch Khan Academy video lessons	2.62	0.81	Most of the Time
I use our scheduled time on Khan Academy to watch video lessons and prepare for upcoming math lessons or exams.	2.89	0.84	Most of the Time

I understand math topics better when I rewatch Khan Academy video lessons.	2.88	0.89	Most of the Time
I feel more confident in solving math problems after watching Khan Academy videos.	2.84	0.89	Most of the Time
I find Khan Academy's video explanations more effective than classroom explanations.	2.45	0.83	Sometimes
I often replay challenging parts of Khan Academy video lessons to improve my understanding.	2.95	0.89	Most of the Time
I believe watching video lessons on Khan Academy helps me do better in math overall.	3.09	0.83	Most of the Time
Overall	**2.84**	**0.84**	**Most of the Time**

Legend:

3.26 – 4.00 – At All Times / Highly Practiced
2.51 – 3.25 – Most of the Time / Practiced
1.76 – 2.50 – Sometimes / Slightly Practiced
1.00 – 1.75 – Never / Not Practiced

Table 3 shows an overall mean of 2.84 (SD = 0.84), described as Most of the Time and interpreted as Practiced, indicating regular engagement with prerecorded video lessons for Mathematics learning, particularly in guided and assigned activities. Learners vary in how deeply they process and understand the video content. This supports Vidergor and Ben-Amram (2020), Martin et al. (2020), and Noetel et al. (2021), who emphasized the benefits of video-based instruction when supported by teacher mediation and structured learning.

The highest indicator, "I believe watching video lessons on Khan Academy helps me do better in math," obtained a mean of 3.09 (SD = 0.83), described as Most of the Time and interpreted as Practiced, showing that learners generally perceive video lessons as helpful to their Mathematics understanding and performance. Khan Academy (2023) and Bond et al. (2021) likewise associated sustained digital engagement with improved participation and mathematics learning outcomes.

The lowest indicator, "I find Khan Academy's video explanations more effective than classroom explanations," obtained a mean of 2.45 (SD = 0.83), described as Sometimes and interpreted as Slightly Practiced. This indicates that learners view videos as supplementary rather than replacements for teacher-led instruction, valuing classroom interaction and immediate clarification. This finding aligns with Vidergor and Ben-Amram (2020), Martin et al. (2020), and Lim et al. (2021), who emphasized teacher interaction and guided support in technology-based learning. Diri (2023) further found that Khan Academy video instruction improved Mathematics performance and conceptual understanding while complementing classroom instruction.

Table 4
Distribution of Respondents' Level of Practices on Khan Academy Platform in terms of Practice Exercises

Indicators **As a learner I, ...**	**Mean**	**SD**	**Description**
I regularly complete Khan Academy math practice exercises.	3.02	0.84	Most of the Time
I find that doing practice exercises on Khan Academy helps me remember and understand the math topics we learn in class.	3.06	0.75	Most of the Time
I become more confident in mathematics after completing practice exercises on Khan Academy.	2.87	0.88	Most of the Time
I understand my math mistakes better when I do practice exercises on Khan Academy.	2.98	0.82	Most of the Time
I improve my math skills by using the instant feedback provided in Khan Academy exercises.	2.89	0.82	Most of the Time
I use the hints in Khan Academy practice exercises when I encounter difficult problems.	2.94	0.97	Most of the Time
I keep working on Khan Academy exercises until I get the correct answer.	3.25	0.86	Most of the Time
I use Khan Academy practice exercises to prepare for math tests or exams.	2.69	0.74	Most of the Time
I track my progress on Khan Academy to monitor how well I'm doing in math.	2.93	0.87	Most of the Time
I have seen improvements in my math grades because I regularly complete Khan Academy exercises.	2.83	0.86	Most of the Time
Overall	**2.94**	**0.84**	**Most of the Time**

Legend:
3.26 – 4.00 – At All Times / Highly Practiced
1.76 – 2.50 – Sometimes / Slightly Practiced
1.00 – 1.75 – Never / Not Practiced

2.51 – 3.25 – Most of the Time / Practiced

Table 4 shows an overall mean of 2.94 (SD = 0.84), described as Most of the Time and interpreted as Practiced, indicating regular use of Khan Academy practice exercises, including completing tasks, using hints, and responding to feedback. Learner engagement varies, with some showing persistence while others focus mainly on task completion. This aligns with Doo et al. (2020), Barana et al. (2021), and Weatherholtz et al. (2020), who found that guided practice and feedback enhance learner engagement and performance.

The highest indicator, "I keep working on Khan Academy exercises until I get the correct answer," obtained a mean of 3.25 (SD = 0.86), described as Most of the Time and interpreted as Practiced, indicating persistence through repeated attempts and feedback. This supports Barana et al. (2021) and Doo et al. (2020), who emphasized feedback and scaffolding in promoting persistence and sustained engagement.

The lowest indicator, "I use Khan Academy practice exercises to prepare for math tests or exams," scored 2.69 (SD = 0.74), described as Most of the Time and interpreted as Practiced. This indicates that learners use exercises more as routine tasks than for assessment preparation, focusing on immediate completion rather than long-term goals. Weatherholtz et al. (2020), Lim et al. (2021), Martin et al. (2020), and Khan Academy (2023) emphasized that structured, goal-oriented platform use and progress tracking strengthen engagement and connect practice with assessment outcomes.

Table 5
Distribution of Respondents' Level of Khan Academy Platform Practices in terms of Proficiency Tracking

Indicators **As a learner I,...**	**Mean**	**SD**	**Description**
I improve my math skills through the mastery system.	3.14	0.83	Most of the Time
I track my math progress by earning levels like Familiar, Proficient, and Mastered.	3.05	0.81	Most of the Time
I feel a sense of achievement when I reach higher mastery levels in math.	3.08	0.81	Most of the Time
I review math topics I haven't mastered yet.	2.89	0.82	Most of the Time
I use the mastery system to identify which math skills I still need to improve.	3.11	0.83	Most of the Time
I follow the mastery system to decide what math topic I should study next.	2.96	0.93	Most of the Time

I aim to fully master each math topic before moving to the next one.	2.83	0.91	Most of the Time
I improve my math skills when I see my progress in the mastery system.	3.03	0.80	Most of the Time
I stay more focused and consistent in learning math because the mastery system keeps me on track.	2.88	0.83	Most of the Time
I have noticed improvement in my math test scores or grades by using the mastery system.	2.98	0.83	Most of the time
Overall	**2.99**	**0.84**	**Most of the Time**

Legend:

3.26 – 4.00 – At All Times / Highly Practiced
2.51 – 3.25 – Most of the Time / Practiced
1.76 – 2.50 – Sometimes / Slightly Practiced
1.00 – 1.75 – Never / Not Practiced

Table 5 shows that learners' proficiency tracking practices on Khan Academy obtained an overall mean of 2.99 (SD = 0.84), described as Most of the Time and interpreted as Practiced. This indicates that learners regularly monitor their mathematics progress through mastery levels, feedback, and progress indicators, although consistency varies. The researcher observed that some learners use tracking information to guide their learning, while others use it mainly for basic progress awareness.

These findings agree with Ifenthaler and Yau (2020) and Khor and Mutthulakshmi (2024), who emphasized that learning analytics and mastery systems support self-regulated learning when actively used to guide decisions. Khan Academy Philippines (2025) and EdTechReview (2024) likewise highlighted the value of integrating mastery-based systems into structured instruction.

The highest-rated indicator, "I improve my math skills through the mastery system," obtained a mean of 3.14 (SD = 0.83), described as Most of the Time and interpreted as Practiced. This indicates that learners associate visible mastery levels and feedback with improvement in mathematics skills. Jaramillo-Mediavilla et al. (2024), Ifenthaler and Yau (2020), and Khor and Mutthulakshmi (2024) similarly emphasized that progress visualization and mastery feedback support learner motivation and engagement.

The lowest-rated indicator, "I aim to fully master each math topic before moving to the next one," obtained a mean of 2.83 (SD = 0.91), also described as Most of the Time and interpreted as Practiced. This indicates that learners do not always achieve full mastery before progressing to new topics, often prioritizing completion of assigned activities within available time. Guskey (2021), Callaman and Itaas (2020), and

Igarashi and Suryadarma (2023) emphasized that sustained feedback and continuous formative assessment are necessary for effective mastery learning.

Table 6
Summary Distribution of Respondents' Level of Practices on Khan Academy Platform

Practices on Khan Academy Platform Variables	Mean	SD	Interpretation
Utilization	2.98	0.86	Practiced
Accessibility	2.96	0.87	Practiced
Prerecorded Video Lesson Presentation	2.84	0.84	Practiced
Practice Exercises	2.94	0.84	Practiced
Proficiency Tracking	2.99	0.84	Practiced
Overall	**2.94**	**0.85**	**Practiced**

Legend:
3.26 – 4.00 – At All Times / Highly Practiced
2.51 – 3.25 – Most of the Time / Practiced
1.76 – 2.50 – Sometimes / Slightly Practiced
1.00 – 1.75 – Never / Not Practiced

Table 6 presents the summary distribution of respondents' level of practices on Khan Academy platform across five variables: utilization, accessibility, prerecorded video lesson presentation, practice exercises, and proficiency tracking. It got an overall mean of 2.94 (SD = 0.85) interpreted as Practiced. This means that learners regularly engage in the platform practices for Mathematics learning across the five variables. This implies that learners regularly engage with the different platform practices as part of their mathematics learning routines. These five dimensions reflect the integration of the platform into learners' mathematics learning experiences. This shows that there are differences in how learners engage with specific platform features.

The learners demonstrate steady engagement across the five platform practices during different learning activities. Participation is commonly associated with guided learning activities. The researcher also observed that learners differ in the intensity of engagement, with some actively engaging in interactive components while others participate at a more basic level, depending on the task.

These findings are consistent with studies indicating the role of structured integration of digital platforms in promoting engagement and learning. Patil and Juanico (2024) and Ulum (2023) reported that when digital learning tools are embedded within classroom instruction, they support consistent participation and measurable academic gains, aligning with the overall engagement pattern observed in this study.

Among the five variables, Proficiency Tracking obtained the highest mean of 2.99 (SD = 0.84), interpreted as Practiced. This means that learners frequently engage in monitoring their progress within the mastery system. Learners track their skill levels and observe performance indicators during learning activities, reflecting awareness of their learning progress.

From the researcher's observation, learners show stronger engagement when they are able to monitor their progress through mastery levels such as Familiar, Proficient, and Mastered. It is noted that visible progress indicators help sustain learners' attention and participation during learning activities. This pattern shows that proficiency tracking plays a central role in maintaining engagement, although the level of use varies across learners.

Supporting this observation, Ifenthaler and Yau (2020) emphasized that learning analytics and progress monitoring support learner engagement and self-regulated learning when consistently integrated into instruction. These findings reinforce the importance of proficiency tracking in learners' engagement.

In contrast, the variable Prerecorded Video Lesson Presentation obtained the lowest mean of 2.84 (SD = 0.84), interpreted as Practiced. This means that learners still engage with video lessons regularly, but at a lower level compared to other platform components. Video content is used as a supporting instructional resource rather than the primary mode of engagement.

The, learners tend to shift from video viewing to more interactive activities such as exercises and practice tasks. The researcher observed that video lessons are typically used for clarification, after which learners proceed to application-based activities. This pattern shows that video lessons support learning but are not the central component of learners' engagement.

These findings are supported by related studies. Fiorella and Mayer (2021) and Hew and Lo (2020) reported that video-based instruction becomes more effective when combined with guided practice, active engagement, and instructional support. These studies explain why video lessons function as supplementary tools rather than the main form of engagement during platform use.

Problem 2. What is the respondents' level of skills proficiency in Mathematics in terms of number sense, data analysis, and reasoning?

Table 7
Distribution of Respondents' Level of Skills Proficiency in Mathematics in terms of Number Sense

Level of Skills Proficiency in Mathematics in terms of Number Sense	**Frequency**	**Percentage**
Outstanding (90-100)	24	12.00
Very Satisfactory (85-89)	68	34.00
Satisfactory (80-84)	95	47.50
Fairly Satisfactory (75-79)	13	6.50
Did Not Meet Expectations (74 – below)	0	0.00
Total	**200**	**100.00**
Overall Mean	**82.48**	**Satisfactory**
SD	**4.80**	

Legend:
90 – 100 - Outstanding / Highly Proficient
85 – 89 - Very Satisfactory / Proficient
80 – 84 - Satisfactory / Approaching Proficiency
75 – 79 - Fairly Satisfactory / Developing
74 and below – Did Not Meet Expectation / Beginning

Table 7 shows an overall mean of 82.48 (SD = 4.80), described as Satisfactory and interpreted as Approaching Proficiency, indicating that learners demonstrate foundational number sense in number meanings, relationships, and routine computations in algebra, measurement, and geometry. Performance is generally procedural, with varying levels of conceptual understanding and flexibility. This aligns with Santos et al. (2022) and Can and Yetkin-Özdemir (2020), who found that learners may rely on rule-based strategies and experience difficulty applying number concepts beyond routine procedures.

The Satisfactory (80–84) range had the highest frequency, with 95 (47.50%) learners, indicating acceptable mastery of basic number concepts and computational skills, although more complex applications remain developing. This supports Cheung (2020) and Santos et al. (2022), who associated satisfactory performance with procedural-focused instruction.

The Fairly Satisfactory (75–79) range had 13 (6.50%) learners, described as Developing, indicating limited proficiency and difficulties with numerical relationships, operations, and multi-step tasks. Santos et al. (2022) and Can and Yetkin-Özdemir (2020) similarly identified limited numerical reasoning and reliance on procedures as factors contributing to difficulties in applying number concepts across contexts.

Table 8
Distribution of Respondents' Level of Skills Proficiency in Mathematics in terms of Data Analysis

Level of Skills Proficiency in Mathematics in terms of Data Analysis	Frequency	Percentage
Outstanding (90-100)	50	25.00
Very Satisfactory (85-89)	58	29.00
Satisfactory (80-84)	65	32.50
Fairly Satisfactory (75-79)	27	13.50
Did Not Meet Expectations (74 – below)	0	0.00
Total	**200**	**100.00**
Overall	**79.85**	**Fairly Satisfactory**
SD	**3.93**	

Legend:
90 – 100 - Outstanding / Highly Proficient
85 – 89 - Very Satisfactory / Proficient
80 – 84 - Satisfactory / Approaching Proficiency
75 – 79 - Fairly Satisfactory / Developing
74 and below – Did Not Meet Expectation / Beginning

Table 8 presents learners' Mathematics skills proficiency in data analysis, with an overall mean of 79.85 (SD = 3.93), described as Fairly Satisfactory and interpreted as Developing. This indicates that learners have emerging competence in organizing, interpreting, and analyzing data using basic statistical and probabilistic concepts. They can compute mean, median, and mode; determine range; interpret graphs; identify types of data; and solve simple probability problems. However, differences in performance show varying abilities in applying these concepts.

The researcher observed that learners generally perform routine and procedural tasks but differ in analytical thinking. Some demonstrate emerging conceptual understanding, while others rely on memorized procedures and guided examples. These findings agree with Delideli (2024), who reported emerging data analysis proficiency among learners receiving basic and guided statistical instruction, and Ncube (2025), who found difficulties in applying analytical and critical thinking to unfamiliar data-related problems.

The Fairly Satisfactory (75–79) category had the highest frequency, interpreted as Developing. This shows that many learners can perform routine statistical, graphical, and probability tasks but still struggle with more complex analysis and reasoning. The researcher observed that learners often rely on formulas and learned procedures, with difficulties in deeper interpretation and decision-making. Boadu and Boateng (2024) noted that procedural-focused instruction may limit conceptual and analytical development, while Mukuka (2024) emphasized that interactive and technology-supported instruction can strengthen mathematical understanding.

Learners in the lower-performing categories experience greater difficulty interpreting graphs, identifying relationships, and solving unfamiliar, multi-step problems. They depend heavily on guided examples and structured procedures, indicating gaps in foundational understanding and analytical reasoning. Selda and Galicia (2025) emphasized the importance of conceptual understanding in data-related mathematics tasks, while OECD (2023) highlighted that mathematical literacy requires analyzing, interpreting, and applying information meaningfully across contexts.

Table 9

Distribution of Respondents' Level of Skills Proficiency in Mathematics in terms of Reasoning

Level of Skills Proficiency in Mathematics in terms of Reasoning	Frequency	Percentage
Outstanding (90-100)	49	24.50
Very Satisfactory (85-89)	65	32.50
Satisfactory (80-84)	51	25.50
Fairly Satisfactory (75-79)	35	17.50
Did Not Meet Expectations (74 – below)	0	0.00

Total	**200**	**100.00**
Overall	**83.23**	**Satisfactory**
SD	**4.70**	

Legend:

90 – 100 - Outstanding / Highly Proficient
85 – 89 - Very Satisfactory / Proficient
80 – 84 - Satisfactory / Approaching Proficiency
75 – 79 - Fairly Satisfactory / Developing
74 and below – Did Not Meet Expectation / Beginning

Table 9 presents learners' Mathematics skills proficiency in **reasoning**, with an overall mean of **83.23 (SD = 4.70)**, described as **Satisfactory** and interpreted as **Approaching Proficiency**. This indicates that learners demonstrate a fair ability to apply logical thinking, recognize patterns, analyze mathematical relationships, interpret statements, and draw conclusions, particularly in familiar and structured tasks. However, learners differ in their ability to reason independently, with some relying on guided procedures.

These findings agree with Rittle-Johnson, Schneider, and Star (2020), who emphasized that clear instruction and guided practice support reasoning development. OECD (2023) likewise reported that learners approaching proficiency can apply reasoning in familiar contexts but may struggle with complex or unfamiliar tasks.

The **Very Satisfactory (85–89)** category had the highest frequency, with **65 (32.50%)** learners, interpreted as **Proficient**. This indicates that many learners can recognize patterns, analyze relationships, and draw logical conclusions with minimal guidance. Rittle-Johnson et al. (2020) and Boadu and Boateng (2024) similarly found that repeated guided reasoning activities strengthen analytical and logical thinking.

In contrast, **35 (17.50%)** learners were in the **Fairly Satisfactory (75–79)** category, interpreted as **Developing**. These learners experience difficulty analyzing relationships, identifying patterns independently, and making valid conclusions. The researcher observed that they often rely on guided examples, especially in tasks requiring deeper reasoning. Ncube (2025) emphasized the importance of continuous reasoning activities, while Selda and Galicia (2025) found that limited opportunities for independent mathematical reasoning contribute to developing-level performance.

Table 10
Summary Distribution of Respondents' Level of Skills Proficiency in Mathematics

Skills Proficiency in Mathematics	Mean	SD	Interpretation
Number Sense	82.48	4.80	Approaching Proficiency
Data Analysis	79.85	3.93	Developing

Reasoning	83.23	4.70	Approaching Proficiency
Overall	**81.85**	**4.48**	**Approaching Proficiency**

Legend:
90 – 100 - Outstanding / Highly Proficient
85 – 89 - Very Satisfactory / Proficient
80 – 84 - Satisfactory / Approaching Proficiency
75 – 79 - Fairly Satisfactory / Developing
74 and below – Did Not Meet Expectation / Beginning

Table 10 presents the summary distribution of respondents' level of skills proficiency in Mathematics, with an overall mean of 81.85 (SD = 4.48) interpreted as Approaching Proficiency. This means that learners are beginning to demonstrate the expected mathematical knowledge and skills. This implies that learners are beginning to demonstrate the mathematical knowledge and skills needed to perform grade-level tasks in number sense, data analysis, and reasoning. Learners are able to carry out expected mathematical processes with some consistency, although not yet at a fully proficient level. It shows that there are differences in learners' performance across the group.

The learners demonstrate varying levels of proficiency across the three domains. Some learners perform well in structured tasks where procedures are clearly presented, while others experience difficulty when tasks require independent analysis and application of mathematical concepts. These learners differ in how they understand and apply mathematical concepts, particularly in tasks that involve deeper reasoning.
Boaler (2022) noted that differences in performance often reflect unequal opportunities for meaningful learning experiences. In the Philippine context, the Organization for Economic Co-operation and Development (2023) reported that learners commonly fall within the satisfactory range, with variations influenced by instructional and contextual factors. Similarly, TIMSS and PIRLS International Study Center (2020) reported that learners at the approaching proficiency level often show moderate variability, indicating partial mastery rather than full understanding.

Among the domains, Reasoning obtained the highest mean score of 83.23 (SD = 4.70), interpreted as Approaching Proficiency. This means that learners demonstrate relatively stronger ability in applying logical thinking, identifying patterns, and analyzing mathematical relationships. This implies that the learners are more able to engage in tasks that involve logical analysis and interpretation compared to other domains.

From the researcher's observation, learners who are exposed to problem-solving activities tend to show greater confidence in reasoning tasks. They able to recognize patterns and arrive at conclusions when tasks are structured. However, some learners still rely on guided procedures, indicating that independent reasoning is still developing.

Supporting this observation, Boaler (2022) emphasized that reasoning develops through meaningful and engaging learning experiences. This supports the observed stronger performance in reasoning among learners.

In addition, Number sense obtained the second-highest mean score of 82.48 (SD = 4.80), also interpreted as Approaching Proficiency. This means that learners demonstrate a relatively strong understanding of numbers, operations, and basic quantitative relationships. Learners are able to perform computations and solve routine problems within structured tasks.

The learners' performance in number sense is supported by frequent exposure to computation-based activities in the classroom. The learners are able to solve equations, work with measurements, and perform operations, although some rely on memorized procedures rather than deeper conceptual understanding.

In contrast, Data Analysis obtained the lowest mean score of 79.85 (SD = 3.93), described as Fairly Satisfactory and interpreted as Developing. This means that learners experience more difficulty in interpreting data, analyzing graphs, and applying statistical concepts.

The learners show hesitation when interpreting graphs, comparing datasets, and explaining statistical information beyond direct computation. The researcher observed that learners perform better when tasks are presented in familiar formats and supported by guided examples.
Delideli (2024) noted that learners often struggle with data interpretation due to limited exposure to real-world contexts. In the Philippine setting, Selda and Galicia (2025) reported similar findings, where learners' data analysis skills remain at a developing level. These findings provide additional context for understanding the current level of learner performance in data analysis.

Problem 3. Is there a significant relationship between the respondents' level of practices on Khan Academy platform and their level of skills proficiency in Mathematics?

Table 11
Result of the Test of Relationships Between Respondents' Level of Practices on Khan Academy Platform and their Level of Skills Proficiency in Mathematics

Learners' Practices on Khan Academy Platform		Skills Proficiency in Mathematics			Overall
		Number Sense	Data Analysis	Reasoning	
Utilization	r – value	**0.41**	**0.38**	**0.44**	**0.41**
	p – value	**0.001**	**0.003**	**0.000**	**0.001**
		S	**S**	**S**	**S**
Accessibility	r – value	**0.36**	**0.33**	**0.39**	**0.36**
	p – value	**0.005**	**0.009**	**0.002**	**0.005**
		S	**S**	**S**	**S**

Prerecorded Video Lesson Presentation	r – value	**0.29**	**0.27**	**0.31**	**0.29**
	p – value	**0.018**	**0.025**	**0.012**	**0.018**
		S	**S**	**S**	**S**
Practice Exercises	r – value	**0.48**	**0.45**	**0.51**	**0.48**
	p – value	**0.000**	**0.000**	**0.000**	**0.000**
		S	**S**	**S**	**S**
Proficiency Tracking	r – value	**0.52**	**0.49**	**0.56**	**0.52**
	p – value	**0.000**	**0.000**	**0.000**	**0.000**
		S	**S**	**S**	**S**
Legend:	*Significant at $p < 0.05$ alpha level		S - significant	NS – not significant	

Table 11 presents the correlation between learners' Khan Academy platform practices and Mathematics skills proficiency in number sense, data analysis, and reasoning. All platform practices, namely utilization, accessibility, prerecorded video lesson presentation, practice exercises, and proficiency tracking, have statistically significant positive relationships with Mathematics proficiency, as all p-values are below the 0.05 significance level. Overall correlations were proficiency tracking ($r = 0.52$), practice exercises ($r = 0.48$), utilization ($r = 0.41$), accessibility ($r = 0.36$), and prerecorded video lesson presentation ($r = 0.29$). These results indicate that higher engagement in Khan Academy practices is associated with higher mathematical proficiency across all three skill domains.

The consistent positive relationships suggest that the platform's components function complementarily, supporting both foundational and higher-order mathematical skills. These findings are consistent with Attard and Holmes (2020), who found that digital Mathematics platforms enhance engagement and achievement when aligned with curriculum goals, and Mukuka (2024), who emphasized the benefits of technology-integrated instruction. Similarly, Aves, Dela Peña, et al. (2023) found that learner engagement, guided instruction, and structured learning significantly influence General Mathematics performance at PHINMA-Cagayan de Oro College.

Utilization showed significant relationships with number sense ($r = 0.41$), data analysis ($r = 0.38$), reasoning ($r = 0.44$), and an overall correlation of $r = 0.41$. This indicates that repeated engagement with mathematical content may strengthen familiarity, understanding, and learning routines. Schindler et al. (2020) and Bernardo, Ganotice, and King (2021) similarly associated consistent digital engagement with improved academic and mathematics outcomes.

Accessibility correlated significantly with number sense ($r = 0.36$), data analysis ($r = 0.33$), reasoning ($r = 0.39$), and overall proficiency ($r = 0.36$). Although necessary, accessibility had a lower correlation than other practices, suggesting that active engagement is more influential than mere availability. This supports Kuhfeld et al. (2020) and Martin and Borup (2022), who emphasized that access is more effective when accompanied by meaningful participation.

Prerecorded video lesson presentation showed significant relationships with number sense ($r = 0.29$), data analysis ($r = 0.27$), reasoning ($r = 0.31$), and overall proficiency ($r = 0.29$), the lowest among the indicators. This suggests that videos primarily provide instructional support and may be more effective when combined with practice and feedback. Mayer (2020) similarly explained that multimedia learning is most effective when learners engage in active processing.

Practice exercises demonstrated strong significant relationships with number sense (r = 0.48), data analysis (r = 0.45), reasoning (r = 0.51), and overall proficiency (r = 0.48). This indicates that repeated application and problem-solving may strengthen procedural skills and mathematical reasoning. Cheung and Slavin (2021) found that practice-oriented digital programs are associated with higher mathematics achievement, while Ncube (2025) reported that structured practice enhances reasoning and problem-solving.

Proficiency tracking showed the strongest relationships with number sense (r = 0.52), data analysis (r = 0.49), reasoning (r = 0.56), and overall proficiency (r = 0.52). This suggests that monitoring progress and mastery may help learners identify areas for improvement and adjust learning strategies. The findings are supported by Pane et al. (2020), Trust and Whalen (2021), Delideli (2024), and Selda and Galicia (2025), who associated mastery-based learning, adaptive systems, continuous assessment, and structured support with improved mathematical proficiency and higher-order thinking.

4. DISCUSSION

The findings for Problem 1 showed that respondents demonstrated a practiced level of engagement with Khan Academy in terms of utilization, accessibility, prerecorded video lesson presentation, practice exercises, and proficiency tracking. Learners regularly used the platform for watching instructional videos, answering exercises, reviewing lessons, accessing materials, and monitoring progress. Proficiency tracking obtained the highest mean, followed by utilization, accessibility, practice exercises, and prerecorded video lesson presentation. However, fewer learners explored additional lessons beyond assigned tasks or considered video explanations more effective than classroom instruction.

For Problem 2, respondents demonstrated an overall Mathematics skills proficiency level described as Approaching Proficiency. Learners showed developing knowledge and skills in number sense, data analysis, and reasoning, with reasoning obtaining the highest mean, followed by number sense, while data analysis obtained the lowest and was interpreted as Developing. Learners performed better in structured and familiar tasks involving logical thinking, computations, and guided problem-solving, but experienced greater difficulty interpreting data, analyzing graphs, and independently applying statistical concepts.

For Problem 3, a significant positive relationship was found between all Khan Academy practices and Mathematics skills proficiency, as all p-values were below the 0.05 significance level. Proficiency tracking had the highest overall correlation, followed by practice exercises, utilization, accessibility, and prerecorded video lesson presentation. Thus, learners who more frequently monitored their progress, completed exercises, used instructional videos, accessed platform activities, and engaged in mathematics tasks tended to demonstrate higher proficiency in number sense, data analysis, and reasoning.

Overall, the findings showed that learners regularly engaged with Khan Academy and demonstrated Approaching Proficiency in Mathematics. They performed better in structured and guided tasks, particularly in reasoning and number sense, but showed greater difficulty in data analysis requiring interpretation and independent analysis. The significant positive relationships further indicate that greater engagement with Khan Academy practices was associated with higher Mathematics skills proficiency.

5. CONCLUSION

The study found that among the five practices on the Khan Academy platform, proficiency tracking obtained the highest mean. Among the three domains of skills proficiency in Mathematics, reasoning obtained the highest mean, described as satisfactory and interpreted as approaching proficiency. The findings further revealed a significant positive relationship between learners' practices on Khan Academy platform and their skills proficiency in Mathematics. Therefore, the study concludes that higher engagement with the platform is associated with higher levels of skills proficiency in mathematics.

Recommendations

Based on the findings of the study, the following are hereby recommended:

1. School heads may improve the effectiveness of Khan Academy in mathematics by promoting its use as a supplementary tool alongside teacher-led instruction. They may encourage teachers to integrate Khan Academy resources with classroom discussions, guided activities, and assessments while providing additional support for learners in prerecorded video lessons, particularly in data analysis concepts. School heads may also support teacher training and regular monitoring of learners' progress through feedback and follow-up activities to enhance engagement and Mathematics achievement.

2. Teachers may improve the effectiveness of Khan Academy in mathematics instruction by using its features to support classroom teaching and monitor learners' progress. They may regularly utilize the Teacher Dashboard to identify learning difficulties, track skill mastery, and provide timely remediation and support. Teachers may also promote mastery-based learning and use Khan Academy as a supplementary tool integrated with teacher-led instruction, guided practice, feedback, and differentiated activities, particularly in data analysis concepts.

3. Learners may improve their mathematics performance through the proper and consistent use of Khan Academy as a supplementary learning tool. They may use video lessons for review and clarification, prioritize practice exercises and mastery activities, particularly in data analysis, and apply learned concepts to real-life situations. Learners may also regularly monitor their progress through the platform dashboard and actively engage in learning by reflecting on feedback, correcting mistakes, and strengthening their problem-solving skills.

4. Future researchers may further examine the effectiveness of Khan Academy in Mathematics instruction by exploring different instructional approaches, learner engagement behaviors, and Mathematics skills, particularly data analysis and problem-solving.

REFERENCES

1. Aguilera-Hermida, A. P. (2020). College students' use and acceptance of emergency online learning due to COVID-19. International Journal of Educational Research Open, 1, 100011. https://doi.org/10.1016/j.ijedro.2020.100011
2. Almaiah, M. A., Al-Khasawneh, A., & Althunibat, A. (2020). Exploring the critical challenges and factors influencing the e-learning system usage during COVID-19 pandemic. Education and Information Technologies, 25(6), 5261–5280. https://doi.org/10.1007/s10639-020-10219-y
3. Attard, C., & Holmes, K. (2020). An exploration of teacher and student perceptions of blended learning in four secondary mathematics classrooms. Mathematics Education Research Journal, 32(4), 719–740. https://doi.org/10.1007/s13394-020-00359-2
4. Aves, J. P., Dela Peña, M. J., & Associates. (2023). Factors affecting learners' performance in General Mathematics at PHINMA-Cagayan de Oro College. International Journal of Research and Innovation in Social Science, 7(5), 221–253. https://ideas.repec.org/a/bcp/journl/v7y2023i5p221-253.html
5. Bandura, A. (1986). Social foundations of thought and action: A social cognitive theory. Prentice-Hall.
6. Barana, A., Marchisio, M., & Sacchet, M. (2021). Advantages of using automatic formative assessment for learning mathematics. Education Sciences, 11(4), 180. https://doi.org/10.3390/educsci11040180
7. Bernardo, A. B. I., Ganotice, F. A., & King, R. B. (2021). Motivation and learning strategies of Filipino students in online learning environments. Asia Pacific Education Review, 22(4), 615–628. https://doi.org/10.1007/s12564-021-09685-3
8. Bergqvist, T., Lithner, J., Palm, T., & Häggström, J. (2024). Mathematical reasoning-relevant claims in classroom interaction. Educational Studies in Mathematics, 115(2), 245–263. https://doi.org/10.1007/s10649-023-10245-8
9. Boadu, S. K., & Boateng, F. O. (2024). Conceptual understanding and procedural performance in mathematics learning among secondary school students. International Electronic Journal of Mathematics Education, 19(1), em0765. https://doi.org/10.29333/iejme/13925
10. Boaler, J. (2022). Mathematical mindsets: Unleashing students' potential through creative mathematics, inspiring messages and innovative teaching (2nd ed.). Jossey-Bass.
11. Bond, M., Bedenlier, S., Marín, V. I., & Händel, M. (2021). Emergency remote teaching in higher education: Mapping the first global online semester. International Journal of Educational Technology in Higher Education, 18(1), 1–24. https://doi.org/10.1186/s41239-021-00282-x
12. Cababat, J. E., & Pespeñan, R. P. (2023). An assessment of the numerical and analytical skills of Grade 11 senior high school students. Psychology and Education: A Multidisciplinary Journal, 8, 61–67. https://doi.org/10.5281/zenodo.7808787
13. Cabuquin, D. A., & Abocejo, F. T. (2023). Mathematics performance and academic achievement among junior high school learners. International Journal of Research Publications, 124(1), 114–126. https://doi.org/10.47119/IJRP1001241520234906
14. Callaman, R. A., & Itaas, E. C. (2020). Students' mathematics achievement in Mindanao context: A meta-analysis. JRAMathEdu (Journal of Research and Advances in Mathematics Education), 5(2), 148–159. https://doi.org/10.23917/jramathedu.v5i2.10282

15. Can, D., & Yetkin-Özdemir, İ. E. (2020). The relationship between number sense and mathematics achievement: A meta-analysis. International Journal of Contemporary Educational Research, 7(1), 293–306. https://doi.org/10.33200/ijcer.656648
16. Cerrado, R. M., & Errabo, M. C. (2020). Khan Academy as intervention material in improving students' reading comprehension in solving mathematical word problems. International Journal of Scientific and Research Publications, 10(10), 392–398. https://doi.org/10.29322/IJSRP.10.10.2020.p10650
17. Cheung, A. C. K., & Slavin, R. E. (2021). The effectiveness of educational technology applications for enhancing mathematics achievement in K–12 classrooms: A meta-analysis. Educational Research Review, 34, 100404. https://doi.org/10.1016/j.edurev.2021.100404
18. Cheung, P. (2020). Procedural and conceptual approaches in mathematics learning and instruction. Mathematics Education Research Journal, 32(4), 567–584. https://doi.org/10.1007/s13394-019-00286-6
19. Cohen, L., Manion, L., & Morrison, K. (2021). Research methods in education (9th ed.). Routledge.
20. Delideli, J. (2024). Developing students' statistical reasoning and data analysis skills through guided mathematics instruction. International Journal of Mathematical Education in Science and Technology, 55(2), 310–325. https://doi.org/10.1080/0020739X.2023.2284517
21. Department of Education. (2015). DepEd Order No. 8, s. 2015: Policy guidelines on classroom assessment for the K to 12 Basic Education Program. Department of Education Philippines.
22. Department of Education. (2022). Basic education learning continuity plan and digital learning initiatives. https://www.deped.gov.ph
23. Department of Education. (2024). Implementation of Khan Academy in Philippine public schools. Department of Education Philippines.
24. Department of Education. (2025). Expansion of Khan Academy implementation in Philippine public schools. Department of Education Philippines.
25. Diri, M. E. (2023). Effect of Khan Academy instructional videos on students' academic achievement in mathematics in Bayelsa State. International Journal of Innovative Science and Research Technology, 8(7), 1880–1887.
26. Doo, M. Y., Bonk, C. J., & Heo, H. (2020). A meta-analysis of scaffolding effects in online learning in higher education. International Review of Research in Open and Distributed Learning, 21(3), 60–80. https://doi.org/10.19173/irrodl.v21i3.4638
27. Fiorella, L., & Mayer, R. E. (2021). Eight ways to promote generative learning from video lessons in STEM. Educational Psychology Review, 33(4), 1191–1219. https://doi.org/10.1007/s10648-021-09599-1
28. Guskey, T. R. (2021). Implementing mastery learning (3rd ed.). Wadsworth Cengage Learning.
29. Hew, K. F., & Lo, C. K. (2020). Flipped classroom improves student learning in health professions education: A meta-analysis. BMC Medical Education, 18(1), 38. https://doi.org/10.1186/s12909-018-1144-z
30. Igarashi, T., & Suryadarma, D. (2023). Foundational mathematics and reading skills of Filipino students over a generation. International Journal of Educational Development, 96, 102688. https://doi.org/10.1016/j.ijedudev.2022.102688

31. Ifenthaler, D., & Yau, J. Y.-K. (2020). Utilising learning analytics for study success: Reflections on current empirical findings. Research and Practice in Technology Enhanced Learning, 15(1), 1–17. https://doi.org/10.1186/s41039-020-00135-2
32. Jaramillo-Mediavilla, L., Basantes-Andrade, A., Cabezas-González, M., & Casillas-Martín, S. (2024). Impact of gamification on motivation and academic performance: A systematic review. Education Sciences, 14(6), 639. https://doi.org/10.3390/educsci14060639
33. Kadusale, M. N., Bucar, R. P., Ompad, J. L., & Bohol, L. C. (2024). Data analysis competence among Grade 12 students in quantitative research. Psychology and Education: A Multidisciplinary Journal, 18, 45–58. https://doi.org/10.5281/zenodo.10834567
34. Khan Academy. (2022). Teachers support mastery learning for addressing learning gaps. https://www.khanacademy.org
35. Khan Academy. (2023). Khan Academy annual report 2023. https://www.khanacademy.org
36. Khan Academy. (2024). 2023–2024 impact report. https://www.khanacademy.org
37. Khan Academy Philippines. (2023). Pilot implementation report on mathematics learning engagement in Philippine schools. Khan Academy Philippines.
38. Khan Academy Philippines. (2025). Khan Academy Philippines progress and engagement report. https://www.khanacademy.org
39. Khan Academy, & NWEA. (2021). MAP Accelerator efficacy study. NWEA Research Reports. https://www.nwea.org
40. Khor, E. T., & Mutthulakshmi, K. (2024). A systematic review of the role of learning analytics in supporting personalized learning. Education Sciences, 14(1), 51. https://doi.org/10.3390/educsci14010051
41. Koedinger, K. R., McLaughlin, E. A., & Kannan, S. (2022). Using mastery learning and MAP Accelerator to improve mathematics achievement. In Proceedings of the International Conference on Educational Data Mining (pp. 412–418).
42. Kuhfeld, M., Soland, J., Tarasawa, B., Johnson, A., Ruzek, E., & Liu, J. (2020). Projecting the potential impact of COVID-19 school closures on academic achievement. Educational Researcher, 49(8), 549–565. https://doi.org/10.3102/0013189X20965918
43. Lim, L., Wang, T., & Graham, S. (2021). Improving student engagement in online learning through analytics-informed instructional strategies. Education and Information Technologies, 26(5), 5485–5503. https://doi.org/10.1007/s10639-021-10525-3
44. Martin, F., & Borup, J. (2022). Online learner engagement: Conceptual definitions, research themes, and scholarly perspectives. Educational Technology Research and Development, 70(2), 643–665. https://doi.org/10.1007/s11423-022-10085-8
45. Martin, F., Sun, T., & Westine, C. D. (2020). A systematic review of research on online teaching and learning from 2009 to 2018. Computers & Education, 159, 104009. https://doi.org/10.1016/j.compedu.2020.104009
46. Mayer, R. E. (2020). Multimedia learning (3rd ed.). Cambridge University Press.
47. Mukuka, A. (2024). Technology-supported mathematics instruction and students' engagement in data interpretation tasks. Education and Information Technologies, 29(4), 5021–5040. https://doi.org/10.1007/s10639-023-12184-5

48. Mullis, I. V. S., Martin, M. O., Foy, P., Kelly, D. L., & Fishbein, B. (2020). TIMSS 2019 international results in mathematics and science. TIMSS & PIRLS International Study Center, Boston College. https://timssandpirls.bc.edu/timss2019/international-results/
49. Murphy, R., Gallagher, L., Krumm, A. E., Mislevy, J., & Hafter, A. (2021). Research on the use of Khan Academy in schools. SRI International. https://www.sri.com
50. Ncube, M. (2025). Concept-based instruction: Improving learner performance in mathematics through conceptual understanding and critical thinking. African Journal of Teacher Education. https://files.eric.ed.gov/fulltext/EJ1469567.pdf
51. Ncube, M. (2025). Learners' analytical thinking and challenges in mathematical problem-solving involving data interpretation. African Journal of Research in Mathematics, Science and Technology Education, 29(1), 44–57. https://doi.org/10.1080/18117295.2024.2456712
52. Ngu, B. H., & Phan, H. P. (2024). Mathematical proficiency, cognitive load, and comparative learning in mathematics education. Education Sciences, 14(2), 154. https://doi.org/10.3390/educsci14020154
53. Noves, J. R., & Palomares, R. E. (2024). Mathematical literacy and reasoning skills among Grade 10 learners. International Journal of Evaluation and Research in Education, 13(1), 233–242. https://doi.org/10.11591/ijere.v13i1.27144
54. Organisation for Economic Co-operation and Development. (2021). 21st-century readers: Developing literacy skills in a digital world. OECD Publishing. https://doi.org/10.1787/a83d84cb-en
55. Organisation for Economic Co-operation and Development. (2023). PISA 2022 results: What students know and can do. OECD Publishing. https://www.oecd.org/en/about/programmes/pisa.html
56. Organisation for Economic Co-operation and Development. (2023). PISA 2022 results (Volume I): The state of learning and equity in education. OECD Publishing. https://doi.org/10.1787/53f23881-en
57. Pane, J. F., Steiner, E. D., Baird, M. D., & Hamilton, L. S. (2020). Continued progress: Promising evidence on personalized learning. RAND Corporation. https://doi.org/10.7249/RR2042
58. Patil, R., & Juanico, M. (2024). The effectiveness of Khan Academy in teaching elementary mathematics. ResearchGate. https://www.researchgate.net/publication/384111931_The_Effectiveness_of_Khan_Academy_in_Teaching_Elementary_Math
59. PHINMA Cagayan de Oro College Researchers. (2022). The effects of teacher-made video lessons on students' academic performance in statistics and probability. Studocu. https://www.studocu.com/ph/document/cagayan-de-oro-college/research-in-mathematics/the-effects-of-teacher-made-video-lessons-on-students-academic-performance-in-statistics-and-probability/46366952
60. Republic Act No. 10533. (2013). Enhanced Basic Education Act of 2013. Official Gazette of the Republic of the Philippines. https://www.officialgazette.gov.ph
61. Rittle-Johnson, B., Schneider, M., & Star, J. R. (2020). Not a one-way street: Bidirectional relations between procedural and conceptual knowledge of mathematics. Educational Psychology Review, 32(1), 1–25. https://doi.org/10.1007/s10648-019-09509-x
62. Santos, R. A., Collantes, L. M., Ibañez, E. D., Ibarra, F. P., & Pentang, J. T. (2022). Innate mathematical characteristics and number sense competencies of junior high school students.

International Journal of Learning, Teaching and Educational Research, 21(10), 325–340. https://doi.org/10.26803/ijlter.21.10.18

63. Schindler, L. A., Burkholder, G. J., Morad, O. A., & Marsh, C. (2020). Computer-based technology and student engagement: A critical review of the literature. International Journal of Educational Technology in Higher Education, 14(1), 25. https://doi.org/10.1186/s41239-017-0063-0
64. Selda, G. D., & Galicia, R. B. (2025). Bridging gaps: Understanding the mathematical proficiency of fourth graders. Psychology and Education: A Multidisciplinary Journal, 39(8), 988–992. https://doi.org/10.70838/pemj.390801
65. Selda, G. D., & Galicia, R. B. (2025). Conceptual understanding and mathematical performance in data-related learning tasks among secondary learners. Journal of Mathematics and Science Education, 13(1), 88–102.
66. Silliman University. (2024). AI framework of Silliman University. Silliman University.
67. Squeakydolphin12. (2019, February 18). Political map of Misamis Oriental and Cagayan de Oro City, Philippines [Map]. Wikimedia Commons. https://upload.wikimedia.org/wikipedia/commons/thumb/1/1e/Ph_fil_misamis_oriental.png/1280px-Ph_fil_misamis_oriental.png
68. Trust, T., & Whalen, J. (2021). Should teachers be trained in emergency remote teaching? Lessons learned from the COVID-19 pandemic. Journal of Technology and Teacher Education, 29(2), 189–199.
69. Ulum, Ö. G. (2023). Digital learning tools and learner engagement in mathematics education. Education and Information Technologies, 28(5), 5421–5440. https://doi.org/10.1007/s10639-022-11364-5
70. van Merriënboer, J. J. G., & Kirschner, P. A. (2020). Ten steps to complex learning: A systematic approach to four-component instructional design (3rd ed.). Routledge. https://doi.org/10.4324/9780429285293
71. Vidergor, H. E., & Ben-Amram, P. (2020). Khan Academy effectiveness: The case of math secondary students' perceptions. Computers & Education, 157, 103985. https://doi.org/10.1016/j.compedu.2020.103985
72. Weatherholtz, K., Harris, B., & Burns, C. (2020). Student engagement and digital formative assessment in online mathematics learning. Journal of Educational Technology Systems, 49(2), 215–233.
73. WestEd. (2021). Evaluation of Khan Academy in middle school mathematics classrooms. WestEd Research Report. https://www.wested.org
74. WestEd. (2021). Teachers' and students' perceptions of Khan Academy in mathematics instruction. WestEd Research Publications.