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# Integrating Khan Academy as Video-Based Instruction: A Pre Experimental Action Research on Grade 7 Learners' Achievement and Engagement

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**ABSTRACT**

**Purpose of the study:** This action research examined whether integrating Khan Academy video lessons into Grade 7 mathematics classes would improve learners' achievement and engagement levels, and documented students' perceptions of the videos after a two-week classroom intervention.

**Methodology:** A pre-experimental one-group pretest–posttest design was employed. Research instruments included a researcher-made 30-item Mathematics achievement test validated by three in-service teachers (reliability = 0.7742), a Mathematics Engagement Level Questionnaire using a 5-point Likert scale (Cronbach's α = 0.857), and purposively selected Khan Academy video lessons. Data were analyzed using the Wilcoxon Signed-Rank Test, Spearman's rho, and thematic analysis.

**Main Findings:** Post-intervention achievement increased significantly, rising from a mean of 10.42 to 17.62, although most learners remained at the "Beginning" level. Engagement levels also improved after the intervention. The relationship between post-intervention achievement and engagement was weak and not statistically significant. Learners reported clearer understanding, increased enjoyment, and greater motivation, alongside some issues related to audio clarity and retention.

**Novelty/Originality of this study:** This study contributes to educational research by demonstrating how short, teacher-guided integration of video-based instruction can simultaneously influence mathematics achievement and multidimensional learner engagement in secondary classrooms. By combining validated pre–post quantitative measures with learners' thematic feedback, the study extends existing evidence on video-based learning by identifying both instructional benefits and implementation constraints (e.g., audio clarity, retention), thereby informing more effective and context-sensitive blending of video resources in mathematics instruction.



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## 1. INTRODUCTION

Maintaining learner engagement and improving learning outcomes in mathematics remains a persistent challenge for educators. While technology has introduced new instructional possibilities, traditional approaches often fail to sustain learners' attention or enhance their conceptual understanding. Studies have explored the integration of technology into classroom instruction; however, effective learning outcomes depend not only on digital tools but also on factors such as teacher support, preparedness, and school infrastructure. For instance, Rodríguez-Muñiz et al., [1] found that teachers generally rated themselves at an intermediate level of digital teaching competence, indicating the need to integrate technology-rich resources with established instructional practices to effectively support student learning.

Despite ongoing adoption of ICT in mathematics education [2]-[4], mere access to digital tools does not ensure improvements in learner engagement or achievement, particularly in areas such as algebra that require strong conceptual understanding. In Grade 7 mathematics, patterns and algebra constitute critical learning competencies, yet learners often demonstrate weak algebraic skills that hinder their performance in subsequent topics [5]. Traditional instructional methods frequently fail to accommodate diverse learning needs, contributing to low engagement and suboptimal achievement in mathematics.

Online learning platforms, such as Khan Academy, have been integrated to address these challenges. Its instructional videos, exercises, and assessments can promote active and meaningful learning experiences [6]. Evidence from Chilean classrooms shows that Khan Academy can increase learner engagement and motivation, altering the way students interact with mathematical content and their teachers [7]. Similarly, learners report that the self-paced nature of the platform facilitates understanding and helps fill instructional gaps in rural or resource-limited contexts [8], [9]. Moreover, computer-based algebra programs have been shown to improve mathematics achievement and learning outcomes [10], [11].

However, there remains a notable gap in localized empirical evidence examining the effects of Khan Academy video lessons on both engagement and achievement using simple classroom-based experimental designs. Most existing research is conducted in large-scale, technology-rich contexts, leaving limited insight into how short, teacher-guided video interventions function in typical face-to-face mathematics classrooms. This gap underscores the urgency of investigating the practical impact of video-based instruction, particularly in local settings where resources and instructional time are constrained. Understanding how such interventions influence both engagement and learning outcomes is essential for providing actionable guidance to educators seeking to improve mathematics instruction.

The present study addresses this need by combining quantitative measures of learner achievement and engagement with qualitative insights drawn from learners' experiences. Its novelty lies in applying Khan Academy video lessons within a localized, teacher-guided classroom context, providing empirical evidence on both the engagement and achievement effects of video-assisted instruction in Grade 7 mathematics.

Thus, this research focuses on integrating Khan Academy video lessons as an instructional aid for teaching second-quarter competencies in patterns and algebra. Specifically, it aims to determine the effects of video-assisted instruction on learners' achievement and engagement, contributing localized empirical evidence to the growing body of research on video-based mathematics instruction.

## 2. RESEARCH METHOD

### 2.1. Research Design

This study adopted a pre-experimental design, specifically a one-group pretest–posttest design. In this design, the same group of learners was exposed to the intervention (Khan Academy video lessons), and their achievement and engagement levels were measured before and after the intervention. This method allows for comparison of learner performance and engagement within the same group to determine changes following the intervention. However, since no control group was used, the study focused on internal changes among the participants over time, and causal conclusions should be interpreted with caution.

The participants of this study were Grade 7 learners from Iligan Capitol College, with a sample size of 21 learners. The learners were selected through purposive sampling, ensuring that they met the criteria for participation in terms of prior grade level and readiness to use Khan Academy as a learning tool. While this approach supported feasibility, it may also limit generalizability and introduce selection bias.

### 2.2. Research Instruments

The following research instruments were utilized.

#### 2.2.1. Achievement Test

A researcher-made 30-item Mathematics achievement test, with a reliability value of 0.7742 and supported by a table of specifications, was used to assess learners' understanding of the topics taught using Khan Academy video lessons. The test consisted of multiple-choice questions aligned with the subject curriculum. It was validated by three in-service teachers to ensure content validity and underwent pilot testing to refine the test items used in the study.

#### 2.2.2. Engagement Level Survey Questionnaire

To assess learners' engagement, a 5-point Likert-scale Engagement Level Survey was used, adapted from Barana and Marchisio [12]. The instrument measured three domains of engagement: cognitive, affective, and psychomotor. The questionnaire was pilot tested, and reliability analysis using Cronbach's alpha yielded a value of 0.857.

**2.2.3. Khan Academy Video Lessons**

In this study, the researcher utilized a ready-made video lesson from Khan Academy's YouTube account. The videos have been purposively selected from a pre-determined learning competencies where learners find it challenging. These video lessons were utilized as a supplemental during the regular class to aide and to support the teacher. Moreover, these videos were face validated by the in-service teacher.

## 2.3. Intervention

The study was conducted in three phases: pre-intervention, intervention, and post-intervention. During the pre-intervention phase, ethical approval was secured, and assent and parental consent were obtained. Learners were oriented on the use of Khan Academy, after which a pretest on Mathematics achievement and a pre-intervention Engagement Level Survey were administered to establish baseline data.

The intervention phase lasted two weeks, during which Khan Academy video lessons were integrated into regular Grade 7 Mathematics classes as a teacher-guided supplemental instructional tool. The lessons were aligned with the DepEd MATATAG curriculum and incorporated into class discussions. The researcher monitored the sessions and provided prompts to support learner engagement.

In the post-intervention phase, the same achievement test and Engagement Level Survey were administered to determine changes in learners' achievement and engagement following the intervention. Given the one-group pretest–posttest design, threats to internal validity such as testing effects, maturation, and researcher involvement may have influenced the results. These potential sources of bias were considered in the interpretation of the findings.

## 2.4. Data Analysis

Table 1. Achievement Test Score Summary

| Achievement Test Score | Percentage | Achievement Level Interpretation |
|---|---|---|
| 26.8-30.0 | 90% and above | (A) Advance |
| 25.5-26.7 | 85%-89% | (P) Proficient |
| 23.8-25.4 | 80%-84% | (AP) Approaching Proficient |
| 22.5-23.7 | 75%-79% | (D) Developing |
| Below 22.4 | 74% and below | (B) Beginning |

*Source: https://www.ciit.edu.ph/k-to-12-grading-system/

Table 1 provides a clear rubric for interpreting student achievement based on test scores, which is vital for assessing and categorizing their performance levels. It aligns the numerical scores with corresponding percentages and qualitative achievement levels, making it a practical tool for evaluation in both research and instructional settings. This table can be utilized by the researcher to analyze learners' performance, evaluate the instructional effectiveness of the intervention, and monitor progress.

Table 2. Engagement Level Scoring

| Engagement Score | Interpretation |
|---|---|
| 133-165 | Strongly Engaged |
| 100-132 | Engaged |
| 67-99 | Moderately Engaged |
| 34-66 | Not Engaged |
| 1-33 | Strongly Not Engaged |

Adapted from Barana and Marchisio [13]

Table 2 presents the Engagement Level Scoring Framework adapted from Barana and Marchisio [13]. Cumulative engagement scores were calculated by summing learners' responses to the Engagement Level Survey and categorized as Strongly Engaged (133–165), Engaged (100–132), Moderately Engaged (67–99), Not Engaged (34–66), and Strongly Not Engaged (1–33). These categories reflect learners' overall involvement, motivation, and participation in learning activities. Using this framework allows identification of engagement patterns, providing insights for improving instructional strategies and fostering a supportive learning environment.

### 2.5. Statistical Tools

The following statistical analyses were used to address the research objectives:

#### 2.5.1. Wilcoxon Signed-Rank Test

After determining that the data were not normally distributed, the Wilcoxon Signed-Rank Test was used for Objectives 1 and 2 to compare learners' achievement and engagement levels before and after the intervention. Since the scores were measured at two time points for the same individuals, this test is suitable for ordinal or interval data.

#### 2.5.2. Spearman Rho Test

Spearman's rho was used to determine the relationship between learners' engagement levels (from the Likert-scale Engagement Level Survey) and achievement scores, both pre- and post-intervention. It also helped identify patterns of improvement and consistency between pretest and posttest scores.

#### 2.5.3. Thematic Analysis for Learner Insights

To understand learners' perceptions of Khan Academy video lessons, thematic analysis was applied to categorize open-ended responses into themes. This qualitative method allowed interpretation of learners' thoughts, feelings, and attitudes, which could not be captured by quantitative measures.

#### 2.5.4. Mean and Standard Deviation

Used to calculate average academic achievement scores and summarize the distribution of responses in the Engagement Level Survey.

### 2.6. Coding of Data

Qualitative responses were coded using participant identification numbers (e.g., R1 = Respondent 1) for systematic presentation and analysis.

## 3. RESULTS AND DISCUSSION

### 3.1. Determine the achievement and engagement levels of learners before and after to the intervention.

Table 3. Learners Achievement Levels Before and After the Intervention

| Phase | N | Mean Score | Standard Deviation | Achievement Level |
|---|---|---|---|---|
| Before Intervention (Pretest) | 21 | 10.42 | 3.07 | Beginning |
| After Intervention (Posttest) | 21 | 17.62 | 4.92 | Beginning |

Table 3 presents the learners' achievement levels before and after the intervention. The mean score increased from 10.42 during the pretest to 17.62 in the posttest, indicating notable academic improvement among the learners after exposure to the intervention. Despite this progress, the learners' achievement levels remained within the "Beginning" category, suggesting that a short-term, one-group intervention alone may be insufficient to advance learners to higher proficiency levels. This underscores the methodological limitation of the one-group pretest–posttest design, which does not control for external factors and may affect internal validity.

The observed improvement aligns with prior research Froiland and Worrell [14] emphasizing that sustained, multifaceted instructional approaches are necessary to achieve significant academic gains. Meta-analytic evidence also suggests that technology-supported mathematics instruction yields moderate, positive effects on K–12 learners' achievement [15]. The variability in posttest scores (SD = 4.92) further highlights individual differences, indicating the need for personalized or scaffolded support to maximize learning outcomes. Pedagogically, these findings suggest that integrating Khan Academy video lessons can be effective as a supplemental tool but should be combined with additional instructional strategies to achieve meaningful proficiency gains [16].

Table 4. Learners Engagement Levels Before and After the Intervention

| Learner | Pretest Score | Engagement Level | Posttest Score | Engagement Level |
|---|---|---|---|---|
| L1 | 101 | Engaged | 126 | Engaged |
| L2 | 119 | Engaged | 148 | Strongly Engaged |
| L3 | 134 | Strongly Engaged | 131 | Engaged |
| L4 | 120 | Engaged | 113 | Engaged |
| L5 | 89 | Somewhat Engaged | 89 | Moderately Engaged |
| L6 | 112 | Engaged | 121 | Engaged |
| L7 | 100 | Engaged | 103 | Engaged |

| | | | | |
|---|---|---|---|---|
| L8 | 112 | Engaged | 147 | Strongly Engaged |
| L9 | 88 | Somewhat Engaged | 94 | Moderately Engaged |
| L10 | 114 | Engaged | 110 | Engaged |
| L11 | 102 | Engaged | 101 | Engaged |
| L12 | 103 | Engaged | 126 | Strongly Engaged |
| L13 | 120 | Engaged | 81 | Poorly Engaged |
| L14 | 101 | Engaged | 115 | Engaged |
| L15 | 98 | Moderately Engaged | 107 | Engaged |
| L16 | 80 | Moderately Engaged | 114 | Engaged |
| L17 | 86 | Moderately Engaged | 109 | Engaged |
| L18 | 95 | Moderately Engaged | 115 | Engaged |
| L19 | 108 | Engaged | 120 | Engaged |
| L20 | 87 | Moderately Engaged | 71 | Poorly Engaged |
| L21 | 106 | Engaged | 128 | Engaged |

Table 4 highlights the learners' engagement levels before and after the intervention, showing mixed results. Some learners, such as L2 and L8, improved from "Engaged" to "Strongly Engaged," indicating the potential of Khan Academy video lessons to enhance participation, as supported by Alrabai [17]. Likewise, technology-supported learning environments have been shown to improve behavioral and emotional engagement when effectively integrated into instruction. For instance, Martin and Bolliger [18] found that digital platforms promote engagement through self-paced and interactive learning, while Schindler et al., [19] emphasized their role in sustaining learner motivation in mathematics classrooms.

However, other learners, such as L13 and L20, showed decreased engagement, with one categorized as "Poorly Engaged." This suggests that the intervention may not equally address all learners' needs. Similar variability has been reported in digital learning contexts, where engagement depends on how well instructional approaches support autonomy, competence, and relatedness [20].

These findings imply that while digital tools offer benefits, they should be complemented by strategies that address individual learning differences. As engagement is multidimensional—encompassing behavioral, emotional, and cognitive aspects [21]—a combination of digital resources, teacher guidance, and collaborative activities is necessary. This is supported by Mercer and Howe [22], which highlights the importance of teacher facilitation and scaffolding in maximizing the effectiveness of technology-enhanced learning, particularly in mathematics education.

### 3.2 Significant Difference between the pre-test and posttest achievement level.

Table 5. Significant Difference between the pre-test and posttest achievement level

| Statistic | Pretest | Posttest | Z-value | p-value |
|---|---|---|---|---|
| Median | 9 | 15 | -4.025 | 0.0001 |
| Mean Rank | 11 | 0.00 | | |
| Sum of Ranks | 231 | 0.00 | | |

The analysis of the pretest and posttest achievement levels revealed a statistically significant difference in learners' academic performance following the intervention. The median score increased from 9 in the pretest to 15 in the posttest, with a Z-value of -4.025 and a p-value of 0.0001, indicating a highly significant improvement. This result aligns with the findings of studies that emphasize the positive impact of targeted instructional strategies on student performance. For example, Zhang et al., [23] demonstrated that interventions involving tailored pedagogical approaches significantly improve learners' understanding of complex concepts in mathematics. Likewise, evidence from mathematics intervention research shows that explicit, systematic, and well-implemented targeted instruction produces meaningful gains in students' mathematics outcomes, especially when the intervention is aligned to curricular goals [24]. For instance, Roschelle et al., [25] reported that structured digital learning environments significantly enhance students' mathematical achievement by allowing individualized pacing and immediate feedback, while Kirschner and Sweller [26] emphasized that adaptive instructional approaches improve learning outcomes by addressing learners' varying levels of prior knowledge and skill development.

The intervention's success can be attributed to its structured approach, potentially incorporating elements like scaffolding and differentiated instruction to address individual learning needs. Similar findings were reported by Mahuro and Hungi [27] who found that participatory teaching methods enhance student engagement and achievement by fostering active involvement in learning. The large effect size in this study underscores the importance of employing research-based instructional practices to drive meaningful learning outcomes, particularly in areas like mathematics where foundational knowledge is critical for future success. This is further supported by Hattie [28], who highlighted that the integration of technology with teacher-guided instruction leads to more significant and sustained improvements in mathematics performance, particularly when learners receive continuous feedback and support.

### 3.3 Significant Difference between the pretest and posttest engagement level.

Table 6. Significant Difference between the pretest and posttest engagement level.

| Statistic | Pretest | Posttest | Z-value | p-value |
|---|---|---|---|---|
| Median | 102 | 114 | -2.259 | 0.022 |
| Mean Rank | 11.82 | 7.42 | | |
| Sum of Ranks | 165.50 | 44.50 | | |

The data showing a significant difference between pretest and posttest engagement levels, with a Z-value of -2.259 and a p-value of 0.022, indicates that the intervention positively impacted learner engagement. The pretest median score of 102 compared to the posttest median of 114 signifies an improvement in engagement levels. These findings align with studies such as Reyes et al. [29], who demonstrated that interventions targeting student interaction and motivation significantly enhance engagement and participation in learning activities. Moreover, such improvements are critical for fostering active learning environments, which directly contribute to academic success. This is also consistent with research on Khan Academy use in secondary mathematics, where students reported higher engagement, self-regulation, and active participation when lessons were delivered through the platform [30]. Recent empirical studies further support these findings, indicating that technology-enhanced learning environments can significantly improve students' behavioral and emotional engagement through interactive and self-paced learning experiences [31]. Additionally, structured integration of digital tools has been shown to strengthen learner motivation and participation, particularly when aligned with clear instructional goals [32].

The observed changes in mean rank and sum of ranks further supports the effectiveness of the intervention. Engagement metrics are crucial because, as supported by Fredericks et al. [33] higher engagement correlates with better cognitive and behavioral outcomes among learners. Engagement-focused strategies, such as incorporating interactive and technology-aided tools, promote greater student involvement, especially in complex subjects like mathematics. This positive shift in engagement post-intervention underscores the importance of employing innovative teaching strategies to maximize learner participation and overall academic outcomes. This is further supported by recent research emphasizing that teacher-guided use of technology significantly enhances sustained engagement and learning experiences in mathematics classrooms [34].

### 3.4 Significant relationship between the achievement and engagement levels of learners after the intervention.

Table 7. Significant relationship between the achievement and engagement levels of learners prior and after to the intervention.

| Spearman's rho | | | Achievement Posttest | Engagement Posttest |
|---|---|---|---|---|
| | Achievement Posttest | Correlation Coefficient | 1.000 | .306 |
| | | Sig. (2-tailed) | . | .178 |
| | | N | 21 | 21 |
| | Engagement Posttest | Correlation Coefficient | .306 | 1.000 |
| | | Sig. (2-tailed) | .178 | . |
| | | N | 21 | 21 |

*Correlation is significant at the 0.05 level (2-tailed)

The Spearman's rho results indicate a weak positive correlation ($\rho = 0.306$) between post-test engagement and achievement levels of learners, though this relationship is not statistically significant ($p = 0.178$). While the correlation suggests a tendency for learners with higher engagement to achieve better academic outcomes, the absence of significance implies other factors may mediate this relationship. Studies have shown that student engagement, particularly behavioral and emotional aspects, is often associated with academic success, but the degree of impact varies across contexts. For example, Lei et al. [35] conducted a meta-analysis and found a moderate positive relationship between engagement and achievement, reinforcing the idea that engagement is a key driver of learning outcomes but may not always yield consistent statistical significance depending on sample size and intervention type. Further support comes from large-scale international evidence showing that engagement relates positively to mathematics achievement, but this link is substantially shaped by teacher classroom practices (e.g., structure, support, and challenge), helping explain why engagement–achievement correlations can appear weak in some short-term or small-sample interventions [36]. Additionally, recent research suggests that cognitive engagement, such as the use of deep learning strategies and self-regulation, plays a crucial role in strengthening the engagement–achievement relationship, particularly in mathematics contexts [37].

The lack of significance in this study aligns with findings by Wang and Eccles [38], who highlighted that engagement's impact on achievement often depends on the quality of instructional methods and the nature of the learning environment. The present study's intervention may have influenced learners' engagement positively, as shown by post-test scores; however, the short duration or limited scope might explain why this did not translate into a stronger or more significant correlation with achievement. Future research could explore longitudinal impacts or include a larger sample size to examine the long-term effects of engagement on academic outcomes more comprehensively.

### 3.5 Draw the insights of the learners on the use of Khan Academy Video Lessons.

Table 8. Insights drawn of the learners on the use of Khan Academy Video Lessons

| Emerging Themes | Codes | Sample Responses | Related Studies |
|---|---|---|---|
| Enhanced Understanding and Comprehension | *Clear Explanation*<br>*Simplified and Efficient Learning*<br>*Comprehensive Understanding* | "After all the videos played, it made me very easy to understand" (R1).<br>"I understand many things about Math. It was a very nice video lesson that I understand a lot" (R3).<br>"I analyzed the topic and learned the lessons faster" (R8).<br>"I understand and learn all the topics because of Khan Academy video lessons" (R21). | [6], [8], [24], [11] |
| Engagement and Enjoyment in Learning | *Interest in Lessons*<br>*Excitement in Learning*<br>*Faster Understanding through Videos*<br>*Love for Mathe* | "The lessons are very interesting, making me learn stuff I didn't know... It is super cool" (R2).<br>"It made everything more fun and interesting" (R12).<br>"Watching the videos helps me understand faster" (R16).<br>"Khan Academy made me love the subject Math" (R20). | [7], [29], [17], [19] |
| Challenges with Retention and Delivery | *Audio Clarity issues*<br>*Retention Difficulty*<br>*Unconvincing Delivery* | "Sometimes I cannot hear what it says from the TV" (R4).<br>"As soon as our discussion ends, I easily forget the topics" (R16).<br>"The deep voice wasn't very convincing and understandable" (R11). | [30], [2], [4] |
| Increased Engagement and Shift in Perception of Math | *Problem Solving skills*<br>*Increased interest in Math*<br>*Active Participation* | "It teaches me to solve many problems" (R5).<br>"I like Math more now" (R12).<br>"It was a very good way of teaching. I became more active in Math because of the videos" (R15). | [6], [8], [9], [26] |
| Appreciation of Teaching Methodology | *Teacher Gratitude*<br>*Valuing Video Lessons* | "Thank you, Sir Eric, for your skills that you teach to us" (R4). | [17], [18], [7] |

| | | |
|---|---|---|
| | *Positive feedback* | "I learned a lot from every video, and I will study more in Math" (R12). |
| | | "I love Khan Academy" (R14). |

Many respondents highlighted how the videos improved their understanding of mathematics concepts. This theme captures how learners perceive video-based learning as beneficial for grasping difficult topics. Studies consistently show that video-based educational tools like Khan Academy significantly enhance learners' understanding and comprehension of challenging subjects like mathematics. For instance, Murphy et al. [8] highlighted improvements in test scores and conceptual clarity through the use of Khan Academy's interactive videos.

Engagement and enjoyment in learning also increase significantly with the integration of video tools. Light and Pierson [7] noted that learners in Chilean classrooms found mathematics more interesting and accessible when using Khan Academy videos, while Rueda-Gómez et al. [39] demonstrated that multimedia tools stimulate sustained engagement through interactive and varied content. Such innovations help combat traditional challenges with learner motivation, offering dynamic and captivating teaching methods that shift learners' perceptions of complex subjects.

Nevertheless, challenges with retention and delivery persist in some contexts, though tools like Khan Academy have shown potential to mitigate these barriers. Libraries Without Borders [40] found that students in under-resourced settings benefited from video-based reinforcement strategies that addressed retention difficulties through clear, repeatable explanations. Furthermore, research by Murphy et al. [8] identified reductions in math anxiety, improving learners' confidence and overall academic self-efficacy. Together, these studies underscore the transformative role of video-enhanced learning in addressing retention difficulties while fostering positive perceptions of subjects like mathematics.

The thematic analysis reveals a generally positive response to Khan Academy videos, with enhanced understanding and engagement standing out as key benefits. However, challenges with retention and delivery indicate areas for improvement, such as addressing audio clarity and integrating techniques for long-term retention. The findings highlight the potential of video-based learning in fostering motivation and enjoyment in mathematics education, supporting its implementation in blended learning environments.

## 4. CONCLUSION

This study showed how Khan Academy video lessons can help learners improve their math skills, especially in challenging topics like algebra. Many students made noticeable progress after using the platform, which proves its ability to simplify and explain complex ideas. However, while some showed great improvement, most remained at a beginning level, suggesting these tools work best when paired with extra support, like guided practice and personalized teaching.

The videos also boosted interest and engagement for many learners, with some saying it made math fun for the first time. However, not all students had the same experience—some struggled to remember the lessons or felt that features like audio quality could be better. This highlights the need for digital tools to be more adaptable and accessible so they can meet the needs of all students.

Overall, the study confirmed that tools like Khan Academy can improve learning and engagement but are most effective when used alongside teacher support. Teachers play a crucial role in guiding and supporting learners, addressing gaps that technology alone cannot fill. By combining the strengths of digital platforms with teacher-led instruction, educators can create more inclusive and effective learning experiences.

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## REFERENCES

[1] L. J. Rodríguez-Muñiz, D. Burón, Á. Aguilar-González, and L. Muñiz-Rodríguez, "Secondary mathematics teachers' perception of their readiness for emergency remote teaching during the COVID-19 pandemic: A case study," *Education Sciences*, vol. 11, no. 5, p. 228, 2021, doi: 10.3390/educsci11050228.

[2] K. Roth, Technology in Education: The Ongoing Debate of Access, Adequacy and Equity. 2020.

[3] M. Cabrol and E. Severin, "ICT to improve quality in education—A conceptual framework and indicators in the use of information communication technology for education (ICT4E)," in Assessing the Effects of ICT in Education: Indicators, Criteria and Benchmarks for International Comparisons, Paris, France: OECD, 2010, p. 83.

[4] C. Dziuban, C. R. Graham, P. D. Moskal, A. Norberg, and N. Sicilia, "Blended learning: the new normal and emerging technologies," Int. J. Educ. Technol. Higher Educ., vol. 15, pp. 1–16, 2018, doi: 10.1186/s41239-017-0087-5.

[5] V. Moodley, "An investigation of learners' performance in algebra from grades 9 to 11," Ph.D. dissertation, Univ. of KwaZulu-Natal, Durban, South Africa, 2014.

[6] H. E. Vidergor and P. Ben-Amram, "Khan Academy effectiveness: The case of math secondary students' perceptions," Comput. Educ., vol. 157, Art. no. 103985, 2020, doi: 10.1016/j.compedu.2020.103985.

[7] D. Light and E. Pierson, "Increasing student engagement in math: The use of Khan Academy in Chilean classrooms," Int. J. Educ. Develop. ICT, vol. 10, no. 2, pp. 103–119, 2014.

[8] R. Murphy, L. Gallagher, A. E. Krumm, J. Mislevy, and A. Hafter, Research on the Use of Khan Academy in Schools: Implementation Report. Menlo Park, CA, USA: SRI Int., 2014.

[9] H. L. Harmon, "Innovating a promising practice in high poverty rural school districts," Rural Educ., vol. 41, no. 3, pp. 26–42, 2021.

[10] R. F. Kizilcec and G. L. Cohen, "Eight-minute self-regulation intervention raises educational attainment at scale in individualist but not collectivist cultures," Proc. Natl. Acad. Sci. U.S.A., vol. 114, no. 17, pp. 4348–4353, 2017.

[11] J. F. Pane, B. A. Griffin, D. F. McCaffrey, and R. Karam, "Effectiveness of cognitive tutor algebra I at scale," Educ. Eval. Policy Anal., vol. 36, no. 2, pp. 127–144, 2014, doi: 10.3102/0162373713507480.

[12] A. Barana and M. Marchisio, "An interactive learning environment to empower engagement in mathematics," 2020.

[13] M. Alonazi, N. Beloff, and M. White, "Exploring determinants of m-government services: A study from the citizens' perspective in Saudi Arabia," in Proc. 2019 Federated Conf. Comput. Sci. Inf. Syst. (FedCSIS), 2019.

[14] J. M. Froiland and F. C. Worrell, "Intrinsic motivation, learning goals, engagement, and achievement in a diverse high school," Psychol. Sch., vol. 53, no. 3, pp. 321–336, 2016, doi: 10.1002/pits.21901.

[15] H. Ran, Y. Kim, and W. G. Secada, "A meta-analysis on the effects of technology's functions and roles on students' mathematics achievement in K–12 classrooms," *Journal of Computer Assisted Learning*, 2021, doi: 10.1111/jcal.12611.

[16] D. A. Kulik, T. Wagner, S. V. Dmytrieva, G. Kosakowski, F. F. Hingerl, K. V. Chudnenko, and U. R. Berner, "GEM-Selektor geochemical modeling package: revised algorithm and GEMS3K numerical kernel for coupled simulation codes," Comput. Geosci., vol. 17, pp. 1–24, 2013.

[17] F. Alrabai, "The effects of teachers' in-class motivational intervention on learners' EFL achievement," Appl. Linguist., vol. 37, no. 3, pp. 307–333, 2016, doi: 10.1093/applin/amu021.

[18] F. D. Martin and D. U. Bolliger, "Engagement matters: Student perceptions on the importance of engagement strategies in the online learning environment," Online Learning Journal, vol. 22, no. 1, pp. 205–222, 2018.

[19] R. Schindler, L. Burkholder, M. Morad, and C. Marsh, "Computer-based technology and student engagement: A critical review of the literature," International Journal of Educational Technology in Higher Education, vol. 14, no. 25, 2017.

[20] J. A. Fredricks, A. L. Reschly, and S. L. Christenson, Eds., Handbook of Student Engagement Interventions: Working with Disengaged Students. Cambridge, MA, USA: Academic Press, 2019.

[21] T. K. F. Chiu, "Digital support for student engagement in blended learning based on self-determination theory," *Computers in Human Behavior*, vol. 124, Art. no. 106909, 2021, doi: 10.1016/j.chb.2021.106909.

[22] N. Mercer and C. Howe, "Explaining the dialogic processes of teaching and learning: The value and potential of sociocultural theory," Learning, Culture and Social Interaction, vol. 15, pp. 1–8, 2017.

[23] D. Zhang, Z. Fang, and M. Liao, "The impact of teacher's pedagogical leadership on student achievement: The mediating role of teaching methods," J. Prof. Capital Community, vol. 9, no. 4, pp. 398–430, 2024, doi: 10.1108/JPCC-11-2023-0074

[24] T. Brafford, B. Harn, B. Clarke, C. T. Doabler, D. Kosty, and K. Scalise, "Implementation factors and their influence on student mathematics outcomes," *Learning Disabilities Research & Practice*, vol. 38, no. 1, pp. 5–14, 2023, doi: 10.1111/ldrp.12298.

[25] J. Roschelle, R. D. Pea, C. M. Hoadley, D. N. Gordin, and B. M. Means, "Changing how and what children learn in school with computer-based technologies," The Future of Children, vol. 16, no. 2, pp. 76–101, 2016.

[26] P. A. Kirschner and J. Sweller, "Why minimal guidance during instruction does not work: An analysis of the failure of constructivist teaching," Educational Psychologist, vol. 41, no. 2, pp. 75–86, 2018.

[27] G. M. Mahuro and N. Hungi, "Parental participation improves student academic achievement: A case of Iganga and Mayuge districts in Uganda," Cogent Educ., vol. 3, no. 1, Art. no. 1264170, 2016, doi: 10.1080/2331186X.2016.1264170.

[28] J. Hattie, "Visible learning: A synthesis of over 800 meta-analyses relating to achievement," Routledge, 2017.

[29] M. R. Reyes, M. A. Brackett, S. E. Rivers, N. A. Elbertson, and P. Salovey, "The interaction effects of program training, dosage, and implementation quality on targeted student outcomes for the RULER approach to social and emotional learning," Sch. Psychol. Rev., vol. 41, no. 1, pp. 82–99, 2012.

[30] H. E. Vidergor and P. Ben-Amram, "Khan Academy effectiveness: The case of math secondary students' perceptions," *Computers & Education*, vol. 157, Art. no. 103985, 2020, doi: 10.1016/j.compedu.2020.103985.

[31] L. Chen, J. Bae, and R. M. Battista, "The role of technology in enhancing student engagement in mathematics classrooms," Computers & Education, vol. 165, Art. no. 104149, 2021, doi: 10.1016/j.compedu.2021.104149.

[32] S. Bond, K. Bedenlier, O. Marín, and M. Händel, "Emergency remote teaching in higher education: Mapping the first global online semester," Int. J. Educ. Technol. High. Educ., vol. 18, no. 50, 2021, doi: 10.1186/s41239-021-00282-x.

[33] J. A. Fredericks, P. C. Blumenfeld, and A. H. Paris, "School engagement: Potential of the concept, state of the evidence," Rev. Educ. Res., vol. 74, no. 1, pp. 59–109, 2004.

[34] D. Hillmayr, L. Ziernwald, F. Reinhold, S. I. Hofer, and K. M. Reiss, “The potential of digital tools to enhance mathematics and science learning: A meta-analysis,” Computers & Education, vol. 153, Art. no. 103897, 2020, doi: 10.1016/j.compedu.2020.103897.

[35] H. Lei, Y. Cui, and W. Zhou, “Relationships between student engagement and academic achievement: A meta-analysis,” Soc. Behav. Pers., vol. 46, no. 3, pp. 517–528, 2018, doi: 10.2224/sbp.7054.

[36] Y. Zhang, S. Russell, and S. Kelly, “Engagement, achievement, and teacher classroom practices in mathematics: Insights from TIMSS 2011 and PISA 2012,” *Studies in Educational Evaluation*, vol. 73, Art. no. 101146, 2022, doi: 10.1016/j.stueduc.2022.101146.

[37] J. A. Fredricks, P. C. Blumenfeld, and A. H. Paris, “School engagement: Potential of the concept, state of the evidence,” *Review of Educational Research*, vol. 74, no. 1, pp. 59–109, 2004.

[38] M. T. Wang and J. S. Eccles, “School context, achievement motivation, and academic engagement: A longitudinal study of school engagement using a multidimensional perspective,” Learn. Instr., vol. 28, pp. 12–23, 2013, doi: 10.1016/j.learninstruc.2013.04.002.

[39] K. L. Rueda-Gómez, L. J. Rodríguez-Muñiz, and L. Muñiz-Rodríguez, “Performance and mathematical self-concept in university students using Khan Academy,” Heliyon, vol. 9, no. 4, Art. no. e15441, 2023, doi: 10.1016/j.heliyon.2023.e15441.

[40] Libraries Without Borders, Transforming Education – Intermediate Study. London, U.K.: Libraries Without Borders, 2014.