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Effectiveness of the Utilization of Supplementary Video Material on Students' Mathematics Performance in Algebra

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Abstract

This study explored the effectiveness of supplementary video materials in enhancing Grade 7 students' performance in Algebra, specifically on integers. It aimed to: (1) assess pretest and post-test scores of control and experimental groups; (2) examine any significant differences between them; (3) evaluate the video's acceptability in terms of learning objectives, engagement, video presentation, and higher-order thinking; and (4) propose instructional material based on results. Using a quasi-experimental pretest-posttest design and descriptive method, the study involved 67 students from a public high school in Camarines Sur. One section received traditional instruction, while the other used teacher-made video lessons aligned with the MATATAG curriculum. These materials were grounded in VARK learning styles and Mayer's multimedia learning theory. A 35-item test and acceptability survey were used for data collection. Results showed both groups improved, with the experimental group reaching a higher performance level, though the difference was not statistically significant. The video materials were rated "Highly Acceptable," especially for motivation and engagement. The study recommends continued use of video-based tools in Algebra instruction and offers a teaching guide to support implementation.

Keywords: *Student Performance, Supplementary Video Material, Mathematics, MATATAG Curriculum*

INTRODUCTION

In today's increasingly digital society, education continues to evolve alongside technological advancements. With learners becoming more visually inclined and media-exposed, there is a growing need for instructional strategies that match this shift in learning preference. Traditional, lecture-based instruction often falls short in subjects such as Mathematics, where abstract concepts demand more engaging, intuitive, and multimodal learning approaches. Algebra, a foundational component of mathematics, presents notable challenges to students' conceptual understanding and problem-solving skills. According to Sugiarti and Retnawati (2019), learning algebra enhances

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students' logical, analytical, and critical thinking, yet many struggle with basic concepts such as variables, expressions, and operations. Egodawatte (2019) adds that students often face difficulties transitioning from arithmetic to algebra, and that conceptual gaps hinder deeper learning. This concern is evident in international assessments. The PISA 2022 results reveal that only a small percentage of Filipino students reached baseline proficiency in mathematics, indicating difficulty in translating real-life situations into mathematical representations (Chi, 2023). Similarly, national data from a public high school in Camarines Sur shows a consistent trend of underperformance in Algebra over the last three school years, particularly in Patterns and Algebra.To address this, educators have turned to supplementary video materials as a support tool for traditional instruction. Studies suggest that multimedia learning can reduce cognitive load, increase retention, and promote self-paced review (Reiss & Renkl, 2024; Kay, 2023). Teacher-made video lessons can supplement instruction by offering step-by-step visuals, interactive modeling, and additional practice outside class hours. This study aims to determine the effectiveness and acceptability of teacher-made supplementary video materials in teaching Grade 7 Algebra, particularly the topic of integers, under the MATATAG curriculum. The intervention focuses on enriching students' learning experience and addressing performance gaps through visual and auditory content that complements in-class instruction.

METHODS

This chapter details the research methodology used in the study. It discusses the research design, respondents of the study, instruments, procedure, the statistical methods applied for data analysis. Each section explains the specific steps taken to ensure the study was carried out systematically and thoroughly.

Research Design

This study employed a quantitative approach using a quasi-experimental design, specifically a pretest-posttest control group design, complemented by descriptive analysis. The primary objective was to determine the effectiveness of teacher-made supplementary video materials in teaching Grade 7 Algebra. The quasi-experimental component measured the difference in academic performance between an experimental group (which received video-based instruction) and a control group (which received traditional instruction). A pretest and posttest, both consisting of 35 items, were used to measure learning gains. Additionally, a descriptive method was applied to assess the level of acceptability of the video materials based on students' perceptions.

Respondents of the Study

The study involved 67 Grade 7 students from a public national high school in Camarines Sur, divided into two groups: 35 in the control group and 32 in the experimental group. Both sections were selected based on their previous quarterly grades, which were closely matched in average and standard deviation to ensure comparability. Random assignment was done by tossing a coin. Both groups were taught by the same teacher to maintain instructional consistency. The experimental group also answered a researcher-made acceptability questionnaire after the implementation.

Research Instruments

The instruments included Teacher-made supplementary video materials-Seven videos (2–6 minutes each) aligned with the MATATAG curriculum, covering four major competencies namely competency A-describe, compare, and order integers; competency B-identify the absolute value of integers; C-perform the four operations on integers; and D-simplify numerical expressions using GEMDAS. A Pretest and posttest were used with 35-item tests validated and pilot-tested in another school. Items were revised and refined based on item analysis and expert validation. An Acceptability questionnaire validated by experts was also used covering four indicators—objective learning, motivation and engagement, video presentation, and higher-order thinking. It used a 5-point scale (5 = highly

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acceptable, 1 = not acceptable) to measure the acceptability level of the video material as perceived by the respondents. Lastly, lesson exemplars were utilized with two sets (14 in total), one for each group, covering the same topics but differing in instructional approach (video-supported vs. traditional).

Data Gathering Procedure

The researcher secured approval from the Graduate School Dean, School Principal, and Schools Division Superintendent. After participant selection, both groups took a pretest. The experimental group used the supplementary videos during lessons over three-four weeks, with topics distributed across several days. The videos were played once in class and made available offline for review. Traditional instruction was used for the control group. After three weeks, both groups took the posttest. The experimental group also completed the acceptability questionnaire to assess the perceived effectiveness of the videos. Acceptability survey were analyzed to assess students' perceptions of the video materials. The rating scale used in the survey are as follow:

1.00-1.80 (Not Acceptable)
1.81-2.60 (Less Acceptable)
2.61-3.40 (Moderately Acceptable)
3.41-4.20 (Acceptable)
4.21-5.00 (Highly Acceptable)

RESULTS AND DISCUSSIONS

Level of Performance of the Control and Experimental Groups in the Pretest and Post-Test utilizing the Proposed Validated Supplementary Video Material

Table 1 shows the level of performance of the control group in the pretest and post-test on Algebra.

Table 1. Level Of Performance of The Controlled Group

	PRETEST			POST-TEST		
Competency	Mean	SD	Description	Mean	SD	Description
A	4.51	2.66	beginning	5.51	2.34	developing
B	1.83	1.40	beginning	3.54	1.05	Approaching proficiency
C	5.89	2.17	beginning	7.60	2.69	developing
D	1.49	0.89	beginning	3.54	1.16	Approaching proficiency
Overall level of Performance	13.72	3.76	beginning	20.20	4.96	Developing

*Legend: **Beginning level** corresponds to scores of 5 and below (competency A), 2 and below (B), 7 and below (C), and 1 (D), with a total score of 17 and below; **Developing**– 6 (A), 3(B), 8 (C), and 2(D), totaling 18–22; **Approaching Proficiency**– 7 (A), 4 (B), 9-10 (C), and 3(D), with a total of 23-26; **Proficient level** – 8 (A), 5 (B), 11-12 (C), and 4 (D), with a total score of 27–31; and **Advanced** – 9-10 (A), 6 (B) , 13-14 (C) , and 5 (D), with a total score of 32-35*

The control group, taught using traditional methods, showed slight to moderate improvement across all competencies. In Competency A (Describing, Comparing, and Ordering Integers), scores improved from Beginning to Developing, though many still struggled with number relationships—likely due to limited visual or interactive

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tools. This supports Polotskaia et al.'s (2022) view that traditional methods may yield correct answers but often lack conceptual depth. In Competency B (Absolute Value), more consistent progress was noted, with students improving to Approaching Proficiency, suggesting that rule-based topics are more compatible with conventional teaching (Demetgül & Baki, 2020).

However, Competencies C (Operations on Integers) and D (GEMDAS) showed persistent challenges, with increased score variability and common errors in subtraction and multi-step operations, echoing findings by Flores et al. (2024) and Eaves et al. (2025). These results highlight the limitations of lecture-based instruction, particularly for abstract topics, as noted by Muller et al. (2023) and Sweller et al. (2019), who emphasize the cognitive overload such methods can cause. More interactive and scaffolded strategies are needed to better support learners.

Table 2 shows the level of performance of the experimental group in the pretest and post-test on Algebra.

Table 2. Level Of Performance of The Experimental Group

Competency	PRETEST			POST-TEST		
	Mean	SD	Description	Mean	SD	Description
A	4.03	1.36	beginning	6.53	1.97	developing
B	1.91	1.33	beginning	4.50	1.63	Approaching proficiency
C	5.67	2.98	beginning	7.91	2.31	Developing
D	1.91	0.82	beginning	3.75	1.14	Proficient
Overall level of Performance	13.52	3.71	beginning	22.69	5.58	Approaching proficiency

*Legend: **Beginning level** corresponds to scores of 5 and below (competency A), 2 and below (B), 7 and below (C), and 1 (D), with a total score of 17 and below; **Developing**– 6 (A), 3(B), 8 (C), and 2(D), totaling 18–22; **Approaching Proficiency**– 7 (A), 4 (B), 9-10 (C), and 3(D), with a total of 23-26; **Proficient level** – 8 (A), 5 (B), 11-12 (C), and 4 (D), with a total score of 27–31; and **Advanced** – 9-10 (A), 6 (B) , 13-14 (C) , and 5 (D), with a total score of 32-35.*

The experimental group, starting at the Beginning level (mean = 13.52), showed notable improvement after the use of supplementary video materials, reaching Approaching Proficiency (mean = 22.69). This suggests that video-assisted instruction enhanced both comprehension and retention in Algebra, offering flexibility for students to pause, replay, and visualize concepts—benefits that traditional methods often lack (Fiorella et al., 2020).

By competency, students showed strong gains in Competency A, where visual explanations supported better understanding of integer relationships (Costa, 2020; Kosterelioğlu, 2019). In Competency B, they moved closer to proficiency, with videos helping reinforce rule-based concepts like absolute value (Demetgül & Baki, 2020). In Competency C, decreased variability in scores reflected more consistent understanding, aided by multisensory, real-life applications through video (Mabborang & Hilario, 2024; Alicando & Ramos, 2022). In Competency D (GEMDAS), students achieved Proficient level, likely due to scaffolded, step-by-step video instruction that helped manage cognitive load (Ofril et al., 2023).

Compared to the control group, which was disrupted by class suspensions, the experimental group benefited from flexible, accessible learning. As Basilaia and Kvavadze (2020) noted, learning interruptions can significantly hinder progress. These findings affirm the value of multimedia tools in bridging instructional gaps and supporting deeper mathematical understanding.Alicando, C., & Ramos, L. (2022). Effectiveness of video-based instruction in enhancing mathematical learning. International Journal of Education and Research, 10(2), 112–12Generally, the experimental group showed greater improvement in terms of performance level compared to control group.

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Comparative Analysis of the Pretest and Post-test Results of the Controlled and Experimental Groups

Table 3 shows the results on the significant difference of the pretest and post-test of the control and experimental groups in Algebra.

The study revealed a statistically significant main effect for time, $F(1,65)=191.802$, $p=.000$, with a large effect size ($\eta^2 = .747$), indicating that both groups improved significantly from pretest to post-test. However, the experimental group—taught with supplementary video materials—achieved greater gains, supporting the idea that multimedia tools enhance engagement, retention, and conceptual clarity in mathematics (Fiorella et al., 2020; Costa, 2020; Kosterelioğlu, 2019). These findings align with prior research showing that video content can benefit visual learners and improve understanding of abstract topics such as integer operations and order of operations (Alicando & Ramos, 2022; Ofril et al., 2023).

Table 3. Mixed-Model Anova Summary Table on The Performance of Controlled and Experimental Group

	Source								
		Type III Sum of Squares	df	Mean Square	F	Sig.	Interpretation	Partial Eta Squared	Interpre-tation
Tests of Within-Subjects Effects	time	2053.191	1	2053.19	191.802	.000	Very highly significant	.747	large
	time * groups	61.012	1	61.012	5.700	.020	Highly significant	.081	moderate
Tests of Between-Subjects Effects	groups	43.191	1	43.191	1.393	.242	not significant	.021	small

Despite this, the main effect for group was not statistically significant, $F(1,65)=1.391$, $p=.242$, $\eta^2 = .021$, suggesting minimal overall difference when comparing average scores between the control and experimental groups. This may be due to implementation limitations—such as only a single video exposure per topic, inconsistent attendance, and the language barrier, as many learners struggled with English-only instruction. As Mayer (2021) and Amalric et al. (2023) emphasized, meaningful learning requires repeated engagement and accessible language. Mercado (2022) also found that code-switching in video lessons enhanced comprehension among Filipino learners.

Furthermore, although both groups benefited from instruction, the significant interaction effect, $F(1,65)=5.7$, $p=.020$, $\eta^2 = .081$, indicated that the experimental group's learning gains were greater over time. This supports findings by Shishigu et al. (2024), who concluded that structured technology integration and sufficient instructional time lead to better learning outcomes. Additionally, Sarmiento and Orale (2019) emphasized that foundational algebra concepts are crucial for future success—highlighting the value of reinforcing them through accessible, flexible tools like videos.

In summary, while both methods were effective, the greater improvement in the experimental group suggests that video-based instruction can significantly support mathematics learning—provided that challenges such as limited access, language barriers, and inconsistent implementation are addressed.

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Level of Acceptability of the Use of Supplementary Video Material

The results of the acceptability survey as shown in Table 4, revealed a generally high level of satisfaction among students regarding the supplementary video materials. Among the four domains, Motivation and Engagement received the highest mean score (M = 4.68), suggesting that the videos successfully captured students' interest and sustained their attention. This supports the findings of Galatsopoulou et al. (2022), who highlighted the motivational benefits of audiovisual learning, and Putra et al. (2023), who found that interactive videos significantly improved engagement and outcomes.

The findings align with Multimedia Learning Theory (MLT), particularly the dual-channel principle, where combining visuals and audio enhances understanding and reduces cognitive overload. High mean scores in Video Presentation (M = 4.51) and Objective Learning (M = 4.47) affirm that the videos effectively supported visual and auditory learners, consistent with Fleming's VARK model.

Table 4. Level Of Acceptability on The Use of Supplementary Video Material

OBJECTIVE LEARNING	Mean	Interpretation
main concepts taught in the videos	4.72	Highly Acceptable
examples in the videos	4.69	Highly Acceptable
instructions and explanations in the videos	4.56	Highly Acceptable
the video is easier to understand	4.34	Acceptable
solve algebraic problems	4.03	Acceptable
Total	4.47	Highly Acceptable
MOTIVATION AND ENGAGEMENT	**Mean**	**Interpretation**
the subject matter become more interesting	4.81	Highly Acceptable
the video was engaging and gains attention.	4.81	Highly Acceptable
participation is encouraged	4.78	Highly Acceptable
the lessons are appreciated	4.59	Highly Acceptable
confidence is built in solving algebra problems	4.41	Highly Acceptable
Total	4.68	Highly Acceptable
VIDEO PRESENTATION	**Mean**	**Interpretation**
The speaker's delivery and the audio are clear and engaging.	4.63	Highly Acceptable
The use of visuals (diagrams, texts, animations etc.) enhances my understanding.	4.59	Highly Acceptable
The pace of the video is appropriate for my learning.	4.53	Highly Acceptable
The video is visually appealing.	4.47	Highly Acceptable
The length of videos was appropriate for the content they covered.	4.31	Highly Acceptable
Total	4.51	Highly Acceptable
HIGHER ORDER THINKING	**Mean**	**Interpretation**
encouraged to think about new ways to solve problems.	4.63	Acceptable
come up solutions with given challenging problems	4.50	Highly Acceptable
critical thinking and problem-solving skills were enhanced.	4.38	Highly Acceptable
apply algebraic concepts to real-life problems.	4.19	Highly Acceptable
solve problems independently	4.13	Highly Acceptable
Total	4.36	Highly Acceptable
OVERALL	4.50	Highly Acceptable

However, the lowest domain score was in Higher Order Thinking (M = 4.36), though still highly acceptable. This suggests that while the videos helped deliver content clearly, they were less effective in fostering analytical and independent problem-solving skills. Utami and Andriani (2023) noted that students often struggle with strategy formation despite understanding a problem, while Fineldi and Hidayati (2023) emphasized that over-reliance on procedural instruction can limit flexible thinking. These findings imply that to fully support higher-order learning,

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videos should incorporate scaffolding, guided reasoning, and opportunities for deeper application beyond procedural tasks.

Proposed Supplementary Material in Algebra (Integers)

As a result, a teaching guide was developed to enhance the effectiveness of the utilization of supplementary video materials in teaching mathematics along with the videos created.

Features of the Teaching Guide

The following are the features of the teaching guide:

1. Comprehensive Guidance on Video Creation and Implementation. This guide provides step-by-step instructions on how to develop and effectively use supplementary video materials in mathematics instruction. It includes essential recommendations based on research findings to enhance student engagement and comprehension. Strategies for optimizing video length, language selection, and interactive elements are also discussed to ensure maximum effectiveness.
2. Sample lesson plans are included. These plans align with curriculum standards and provide clear guidance on incorporating videos into various teaching phases—before, during, and after the lesson.
3. The guide also includes a variety of sample assessments designed to measure student understanding and learning outcomes effectively. These assessments range from formative evaluations, such as quizzes and reflection exercises, to summative assessments that gauge overall mastery of mathematical concepts presented in the videos.

The materials created for this study can be accessed through the QR code provided.

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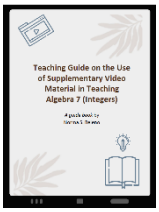

CONCLUSION

In conclusion, the findings suggest that while the experimental group showed a larger improvement in performance, there was no statistically significant difference between the experimental and control groups. Nevertheless, the supplementary video materials were highly accepted by the students, indicating their effectiveness in enhancing learning, promoting motivation, and fostering higher-order thinking skills. The study recommends the continued integration of video-based instructional materials in the curriculum to support student engagement and improve learning outcomes in Algebra. A teaching guide on the use of the supplementary video material in teaching mathematics was also developed for effective implementation.

RECOMMENDATIONS

Based on the study's findings and observed limitations, several key recommendations are proposed to enhance the effectiveness of supplementary video materials in mathematics instruction. First, videos should be designed with appropriate length relative to the complexity of the topic—shorter videos (5–10 minutes) for rule-

based or single-step procedures, and longer, segmented videos for complex or multi-step topics such as GEMDAS or integer operations. This aligns with the recommendations of Kosterelioğlu (2019) and Capone (2022), who emphasized that properly timed and structured video content reduces cognitive overload and sustains learner attention. Second, students should be provided with repeated and flexible access to the videos, allowing them to pause, replay, and review lessons independently, especially in asynchronous or blended learning contexts. This repeated engagement supports deeper learning, as emphasized by Mayer (2021). Third, addressing language barriers is essential; videos may include code-switching or bilingual subtitles to accommodate students with varying English proficiency levels, as supported by Mercado (2022). Finally, integrating videos with structured post-viewing activities, teacher-guided practice, and differentiated support will help bridge gaps for struggling learners, ensuring that video-based instruction not only enhances understanding but also fosters independent problem-solving and sustained learning outcomes like algebra.

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