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Hypothetical Learning Trajectory and Video Program with Differentiated Multi-Language in Teaching Mathematics 9

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Abstract: This study investigated the effectiveness of video-based instruction in enhancing students' academic achievement in Mathematics. Specifically, it evaluated the quality of the developed instructional videos in terms of relevance to the curriculum, organization and structure, instructional quality, and cultural formation. A quasi-experimental research design was employed, involving eighty-eight Grade Nine students from Gapok National High School, divided equally into control and experimental groups. The experimental group received instruction using video-based learning materials with differentiated multi-language, while the control group was taught using conventional methods. Pretest and posttest assessments were conducted to measure student achievement, and a Pearson correlation analysis was performed to determine whether students' perceived ratings of the video materials influenced their academic performance.

Findings revealed that both jurors and respondents rated the video materials highly across all quality indicators, suggesting their effectiveness as instructional tools. The posttest results demonstrated a statistically significant improvement in the experimental group compared to the control group. The analysis of gain scores further supported this finding, confirming the positive impact of video-based instruction on student learning. However, the Pearson correlation analysis revealed a very weak and non-significant relationship between perceived video quality and posttest scores, indicating that students' perceptions of instructional materials did not significantly influence their actual academic performance.

The study concludes that video-based instruction is an effective pedagogical tool for improving student achievement in Mathematics. It recommends the integration of instructional videos into mathematics teaching and suggests further research on long-term learning effects, student engagement factors, and the applicability of video-based instruction across different subject areas.

Keywords: *Video Based Instruction, Differentiated Multi Language, Hypothetical Learning Trajectory, Mathematics Education, Student Academic Achievement.*

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I. INTRODUCTION

The students learned most, especially learners with limited resources to use as a guide in learning Mathematics. Students were in full adjustment to learning Mathematics because of a lack of experience in dealing with mathematical problems.

Hendrik et al. (2020) emphasized that Mathematics learning in this era requires teachers to develop learning models that pay attention to the characteristics of students, so it is important for teachers to know the learning trajectory.They also added that based on the theories studied, it is concluded that a hypothetical learning trajectory is a learning design in the form of allegations on student learning activities based on initial understanding and characteristics of students to achieve higher understanding.

Shuukwanyama (2022) stressed that using a multi-language in teaching will support learners experiencing difficulties understanding English as a pure instruction medium. Moreover, students were motivated to participate in the lessons and discussions because they understand the

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language, can use it to draw on what they already know and relate what they learn to everyday life.

Shevell et al. (2014) state that the students found that the video clips displayed this educational content in an interesting, entertaining, and engaging manner. Providing video clips as learning material is an extra challenge for teachers.

However, the Mathematics Teachers of Gapok National High School (GNHS) kept on murmuring about the mathematical learning ability of the learners, specifically on problem-solving skills, as deliberated in the school meetingsduring the Learning Action Cell (LAC) sessions. They shared that students' problems include a lack of interest, poor comprehension, inappropriate teaching approaches, and low academic performance in Mathematics.

Moreover, the General Scholastic Average (GSA) results for the Year 2023-2024 of grade 9 students in Mathematics of Gapok National High School (LNHS) was 78%, which is quite alarming. Those problems frustrated the students to continue developing their mathematical problem-solving skills.

With these problems encountered in Gapok National High School, the researcher believed that a thorough investigation must be conducted to solve the problem the students experienced in Mathematics. The locus of this study is to measure the achievement of grade 9 Mathematics and develop their problem-solving skills by considering their learning trajectories and the use of video clips with differentiated multi-language in teaching.

A hypothetical learning trajectory is an approach to designing mathematical instructions. This method considered the characteristics of students and the materials to be taught Ulfa et al. (2019). Through ample investigation, video clips using differentiated multi-language as a learning material was useful in engaging students in an interesting way of learning.

Shevell et al. (2014) stressed that video clips encourage reflection and critical thinking. Moreover, using Hypothetical Learning Trajectory and Video Program with Differentiated Multi-language (HLT-VPDML) enabled students to create new learning in their language. Moreover, the students can draw on what they already know and relate what they learn to everyday life (Shuukwanyama, 2022).

This study sheds light on improving educational and classroom practices through different effective approaches in Gapok National High School. It improved the students' mathematical engagement. In addition, research-based techniques were used in the context of Grade 9 students to determine holistic activities and approaches in teaching Mathematics.

II. REVIEW OF RELATED LITERATURE

This chapter shows the materials that have a close bearing on the present study, which are taken from books, government regulations, journals, online sources, published and unpublished master's theses and dissertations, and other related literature. These materials provide valuable information for the conceptualization of the framework and also give support to the analysis and the data interpretation.

- *Hypothetical Learning Trajectory (HLTs) in Designing Learning Tasks*

Ulfa et al. (2019) stated that in Mathematics education, there is a learning process that needs more attention than learning outcomes. The learning process is a learning activity that should be planned maximally.

According to Gomeza et al. (2015), when a teacher plans mathematical tasks, he carries out some anticipation about his students' learning processes. It is one basic assumption for any of the teachers' planning responsibilities, from the annual subject design to the planning of every daily class period.

Teacher knowledge, experience, and the available literature are the basic resources for the teacher to generate HLTs that support his daily planning task. This information needs to be organized in some systematic process and required to be supported by some specific tools to serve a concrete teacher planning purpose.Teachers can select appropriate learning activities to stimulate students to think and act when constructing Mathematics.

Moreover,Prahmanaet al. (2016) used the three components of Hypothetical Learning Trajectory (HLT) from the study of Gravemeijer (2004), namely (1) the purpose of mathematics teaching for students, (2) learning activities, devices, or media used in the learning process, and (3) a conjecture of understanding the process of learning how to learn and strategies students that arise and thrive when learning activities are done in class. Thus, in designing the activities for learning Mathematics, the teacher should know the learners' learning trajectories.

- *Learning Trajectory*

According to Tamba et al. (2018), learning trajectory describes key aspects in planning Mathematics learning. It also helps teachers follow and interpret students' mathematical thinking so that learning can be developed following the characteristics of students and even become a tool for teachers to develop curriculum. They also stated three main components of learning trajectory: learning goals, learning activities, and hypothetical learning processes.

They also emphasized that the student's level of thinking and mathematical thinking must be a primary consideration because every student has a different level of thinking and mathematical thinking orientation.

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- *Technology-based Learning*

Technology, as of today, brings the generation to more accessible learning in different fields. As stressed by Eckhaus et al. (2019), Computer-mediated learning supports the transfer of teaching materials from offline learning into online situations, thus enabling distance learning.

Chin (2022) cited that technology is used as a supplementary teaching tool in primary and secondary classrooms from the study of (Hayes, 2007). Interactive multimedia supported by text, image, video, audio, and animation services create a dynamic and interactive presentation that provides active facilities for TISOL learners to use as a learning resource.

Rukayah et al. (2022) expressed that learner needs interactive multimedia based on hybrid learning for the TISOL program. Thus, technology-based learning brings a difference in terms of learning.

Moreover,Rukayah et al. (2022) cited the integration of technology in learning to create effectiveness and independence in learning anytime and anywhere as characteristics of 21st-century learning from the study of (Barak et al., 2016; Simonson et al., 2019; Tican& Deniz, 2019).

Rukayah et al. (2022) also emphasized that instructors and learners needed technology-based learning media that could utilize the principle of combining the power of traditional face-to-face learning and online learning. Interactive multimedia was supported by various types of media involved in learning to increase student interest and meet different learning styles.

He also added that media interactivity supported the strengthening of two-way interaction in the learning process so that it was expected to increase the acquisition of language skills, both receptive and productive.

- *Video Program and Its Implication to Teaching and Learning*

It has been long since video clips were used for teaching and learning. Many researchers have argued that video clips are useful as a source of ideas in learning the different subject areas in education.

Shevell et al. (2014) stated that the students found that the video clips displayed this educational content in an interesting, entertaining, and engaging manner. Furthermore, they believed this method of presentation is effective in transmitting knowledge and communicating information. Video clips would appeal to recent cohorts of medical trainees. They also added that the video clips encourage reflection and critical thinking.

Moreover, according to Ghilay(2021), Video-Based Learning (VBL) is a method in which a course syllabus is fully covered by video clips, either as a replacement for or as a supplement to live lectures.

- *Video Program Learning*

The use of learning videos can be a solution in presenting material with audio and visuals that can draw students' attention compared to conventional online learning. Video is one of the learning media audio-visual, which is very effective in supporting the learning process (Rauf et al., 2021).

He added that the benefits of learning videos could be perceived as real as they can reach all learners and are effective as a medium of learning because they can be reproduced, viewed, and repeatedly presented, as supported by the study of Panggabeanet al. (2021).

Moreover, Rauf et al. (2021) emphasize that students of any age will learn more using multiple media. Thus, videos are not just for keeps but contribute to learning. He also stated that many studies have shown that video can be a highly effective educational tool.

Samosaet al. (2021) stress that using video as a technology-based tool resulted in a more engaging and enjoyable method of learning fractions. They also emphasized that using Video-based instructional material encouraged students to interact and participate socially in Mathematics sessions. Learners are motivated to participate actively in Mathematics lectures that are entertaining and fascinating, according to the findings of this study.

- *Filipino and Other Local Languages in Teaching Mathematics*

Teaching Mathematics in different languages considering the local where the learners belong is advantageous because they may be able to cope with the standard. They may understand the lesson differently, for they can relate to it. Furthermore, the learners are allowed to create new learnings in their language.

Shuukwanyamaet al. (2022) cited the study of Nkonde et al. (2018), which has the findings that when the Mother Tongueis used in teaching mathematics, teachers can handle explaining mathematical concepts.

Learners recalled effortlessly what they were taught.Stated also in the 1987 Philippine Constitution, Article XIV, Sec. 7 that the official languages of the Philippines are Filipino and, until otherwise provided by law, English.

The regional languages are official languages in the regions and shall serve as auxiliary media of instruction. Furthermore, the Philippine RA 10533 of 2012 that teachers will utilize students' mother tongue as a learning resource. Thus, the learners are privileged to act and talk in their native language, especially in Mathematics.

Shuukwanyama(2022) stated that although support for using native languages in Mathematics education is prevalent in research, Philippine texts are still in English. It will support learners who need help understanding English as a pure instruction medium.

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Moreover, as the finding of his study, students are motivated to participate in the lessons and discussions because they understand the language, can use it to draw on what they already know, and relate what they are learning to everyday life. He also added that students can negotiate meaning together as they interact.

Mother tongue instruction thus supports a learner-centered approach for both preservice teachers and, ultimately, their learners as they actively participate during the lessons. There should be a proper evaluation of the word equivalence of mathematics terms to avoid bias and mistakes in delivering the teaching and learning process.

Mother Tongue may be the most convenient language to convey comprehensive information to everyone in Philippine settings. It may also be useful in teaching Mathematics.

Learning Trajectory and Video Program with Differentiated Multi-language in Teaching and Learning.

The teacher who is first witting on the learning trajectory of the learners may intelligently design tasks that fit to cope with the learner's needs in terms of learning.

Moreover, as supported by many researchers, the video program is useful in addressing learners in developing their problem-solving skills. Ozleret al. (2021) found that video modeling effectively teaches computer skills to students, even those with intellectual disabilities. Video modeling could be applied more broadly.

However, a video program with the use of multi-language instruction may be helpful to introduce the learners in Mathematics 9, for they will fully understand the language used, and even they may be able to make meaning to the lessons being discussed.

Thus, incorporating the video program with differentiated multi-language teaching as strategies to be used in teaching and learning considering the learners' learning trajectory will help in developing the learners' problem-solving skills.

III. METHODOLOGY

This chapter showed the research design, the study's locale, the study's respondents, sampling size and sampling technique, data gathering instruments, the research procedure, and the statistical treatment for this study.

- *Research Design*

Quasi-experimental research design, specifically the pretest and posttest design was used to conduct this study. Pretest manners were employed in both the control and experimental groups.

The result of the pretest was used to determine the Learning Trajectory of the learners in the experimental group and the posttest manner was employed in the experimental group as teaching strategies to determine the effectiveness of the developed video clips with differentiated multi-language in (HLT-VPDML) teaching Mathematics 9 and its effect to develop problem-solving skills of the students. One (1) section was randomly assigned to the Control group, and the other one (1) section for the experimental group.

The video clips developed were done using Microsoft 365's PowerPoint. The video clips will be evaluated by five (5) Mathematics teachers who have finished their master's degree in mathematics and the forty four (44) target respondents in the experimental group..

The video clips were evaluated to determine their relevance to the curriculum, organization and structure, instructional quality, cultural formation through the descriptive-evaluative design. The Inter-Rater Reliability Analysis Using Fleiss' Kappa was used to measure the level of agreement among multiple raters when assigning categorical ratings. The computed Fleiss' Kappa value is 0.8711, which falls under the "Almost Perfect Agreement" category based on standard interpretation guidelines (Landis & Koch, 1977). It indicated that the evaluators demonstrated a high degree of consistency in their ratings. Thus the strong inter-rater reliability ($\kappa = 0.8711$) confirms that the evaluation instrument is highly reliable for assessing the given criteria

The output of the experimental group depended on the strategies of the researcher considering the students' learning trajectory with developed video clips. Also, the result of the control group was depended on the strategies to be employed by the researcher.

- *Locale of the Study*

This study was conducted at Gapok National High School, located in the rural and mountainous barangay of Gapok in Senator Ninoy Aquino, Sultan Kudarat. Gapok is considered as one of the rural areas in Sultan Kudarat which often faces challenges that hinder effective teaching and learning. Moreover, Bernardo (2020) stated in his study that rural schools in the Philippines commonly deal with issues such as limited access to resources, underdeveloped educational infrastructure, and minimal exposure to innovative teaching strategies. These challenges can negatively impact students' learning experiences, problem-solving skills, which are crucial for academic success and lifelong learning (Llanes &Totio, 2021).

The use of differentiated instruction, specifically through video-based learning, has been shown to enhance student engagement and improve learning outcomes. Tomlison (2017) emphasized that differentiated teaching addresses the diverse needs of learners by tailoring instruction to their readiness levels, interests, and learning profiles. Moreover, incorporating technology, such as videos in multi-languages, fosters contextualized and accessible learning, which is particularly beneficial in rural settings where cultural and linguistic diversity is present (Bautista & Maravilla, 2019).

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As the study conducted, teachers at Gapok National High School were equipped with effective tools to implement differentiated instruction and improve student outcomes. Additionally, the study will contribute to closing the educational gap in underserved communities by providing a replicable framework for improving teaching strategies and student learning in rural areas (UNESCO, 2020)

➢ *Respondents of the Study*

This study evaluates the effects of the Hypothetical Learning Trajectory and Video Program with Differentiated Multi-Language (HLT-VPDML) in teaching Mathematics 9 on the learning achievement of students, particularly in terms of their problem-solving skills. The respondents of this study were eighty-eight (88) Grade 9 students from Gapok National High School, Senator Ninoy Aquino, Sultan Kudarat. These students were equally distributed across two (2) sections.

The selection of Grade 9 as the target population is grounded in both national and international educational assessments and policies. In the Programmed for International Student Assessment (PISA) 2018, Filipino students ranked last among 79 participating countries, with a mean score of 353 in mathematics, significantly below the OECD average of 489. The PISA primarily assesses 15-year-old students, who were typically enrolled in Grade 9 in the Philippine education system. This alignment underscores the importance of focusing on Grade 9 students as a critical group for interventions aimed at improving mathematical proficiency and problem-solving skills.

Furthermore, the Mathematics 9 curriculum covers advanced topics such as quadratic equations, rational algebraic expressions, and trigonometry, which are cognitively demanding and require higher-order thinking skills (HOTS). These topics make the Grade 9 level particularly appropriate for implementing the HLT-VPDML, which utilizes step-by-step learning trajectories alongside differentiated, language-inclusive video instruction to address the diverse needs of learners. This approach is consistent with DepEd Order No. 21, s. 2019, which emphasizes the integration of 21st-century skills such as critical thinking, problem-solving, and mathematical reasoning into the curriculum.

Moreover from developmental perspective, Grade 9 students, aged 14–15, are in the formal operational stage of cognitive development, as described by Piaget's Theory of Cognitive Development. At this stage, learners begin to think abstractly, reason logically, and solve complex problems—skills that align with the objectives of the HLT-VPDML intervention. Thus, addressing the learning gaps in mathematics at this level aligns with national priorities, as highlighted in initiatives such as Sulong Edukalidad and the Basic Education Development Plan 2030 (BEDP). These programs emphasize the need for innovative and inclusive teaching strategies to improve student outcomes in mathematics and other key subject areas.

By targeting Grade 9 students, this study contributed to addressing the persistent challenges identified in the PISA 2018 results and supports the goals of the Enhanced Basic Education Act of 2013 (RA 10533) to enhance student readiness for senior high school and beyond.

➢ *Sampling Size and Sampling Technique*

Convenience sampling was used to select participants from two pre-existing sections at a local school, as they were easily accessible for the research (Etikan, Musa, & Alkassim, 2016). While this method doesn't guarantee a random selection from the entire population, it was a practical choice for this study.

After selecting the students, random assignment was applied to divide them into experimental and control groups. This process ensured that each student had an equal chance of being assigned to either group, helping to control for other factors that might influence the results (Creswell, 2014).

This study involved 88 Grade 9 students from Gapok National High School, distributed across two (2) sections. The researcher was randomly assigned one section to the control group and the other section was assigned to the experimental group. Random assignment is a fundamental principle in experimental research as it helps eliminate confounding variables, ensuring that any observed differences between groups can be attributed to the intervention (Fraenkel & Wallen, 2019).

The selection and participation of students conducted with adherence to ethical standards. Permission sought from the school principal, and approval will be obtained from the Office of the Schools Division Superintendent prior to conducting the study. Ethical considerations, including informed consent and administrative approval, align with research guidelines emphasizing respect, integrity, and accountability in educational research (American Educational Research Association, 2011).

➢ *Data Gathering Instrument*

The Pretest/Posttest questionnaire was administered by the researcher to conduct the study. It was modified and adapted from the learner's material. The test questionnaire, which consists of 40 items that validated through face validation by master teachers in mathematics and teachers who have finished their master's degree related to mathematics.

The questionnaire has been administered to Grade 10 students at Lebak National High Schoo-Villamonte. The reliability of the test was 0.84 indicates that the test has high reliability and is internally consistent. This means that the items within the test effectively measure the same concept, and students who take the test multiple times would likely achieve similar scores. Morover, a KR-20 score above 0.80 is considered strong, indicating that the test items are well-correlated and contribute to a cohesive assessment. This reliability level ensures that the test can be used with confidence to evaluate students' understanding.

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The test questionnaire contained the activities that determine the learning trajectories of the learners. The pretest/posttest was administered to 44 respondents in the control group and 44 in the experimental group.

Moreover to determine the Hypothetical Learning Trajectory (HLT) of the learners, the researcher used the DepEd's grading system or Bloom's taxonomy to determine the performance level of the respondents.

Table 1 DepEd's Grading System or Bloom's Taxonomy Rubric.

Percentage	Perrformance Level	Verbal Description
80-100%	Mastery	Students have fully grasped the concept and can apply it independently.
60-79%	Developing	Students demonstrate understanding but still need reinforcement.
40-59%	Approaching	Students have partial understanding but struggle with application.
Below 40%	Beginning	Students have minimal understanding and require significant intervention.

The HLT-VPDML was used as a source of Mathematical Information and served as a strategy for the researcher in conducting the study. An evaluation instrument employed was modified and adapted from the study of (Cajandig and Lumibao, 2020). The jurors (Math experts) and the respondents of the study were guided by the five-point Likert Scale type questionnaire with corresponding interpretation to determine quality level of the video clips based on its relevance to the curriculum, organization and structure, instructional quality, and cultural formation.

Table 2 Evaluation of Instructional Materials (EITM).

Scale	Range Mean	Verbal Description
5	4.2- 5.0	Outstanding
4	3.4-4.19	Very Satisfactory
3	2.6 - 3.39	Good
2	1.8-2.59	Fair
1	1.00-1.79	Poor

➢ *Data Gathering Procedure*

This study and its research outline were to be submitted and approved by the College of Graduate School. There were letters was addressed to the Schools Division Superintendent and the school principal to have the approval to conduct the study.

The test formulated and administered by the researcher as a pretest and posttest. The pretest was administered to the selected students for the experimental group of 44 and 44 students for the control group to determine the learning trajectory of the learners in Mathematics.

A survey questionnaire was provided to assess the quality level of the HLT-VPDML's on its relevance to the curriculum, organization and structure, instructional quality and cultural formation. The Video clips were employed served as teaching material used by the researcher.

The HLT-VPDML was composed of several units of the lesson. All lessons were guided by the objectives adapted from the Curriculum Guide of the DepEd, and different tasks were done for 45 minutes per session. After a series of lectures, activities, and performances, the researcher administered a posttest to the respondents. After that, the level of achievement was analyzed and interpreted.

Presented below is the waterfall diagram of how the data will be collected.

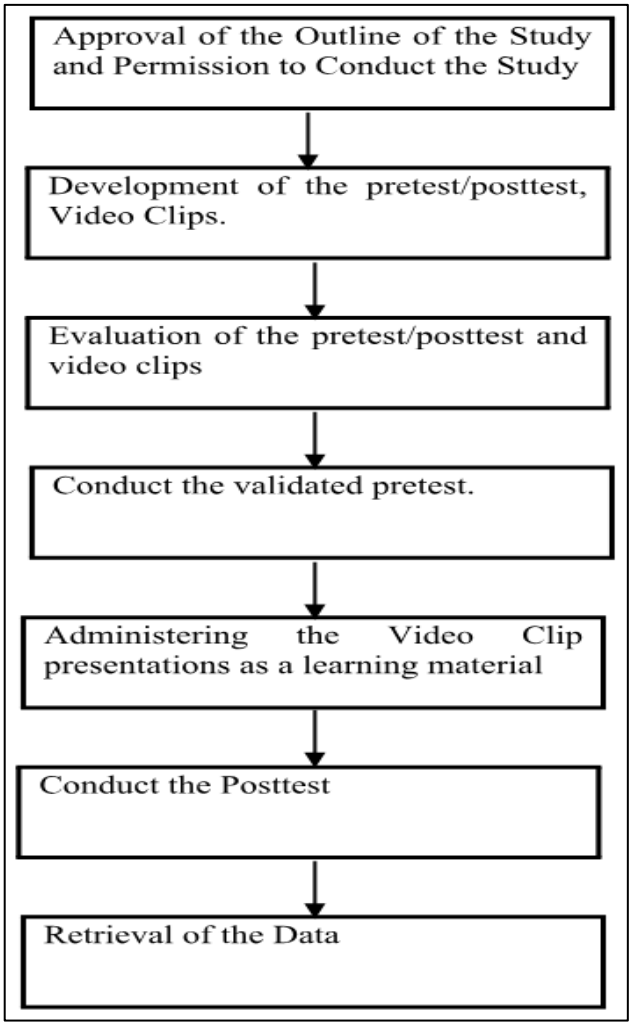

Fig 1 Flow Process of the Data Gathering Procedure. SKSU. 2018.

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➢ *Statistical Treatment*

Problem1: What is the level of the developed video clips presentations based on the perceptions of the jurors and target users in terms of relevance to the curriculum, organization and structure, instructional quality, and cultural formation?

In analyzing the problem 1, the mean and standard deviation were used to determine the level of quality of the developed video clips in terms of their relevance to the curriculum, organization and structure, instructional quality, and cultural formation.

Problem 2: What is the level of achievement in pretest of the Grade 9 students in the control and experimental group?

This also used the mean and standard deviation to determine the achievement of the control and experimental groups in the pretest on the activities designed.

Problem 3: What is level of achievement in posttest of Grade 9 students in the control and experimental group?

This also used the mean and standard deviation to determine the level of achievement of the control and experimental group in the post-test.

In problem 4: Is there significant difference in the student's level of achievement in the pretest of the control and experimental group?

A t-test for two independent scores was used to determine if the pretest of the control group and experimental group has significant differences.

In problem 5: Is there a significant difference in the mean gain score of the control and experimental group?

A t-test for two independent scores was applied to determine if the posttest of the control group and experimental groups' posttest has a significant difference.

Problem 6. Is there significant difference in the mean gain score of the control and experimental group?

To solve this problem, mean was employed to determine the mean gain scores of the control and experimental group. T-test also used to determine the significant difference in the mean gain scores of the control and experimental groups.

Problem 7. Is the posttest score of the experimental group significantly influenced by their perceived rating on the quality of the materials?

To address this problem, Correlation Pearson (r) will be employed to assess the relationship between the perceived rating on the quality of the materials (independent variable) and the posttest scores (dependent variable). This analysis determined whether the perceived quality ratings significantly influence the posttest scores of the experimental group.

IV. PRESENTATION, ANALYSIS AND INTERPRETATION

This chapter presents the statistical analysis of the collected data, including the pretest and posttest scores, the learning trajectory of students, and the effectiveness of video-based instruction. The findings are presented in tables and interpreted accordingly.

Table 3 The Perceived Quality of the Developed Video Clip Presentations by Jurors and Target Users in Terms of Their Relevance to the Curriculum.

Group	n	Mean	SD	Verbal Description
Jurors	5	4.55	0.17	Outstanding
Respondents	44	4.76	0.02	Outstanding

The results in Table 3 indicate that jurors rated the video materials as M = 4.55, SD = 0.17, while respondents provided a slightly higher rating of M = 4.76, SD = 0.02**,** both classified as "Outstanding." The minimal standard deviation values suggest a high level of Cognitive Theory of Multimedia Learning**,** agreement among evaluators. These results support Mayer's (2021) which emphasize the role of well-structured audiovisual materials in enhancing student comprehension. Given these results, the null hypothesis (H_o), which stated that the developed video clips are not significantly relevant to the curriculum, is rejected. This confirms that the video clips are indeed relevant to the curriculum and align effectively with instructional goals.

Table 4 The Perceived Quality of the Developed Video Clip Presentations in Terms of Organization and Structure, as Evaluated by Jurors and Target Users.

Group	n	Mean	SD	Verbal Description
Jurors	5	4.60	0.21	Outstanding
Respondents	44	4.93	0.06	Outstanding

The Table 4 data revealed that the developed video materials were highly rated for organization and structure. Jurors rated the materials at M = 4.60, SD = 0.21**,** while respondents provided an even higher rating of M = 4.93, SD = 0.06**,** both categorized as "Outstanding." The small standard deviations indicate a strong consensus among evaluators. These findings align with Mayer's (2021) research on multimedia learning, which highlights the

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importance of structured instructional content in improving comprehension. As a result, the null hypothesis (H_0), which suggested that the developed video clips are not significantly well-organized and structured, is rejected. This confirms that the videos are well-structured and effectively organized to enhance learning.

Table 5 The Perceived Quality of the Developed Video Clip Presentations in Terms of Instructional Effectiveness, as Evaluated by Jurors and Target Users.

Group	n	Mean	SD	Verbal Description
Jurors	5	4.55	0.17	Outstanding
Respondents	44	4.76	0.02	Outstanding

The instructional quality of the developed video clips was highly rated by both jurors and student respondents, as shown in Table 5. Jurors assigned a rating of M = 4.57, SD = 0.18, while respondents provided a perfect score of M = 5.00, SD = 0.00, classifying the materials as "Outstanding." The unanimous agreement among respondents suggests a strong perception of the videos' effectiveness in supporting learning. Mayer's (2021) Cognitive Theory of Multimedia Learning supports this, highlighting that the combination of visuals and narration fosters deeper comprehension and engagement. Based on the strong ratings, the null hypothesis (H_0), which states that the developed video clips do not significantly enhance instructional quality, is rejected. This confirms that the instructional materials are effective and contribute positively to the learning process.

Table 6 The Perceived Quality of the Developed Video Clips Presentation Based on the Perception of Jurors and Target Users in Terms of Cultural Formation.

Group	n	Mean	SD	Verbal Description
Jurors	5	4.68	0.13	Outstanding
Respondents	44	4.90	0.12	Outstanding

As presented in Table 6, the developed video clips were highly rated in terms of cultural formation, with jurors providing a mean rating of M = 4.68, SD = 0.13, and respondents assigning an even higher score of M = 4.90, SD = 0.12, both classified as "Outstanding." The minimal variability in scores indicates a strong level of agreement. These results align with Ladson-Billings' (1995) Culturally Relevant Pedagogy, which underscores the importance of integrating cultural identity into educational materials. Consequently, the null hypothesis (H_0), which posits that the developed video clips do not significantly incorporate cultural formation, is rejected. This finding confirms that the instructional videos successfully integrate diverse cultural perspectives, making them more relatable and inclusive for students.

Table 7 Summary of the Perceived Quality of the Developed Video Clips Based on Evaluations from Jurors and Target Users.

Group	n	Mean	SD	Verbal Description
Jurors	5	4.90	0.01	Outstanding
Respondents	44	4.59	0.03	Outstanding

Table 7 summarizes the overall perceived quality of the developed video materials. The jurors provided a near-perfect score of M = 4.90, SD = 0.01**,** while respondents rated the materials at M = 4.59, SD = 0.03, both classified as "Outstanding." The strong level of agreement among evaluators suggests that the instructional materials were perceived as highly effective. Mayer's (2021) Multimedia Learning Theory highlights how well-structured and engaging digital materials improve student learning outcomes. Based on the consistently high ratings, the null hypothesis (H_0), which states that the overall perceived quality of the developed video clips is not significantly high, is rejected. This confirms that the video materials were of excellent quality and well-received by both experts and learners.

Table 8 The Level of Achievement in Pretest of the Grade 9 Students in the Control and Experimental Group.

Group	n	Mean	SD	Verbal Description
Control	44	11.05	2.74	Beginning
Experimental	44	10. 68	2.36	Beginning

The pretest scores in Table 8 reveal that the control group achieved a mean score of M = 11.05, SD = 2.74, while the experimental group recorded a slightly lower mean of M = 10.68, SD = 2.36. The similar mean scores suggest that both groups had comparable levels of mathematical proficiency before the intervention. This finding supports experimental research principles that emphasize the need for equivalent baseline knowledge between groups to ensure valid comparisons of posttest results (Creswell & Creswell, 2018). As the difference in pretest scores was small, the null hypothesis (H_0), which states that there is no significant difference in pretest scores between the control and experimental groups, is retained. This confirms that both groups started at a comparable level, allowing for a fair assessment of the intervention's impact.

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Table 9 Level of Achievement in Posttest of the Grade 9 Students in the Control and Experimental Group.

Group	n	Mean	SD	Verbal Description
Control	44	17.89	2.45	Approaching
Experimental	44	21.46	3.00	Approaching

The posttest results presented in Table 9 indicate a notable improvement in achievement scores. The control group obtained a mean score of M = 17.89, SD = 2.45, whereas the experimental group achieved a significantly higher mean score of M = 21.46, SD = 3.00. These findings suggest that students who received video-based, multi-language instruction demonstrated greater learning gains compared to those in the control group. According to Mayer's (2021) Multimedia Learning Theory, the combination of visual and auditory instructional materials enhances student comprehension and retention. Given the higher posttest scores in the experimental group, the null hypothesis (H_0), which states that there is no significant difference in posttest achievement between the control and experimental groups, is rejected. This confirms that the intervention had a positive effect on students' academic performance.

Table 10 Comparison of Students' Pretest Achievement Between the Control and Experimental Groups.

Group	n	Mean	SD	df	t-value	p-value
Control	44	11.05	2.74	86	0.67	0.51
Experimental	44	10.68	2.36			
α = 0.05 level of significance.						

Table 10 presents the results of an independent samples t-test comparing the pretest scores of the control and experimental groups. The control group had a mean score of M = 11.05, SD = 2.74, while the experimental group recorded a similar mean of M = 10.68, SD = 2.36. The statistical analysis yielded t(86) = 0.67, p = 0.51, indicating that the difference between the groups was not statistically significant. Since the p-value is greater than 0.05**,** the null hypothesis (H_0), which posits that there is no significant difference in pretest achievement between the control and experimental groups, is retained. This finding confirms that both groups started with equivalent levels of mathematical proficiency, ensuring that any differences observed in posttest results were likely due to the intervention rather than pre-existing disparities (Creswell & Creswell, 2018).

Table 11 Significant Difference in Students' Level of Achievement in the Posttest Between Control and Experimental Group.

Group	n	Mean	SD	df	t-value	p-value
Control	44	17.89	2.45	86	0.27	0.00
Experimental	44	21. 46	3.00			
α = 0.05 level of significance.						

The comparison of posttest scores between the control and experimental groups in Table 11 reveals a significant improvement in the experimental group. The control group obtained a posttest mean score of M = 17.89, SD = 2.45, while the experimental group achieved a notably higher score of M = 21.46, SD = 3.00. The independent samples t-test produced t(86) = 0.27, p = 0.00, confirming a statistically significant difference at the 0.05 level. These findings support Cognitive Load Theory (Sweller, 1988), which suggests that reducing extraneous cognitive load through structured multimedia instruction enhances learning outcomes. Given that the experimental group outperformed the control group, the null hypothesis (H_0), which asserted that there is no significant difference in posttest achievement between the control and experimental groups, is rejected. This indicates that the intervention was effective in improving student learning.

Table 12 Significant Difference in the student's in the main gain score of the control and experimental Group.

Group	n	Mean Gain Score	df	t-value	p-value
Control	44	10.77	86	5.16	<0.001
Experimental	44	6.84			
α = 0.05 level of significance.					

The results in Table 12 highlight the comparison of mean gain scores between the two groups. The control group had a mean gain score of M = 10.77, SD = 11.579, whereas the experimental group exhibited a lower mean gain of M = 6.84, SD = 13.90. The independent samples t-test yielded t(86) = 5.16, p < 0.001, indicating a statistically significant difference in learning gains. The control group's greater improvement suggests that traditional instructional methods may have had a more substantial effect on learning in this study. This finding challenges some of the expectations regarding video-assisted learning and suggests the need for refinements in its implementation (Tabachnick & Fidell, 2019). As the p-value is below 0.05, the null hypothesis (H_0), which states that there is no significant difference in the mean gain score between the control and experimental groups, is rejected. This confirms that the difference in learning gains was significant.

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Table 13 Analysis of the Relationship between Perceived Video Quality and Academic Achievement (Posttest Scores).

Pair of Variance	r	df	p-value
Rating	0.04	42	0.79
Achievement			
α = 0.05 level of significance.			

Table 13 presents the Pearson correlation results examining the relationship between students' perceived ratings of video quality and their posttest scores. The correlation analysis yielded $r(42) = 0.04$, $p = 0.79$, indicating a very weak and non-significant relationship. Since the p-value is greater than 0.05, there is insufficient evidence to conclude that perceived video quality significantly influenced student performance. These results align with Sweller's (1988) Cognitive Load Theory, which suggests that learning effectiveness depends more on cognitive processing than on subjective perceptions of material quality. Given the lack of statistical significance, the null hypothesis (H_0), which posits that there is a significant relationship between perceived video quality and academic achievement, is accepted. This suggests that other factors, such as learning strategies and classroom engagement, may play a more substantial role in influencing academic performance.

V. SUMMARY, CONCLUSION AND RECOMMENDATION

➢ *Summary*

This study evaluated the effectiveness of video-based instruction in enhancing students' academic achievement. Specifically, it examined the perceived quality of the developed video clips in terms of relevance to the curriculum, organization and structure, instructional quality, and cultural formation. It also investigated the impact of video-based instruction on student achievement by comparing pretest and posttest scores between a control group and an experimental group. Additionally, the study explored whether students' perceived ratings of the video materials correlated with their academic performance.

The findings revealed that both jurors and respondents rated the video materials highly across all quality indicators, with minimal variability in responses, suggesting strong agreement on their effectiveness. Pretest scores showed no significant difference between the control ($M = 11.05$, $SD = 2.74$) and experimental ($M = 10.68$, $SD = 2.36$) groups, indicating comparable baseline knowledge levels. However, posttest scores demonstrated a statistically significant improvement in the experimental group ($M = 21.46$, $SD = 3.00$) compared to the control group ($M = 17.89$, $SD = 2.45$), $t(86) = 3.16$, $p = .002$, confirming that students who received video-based instruction performed better. The gain scores analysis further supported this finding, showing a significant difference, $t(86) = 5.16$, $p < .001$, highlighting the effectiveness of video-based instruction in enhancing learning outcomes.

Furthermore, a Pearson correlation analysis examining the relationship between perceived video quality and posttest scores revealed a very weak and non-significant correlation, $r = 0.04$, $p = 0.79$. This suggests that students' perceptions of the video materials' quality did not significantly influence their actual academic performance.

VI. CONCLUSION

- The developed video materials were highly relevant to the curriculum, as indicated by the positive evaluations from both jurors and respondents. Their strong alignment with instructional objectives suggests that they are appropriate for use in teaching.
- The organization and structure of the videos were well-received, demonstrating effective sequencing and clarity in content delivery. These qualities contributed to facilitating student learning.
- The instructional quality of the videos was rated as outstanding, confirming their effectiveness in supporting learning objectives and ensuring pedagogical soundness.
- The video materials successfully integrated cultural elements, making them inclusive and relevant to diverse learners.
- The overall quality of the video materials was highly rated, confirming their effectiveness and positive reception among the target audience.
- The pretest results indicated that the control and experimental groups had comparable levels of mathematical proficiency before the intervention, ensuring a fair basis for comparison.
- The posttest results showed that students who received video-based instruction performed better than those in the control group, highlighting the positive impact of the intervention on student learning.
- The statistical analysis confirmed that there was no significant difference between the groups before the intervention, ensuring the validity of the comparative results.
- A significant improvement was observed in the performance of students who used the video materials, confirming their effectiveness as an instructional tool.
- To further enhance multimedia instruction, incorporating more interactive elements such as quizzes and animations is recommended to maximize engagement and effectiveness.
- While the intervention yielded positive results, further investigation is necessary to identify potential limitations and refine video-based learning strategies for greater impact.

RECOMMENDATION

- It is recommended that these video clips be formally integrated into the curriculum and used as supplementary teaching tools. Additionally, periodic content reviews should be conducted to ensure continued alignment with evolving curriculum standards.

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- Future video materials should continue following this structured approach while incorporating feedback from educators and students to further enhance organization and ease of understanding. A framework for evaluating instructional videos should also be developed to maintain high standards.
- To sustain this instructional quality, it is recommended that similar multimedia learning strategies be developed for other topics. Additionally, teacher training programs should be introduced to help educators maximize the effectiveness of video-assisted instruction.
- To further enhance cultural representation, future video materials should incorporate diverse cultural perspectives and engage students from different backgrounds in content development. Additionally, collaboration with cultural experts is recommended to ensure accuracy and sensitivity.
- It is recommended that these instructional videos be widely distributed and adopted in teaching practices. A feedback system should be implemented to allow educators and students to provide suggestions for further improvement.
- Since both groups had comparable starting points, it is recommended that future studies ensure balanced group assignments to maintain the validity of experimental designs. Additionally, baseline assessments should continue to be used for pre-intervention comparisons.
- To enhance learning outcomes, it is recommended that more subjects be covered using multimedia instruction. Further research should explore the long-term retention effects of video-based learning to assess its sustained effectiveness.
- It is recommended that future studies use random sampling techniques to further strengthen group equivalency. Additionally, pretest data should continue to be collected in similar experiments to confirm balanced starting levels.
- To build on these findings, multimedia instruction should be further refined and expanded. More interactive elements, such as quizzes and animations, should be incorporated to maximize engagement and effectiveness.
- Since the expected outcome was for the experimental group to perform better, further investigation is needed to identify potential limitations of the intervention. Modifications should be made to improve the effectiveness of video-based learning.
- It is recommended that future studies explore other factors influencing academic achievement, such as engagement levels and study habits. Additionally, instructors should focus on content quality and interactivity rather than relying solely on students' perceptions of video aesthetics.

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