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Video-Based Instruction in Teaching Mathematics 7

Irecor D. Abuton[1*]
[1] Department of Education – Oroquieta City Division, Oroquieta City, Misamis Occidental, Philippines
Corresponding Author email: *irecor.abuton@deped.gov.ph*

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Abstract
Aim: This study assessed the effectiveness of Video-Based Instruction in teaching Mathematics to Grade 7 students.
Methodology: A quasi-experimental study was conducted to 50 Grade 7 students who were randomly assigned into two groups: Control and Experimental Groups. One group attended a chalk-talk lecturing kind of instruction in teaching Mathematics. The other group was exposed to the Video-Based Instruction.
Results: This study revealed that Video-Based Instruction is an effective teaching strategy in teaching Mathematics. Video-Based Instruction was advocated by Dr. Christopher Rayner in 2011. This refers to the creation of videos by the teacher to be integrated in teaching a specific concept or content.
Conclusion: Students were more engaged in the proper lesson. Retention of the lesson was also evident through the comparison of their pretest and posttest scores.

Keywords: Teaching mathematics, video-based instruction, quasi-experimental

INTRODUCTION

Teaching Mathematics in today's mainstream classroom is a challenging task considering the myriad of academic and behavioral challenges present. Math lecturers have a nuanced job. They need to teach the building blocks of mathematics, like range sense and operational skills, also as boost student's ability to consider issues. They must include aspects of language, together with reading and writing into their subject and supply direct instruction on strategies of exploration. In addition, mathematics lecturers should inspire students to do and teach them to carry on once issues are difficult.

This is when technology takes part in teaching mathematics. It is essential that teachers and students have regular access to technologies that support and advance mathematical sense creating, reasoning, drawback resolution, and communication. Effective teachers optimize the potential of technology to develop students' understanding, stimulate interest, and increase proficiency in arithmetic. Once teachers use technology strategically, they will give larger access to mathematics for all students. The strategic use of technology strengthens arithmetic teaching and learning.

Relevant to the articulations presented, it was observed also among developed countries the prevailing issues on poor academic performance in mathematics among students. Mathematics education system is unjust. It operates ways in which leave a major proportion of scholars with negative mathematics experiences and inadequate preparations (Adiredja, 2018). Success rates, retention rates within the arithmetic pipeline are low in all education levels (Driskill, Enright, & al, 2017).

In the Philippines, the same concerns have been felt among private and public school teachers relevant to the identified problem under scientific investigation. In the area of primary education, the Philippines hierarchic 99th out of 138 economies. The Philippines hierarchic 69th in academic system, 112th in science and mathematics, and 76th on net access. Sen. Angara cited the world aggressiveness Report wherever the Philippines hierarchic a hundred and fifteenth out of 142 countries in 2011-2012. The report gauges the standard of a country's science education. Average National Achievement Test (NAT) scores on mathematics for Grade three students showed a drop from 62.8 % in 2007-2008 to 59.9 % in 2011-2012. Science scores conjointly swayback from 56.1 % to fifty-five. NAT performance of high schools in mathematics conjointly fell from 50.7 % in 2007-2008 to 46.3 % in 2011-2012.

Giving the foregoing, the researcher is convinced to scrutinize the issue on the possible usage of technology to purposively address the low performance in mathematics among students. Recent analysis in mathematical pedagogy advocates utilization of technology in an integrated manner, as well as a pedagogics to impart content.

The study is anchored on the Video-Based Instruction (VBI) which was advocated by Dr. Christopher Rayner in 2011 to use for autistic students. However, the ideas of enhanced self-management similarly as consistent instruction may be equally applied within the regular schoolroom, particularly in mathematics (Plavnick, 2015).

Video-Based Instruction refers to the creation of videos that a teacher makes outside of class contact hours that specifically teach a concept or content. It

differs from flipped or blended learning in that the video is viewed in the classroom during the lesson time, rather than at home. This means that the teacher is in control of the exact content to be presented in the videos, and different videos can be made at various levels, catering precisely to student needs. It also changes the teacher's role to that of facilitator or coach, able to roam around the classroom overseeing the various videos being used as students complete their work.

Teacher-created videos ensures content is differentiated as required, participating for college students each academically and behaviorally giving students autonomy and self-control of learning.

In an integrated classroom, particularly with often limited additional human resources (Plavnick et. al, 2015), utilizing VBI to provide differentiated content for mathematics ensures the range of learning abilities within the classroom is accommodated in an efficient and effective way.

The influence of digital videos on everyday culture is undeniable. Online video sharing sites such as YouTube, Vimeo and Metacafe boast monthly audience numbers in the millions. With digital videos continuing to gain popularity, it seems only natural that this familiar and widespread platform extends into the education setting.

Video as a teaching, learning and training tool has been successfully adopted by many educators in recent decades. However, the success of video as an instructional tool is very dependent on the design of demonstration material and also how it is employed. In addition, active learning must take place during the video presentation, thus learners should be mentally engaged in the learning process and motivated to learn.

Studies have shown that the utilization of short video clips permits for additional efficient process and memory recall. The visual and sense modality nature of videos appeals to a good audience and permits every user to method info in an exceedingly manner that's natural to them.

Video-Based Instruction is anchored on the following theories:

First, Cognitive psychology that explores the branch of mental science that deals with motivation, problem-solving, decision-making, thinking, learning, memory and attention. It states that there are 2 goals of all sorts of learning, together with multimedia system learning: memory and understanding; or retention and transfer. A retention check may be used to confirm what quantity data a learner has kept in mind; this test asks learners to put in writing all information they'll remember from a particular passage they have browsed. Similarly, a 19-transfer check may be used to test what quantity data a learner has understood; this test asks learners to perform the same set of tasks during which they, in how, apply the data given (Mayer, 2014).

Second, Dual-coding theory which assumes that humans possess separate channels for process visual and sensory system info. Allan Pavio's definition of dual-coding (or dual-channel theory) rests on a assumption that "there are 2 categories of phenomena handled cognitively by separate subsystems. From there, the overall level divides into verbal and non-verbal symbolic subsystems, which expand into sensorimotor (visual, auditory, haptic) subsystems (Paivio, 2019).

Third, the modality principle suggests that students learn higher from animation and narration than from on-screen text. This theory suggests that once pictures and texts are each presented visually, all the data is being processed through one channel, inflicting sensory overload. The modality principle tries to extend the capability of our remembering by presenting info using both aural and visual sensory modes. The modality result operates below the similar assumptions as the dual-coding theory. The idea assumes that parts of remembering are dedicated to aural process et al to visual processing problems, and be communicatory (Oberfoell, 2016).

Fourth, cognitive load learning theory deals with the amount of "mental energy" required to process a given amount of information. This assumption suggests that as the amount of information increases, so does the cognitive load on our mental resources (Sweller, 2018).

Fifth, Constructivist learning theory maintains that when skills are acquired in a meaningful context they have added value to the learner and thus learners with existing skills and previous experience in diverse areas should be predisposed to learning and can take advantage of previous real-world knowledge. Critically when using video, learners have the advantage of both auditory and visual symbol systems to provide visual systems which enable learners to construct detailed mental representations of the material provided thus providing additional and complementary information supporting learning. The advantage and superiority of video when learning complex skills and in exposing learners to situations where problems, equipment and events which could not have been otherwise demonstrated has been suggested (Bruner, 2018).

From the outgrowth of the following theories and concepts mentioned above, a reality that tell teachers and students experience the benefits of this pedagogy of using Video-Based Instruction. Therefore, this study aims to come up with proposed instructional videos in teaching mathematics to grade 7 students to improve the academic performance of the students.

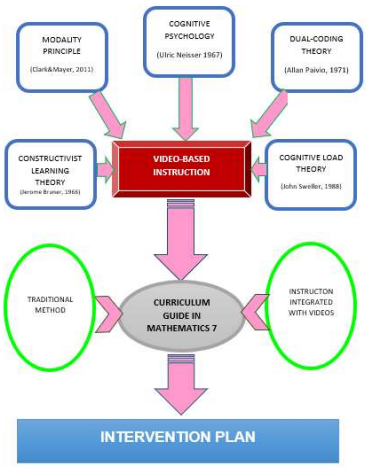

Figure 1. Conceptual Model of the Study

Objective

This research assessed the effectiveness of the use of video-based instruction in teaching Mathematics among Grade Seven students at Maximino Noel Memorial National High School, Carcar City, Cebu during the School Year 2019-2020 as basis for an intervention plan.

Specifically, the study sought answers to the following sub-problems:

1. What are the pretest and posttest scores of the Grade 7 students in the control and experimental groups?

2. Is there a significant difference in the pretest and posttest scores in the:

2.1 control group; and

2.2 experimental group?

3. Is there a significant mean gain difference in the performance among the Grade 7 students in the two groups?

4. Based on the findings of the study, what intervention plan can be crafted?

Hypothesis

The following hypotheses were tested at 0.05 level of significance.

Ho 1. There is no significant difference in the pretest and posttest scores in the

1.1 control group; and

1.2. experimental group.

Ho 2. There is no significant mean gain difference in the performance among the Grade 7 students in the two groups.

METHODS

Research Design

The researcher used the quasi-experimental method, basically used to show significant difference among various groups of subjects. It sought to establish a cause-effect relationship between two or more variables through the use of pretest and posttest design.

The two (2) groups consisted of Grade 7 students. The first group, Grade 7 – Sampaguita was assigned as the Control Group while the second group, Grade 7 - Sunflower was assigned as the Experimental Group. The control group had their usual lecture-exercise method while the experimental group was exposed to Video-Based Instruction. Both groups were composed of heterogeneous subject. The heterogeneous grouping was done during the first day of classes.

Prior to the conduct of the treatment, both groups were given a standardized pretest consisting of 25 items in a Multiple Choice type of test. After the pretest both groups are subjugated to the respective teaching methods accordingly. After the treatment, the researcher conducted posttests on both groups. The pretest and posttest results of both groups were collected, analyzed and statistically treated.

Participants

The participants of the study were those officially enrolled as Grade 7 in Maximino Noel Memorial National High School. This grade level had the most declared number of LARF's or Learners At Risk of Failing, based on the report of Quarterly School Monitoring, Evaluation, and Adjustment (SMEA) Conference.

Table 1. Distribution of Respondents

GRADE 7	RESPONDENTS
Control Group Sampaguita	25
Experimental Group Sunflower	25
TOTAL	50

Table 1 shows the two sections: Sampaguita and Sunflower in Grade 7 which served as the control and experimental groups, respectively. Each section is grouped heterogeneously. Grade 7 - Sampaguita consists of 25 students while Grade 7- Sunflower consists also of 25 students.

Instrument

The instrument was adapted from the test questions of Division Achievement Test (DAT) which was administered last school year 2017-2018 as part of the Standardized Testing Program under policies set by DepEd Carcar City Division. All questions were evaluated by committees of content experts, including teachers and administrators headed by the Educational Program Supervisor in Mathematics of Carcar City to ensure their appropriateness for measuring the Philippines educational content standards in Grade seven mathematics. Additionally, all things were reviewed and approved to confirm their adherence to

the principles of fairness and to ensure no bias exists with regard to characteristics like gender, ethnicity, and language.

The instrument focused on the 1st quarter competencies in Mathematics for Grade 7. This competencies were based on the K-12 Curriculum Guide in DepEd.

Ethical Consideration

The participation in the conduct of the study was voluntary and with respondents' free will. Research participants were not subjected to harm in any ways whatsoever. Respect for the dignity of research participants were prioritized. Full consents were obtained from the parents of the learners prior to the study. Furthermore, adequate level of confidentiality of the research data was secured.

Data Collection

A transmittal letter addressed to Carcar City Schools Division Superintendent was presented to his office to seek approval in conducting the said study. After which, a transmittal letter addressed to the school head of Maximino Noel Memorial National High School, was also presented with an attached copy of the approved request of the Schools Division Superintendent.

After the permission was obtained, the researchers identify the 2 sections on Grade 7 as subjects of the study. Grade 7 – Sampaguita was determined as the control group, in which the students were taught through lecture-exercises; while grade 7 – Sunflower was determined as the experimental group and were taught through the aid of Video-Based Instruction.

An orientation and agreement between the parents and the researchers were successfully obtained through the Informed Consent Letter. Thus, the researcher proceeded in conducting the study through the administration of pretest and posttest to both groups.

The teacher in the Control group remained to teach in a traditional way of lecture-teaching. On the other hand, the experimental group was exposed to different videos as supplemental instruction. The contents of the videos were based on the lessons for Grade 7 in accordance with the DepEd Curriculum Guide. Majority of the videos were taken from the DepEd Learning Portal called Learning Resources Management and Development (LRMDS). It is designed to support increase distribution and access to learning, teaching, and skilled development resources at the Region, Division and School Level. Educational websites also served as references and locations where videos can be downloaded.

After 3 months, the researcher collected the posttest of both groups. The data gathered were collected, retrieved, and tabulated

Treatment of Data

The researcher utilized statistical techniques to analyze the results of the quantitative questions. The following were the statistics used, Frequency Count, this was used to determine the number of occurrences of particular scores in the pretest and posttest. Simple Percentage, this was used to display data that specifies the percentage of observations that exist. Mean, this refers to the average that was used to derive the central tendency in the data. It was determined by adding all the data points gained in the pretest and posttest. T test was used to determine the significant difference of students' performance among the 2 groups: control and experimental.

RESULTS and DISCUSSION

This section reveals the pretest and posttest scores of the Grade 7 students. There were 25 students from the control group, and another 25 students from the experimental group.

Control Group

This part shows the gathered scores of the control group in their pretest and posttest.

Table 2. Pretest and Posttest Scores of the Control Group

Student	Pretest	Posttest
A	4	3
B	5	6
C	6	8
D	4	8
E	2	4
F	7	10
G	5	7
H	7	7
I	3	8
J	2	6
K	6	9
L	8	14
M	8	10
N	3	3
O	7	8
P	2	6
Q	10	15
R	4	5
S	3	4
T	1	3
U	5	4
V	6	6
W	3	4
X	8	10
Y	6	10
TOTAL	**125**	**178**

Table 2 shows the Pretest and Posttest scores of the 25 Grade 7 students in the control group. The alphabet letters, A-Y represent the students.

The total score gained in the Pretest was 125 while they gained 178 in the posttest. There was a difference of 53 points in the total gained scores.

It appears therefore that there was only a minimal improvement of the pretest and posttest results of the

students when taught through traditional teaching strategies.

This implies that teachers must have to adapt to the role of facilitators and not teachers alone. According to the social constructivism approach, a teacher is someone who gives a didactic lecture that covers the subject matter. On the other hand, a facilitator helps the learner to induce to his or her own understanding of the content. Within the former situation, the learners play a passive role and within the latter situation the learner plays a full of life role in the method. The stress therefore turns far from the teacher and the content, and towards the learner. This dramatic modification of role implies that a facilitator has to show a very completely different set of skills than a teacher. Content learned in this way is more meaningful to the students. It facilitates the transfer of what is learned in school to real-life (Waxman, et. al, 2016)

Experimental Group

This part shows the gathered scores of the experimental group in their pretest and posttest.

Table 3. Pretest and Posttest Scores of the Experimental Group

Student	Pretest	Posttest
A	3	10
B	5	12
C	7	14
D	11	19
E	9	11
F	5	12
G	7	18
H	3	10
I	5	9
J	6	17
K	3	9
L	5	11
M	5	16
N	3	8
O	6	18
P	2	7
Q	6	14
R	5	13
S	4	7
T	8	20
U	7	21
V	4	10
W	8	19
X	9	21
Y	4	7
TOTAL	**140**	**333**

Table 3 shows the Pretest and Posttest scores of 25 Grade 7 students in the experimental group. The alphabet letters, A-Y represent the students. The total score gained in the Pretest was 140 while they gained 333 in the posttest. There was a difference of 193 points in the total gained scores.

It appeared therefore that there was already distinct and evident improvement of the pretest and posttest results of the students in the experimental group.

Based on the study of Harris et al (2016), it was found out that technology is one of the factors in student educational accomplishment and motivation in school. With additional technology exposure for learners and more skilled development for teachers to hone new teaching strategies, technology is going to be the catalyst to assist learners accomplish higher educational performance. Technology may also improve the dynamics between teachers and students, usually resulting in increased learning.

Significant Difference of the Pretest and Posttest Scores

This section unveils the significant difference of the gathered pretest and posttest scores of the Grade 7 students in the control and experimental group. This was made possible through the use of the T test of significant difference specifically the paired-samples T test.

Control Group

This part shows the significant difference of the gathered pretest and posttest scores in the control group.

Table 4. Test on Significant Mean Difference Between the Pretest and Posttest Scores of the Control Group

Source of Difference	Mean	sd	Mean Difference	df	Computed t-value	p-value	Decision
Pretest	5.00	3.33	2.12	24	5.58	0.00	Reject the null hypothesis
Posttest	7.12	3.22					

Table 4 shows the Test on Significant Mean Difference between the Pretest and Posttest Scores of the Control Group. The mean difference was generated through subtracting the mean of the pretest scores which is 5.00 from the mean of the posttest scores which is 7.12, thus it resulted to 2.12. The standard deviation of the pretest is 3.33 and of the posttest is 3.22. This shows that the data are clustered closely around the mean. This gives an impression of having more reliable data due to a low standard deviation. The table also shows the computed t-value which is 5.58 and degrees of freedom which is 24.

Based on the data being shown, the computed p-value, 0.00 is lesser than the determined alpha level of 0.05. The computed significance level (0.00) increases the probability of rejecting the null hypothesis. Thus, the T-test has resulted to rejecting the null hypothesis. Undoubtedly, there is a significant difference in the pretest and posttest scores in the control group.

The results imply that the traditional strategies in teaching mathematics still give an increase of scores yet very minimal from the students' pretest to posttest results. Since there was only a minimal increase, thus it did not give an impressive impact to the academic performance of the Grade 7 students. It shows that traditional methodology

appears to have some disadvantages. Lessons are typically taught by the teacher introducing skills employing a chalkboard amid a verbal clarification or lecture. According to a study, "Disadvantages of Traditional Classroom Training", this style of learning doesn't allow pupils to have deeper levels of understanding required for complex concepts and lifelong learning. Students are also spoon feed in the traditional teaching. They are always dependent on their teachers which suppresses the creative side of their personality.

Experimental Group

This part shows the significant difference of the gathered pretest and posttest scores in the experimental group.

Table 5. Test on Significant Mean Difference Between the Pretest and Posttest Scores of the Control Group

Source of Difference	Mean	sd	Mean Difference	df	Computed t-value	p-value	Decision
Pretest	5.60	2.24	7.72	24	11.84	0.00	Reject the null hypothesis
Posttest	13.32	4.68					

Table 5 shows the Test on Significant Mean Difference between the Pretest and Posttest Scores of the Experimental Group. The mean difference was generated through subtracting the mean of the pretest which is 5.60 from the mean of the posttest scores which is 13.32, thus it resulted to 7.72. The standard deviation of the pretest is 2.24 and of the posttest is 4.68. This shows that the data are clustered closely around the mean. This gives an impression of having more reliable data due to a low standard deviation. The table also shows the computed t-value which is 11.84 and degrees of freedom which is 24.

Based on the data being shown, the computed p-value, 0.00 is lesser than the determined alpha level of 0.05. The computed sig level (0.00) increases the probability of rejecting the null hypothesis. Thus, the T-test has resulted to rejecting the null hypothesis. Undoubtedly, there is a significant difference in the pretest and posttest scores in the experimental group.

The results imply that Video-Based Instruction gives a positive impact in teaching Mathematics to Grade 7 students. Videos increase data retention, since they will be stopped and replayed as over and over as required. They will even be reviewed long once the initial lesson was taught. It absolutely was known that this approach implies that students 'can dramatically impact the pace of the course' because it allows learners to proceed at their own rate (Kuiper, et al 2015). Studies have shown that the utilization of video clips permits for a lot of efficient processing and memory recall. The utilization of videos in teaching doesn't solely profit the students, but also teachers (Bevan, 2017).

Mean Gain Difference among the Two Groups

This section reveals the mean gain difference among the two groups: control group and experimental group. This was made possible through the use of the T test of significant difference specifically the independent samples T test.

Table 6. Test on Significant Mean Gain Difference Between the Control Group and the Experimental Group

Variables	Mean	Mean Gain Difference	t	df	Sig	Std. Error Difference	95% Confidence Interval of the Difference	
							Lower	Upper
Control	2.12	5.60	7.42	48	0.000	.755	4.08	7.12
Experimental	7.72							

Table 6 shows the Test on Significant Mean Gain Difference between the Control Group and the Experimental Group. The mean gain of the control group which is 2.12, and the mean gain of the experimental group which is 7.72 has a mean gain difference of 5.60. The standard error mean difference of .755 is an indication that the sample mean is a more accurate reflection of the actual population mean. The researcher is 95% confident that the mean scores of all Grade 7 students in this school is between 4.08271 and 7.12. The table also shows the computed t-value which is 7.42 and degrees of freedom which is 48 when equal variances are assumed.

Based on the data being shown, the computed sig level (2 tailed), 0.000 is lower than the determined alpha level of 0.05. The computed sig level (0.000) increases the probability of rejecting the null hypothesis. Thus, the T-test has resulted to rejecting the null hypothesis. Undoubtedly, there is a significant difference in the posttest scores of the Grade 7 students in both control and experimental groups. It appears therefore that the students got higher scores with the teacher's utilization of Video-Based Instruction compared to the use of traditional teaching strategies in teaching Mathematics.

This implies that students learn and perform better when instruction or remediation is presented through videos. The pc programs are interactive and may illustrate a plan through engaging animation, sound, and demonstration. Moreover, they permit students to progress at their own pace and work one by one or in a very cluster. Students are visual creatures, thus they appreciate to learn using this medium. This is the reason why digital videos gain popularity. It appears solely natural that this familiar and widespread platform extends into the academic setting (Bevan, 2017).

Based on Ash Pandey's article, "Examples of Video-Based Learning For Corporate Training", there

are 8 examples of videos that reflect diverse design approaches. These are the following: Animated Videos Featuring Infographics and Text; Scenarios Or Story-Based Videos Featuring People; Explainer Videos Featuring Experts; Explainer Videos Featuring Concepts Through A Story/Narrative; Videos Featuring Kinetic Text (With Static Background); Videos Featuring Kinetic Text And Videos In The Background; Videos Featuring Whiteboard Animation; and Interactive Videos (Pandey, 2018). This goes to show that as technology is more and more utilized in the teaching method, it's turning into additional powerful tool in putting the multiple intelligences to use. The association of technology and Gardner's multiple intelligences theory will profit not solely the scholars however also the teachers similarly (Dimick, 2016).

An interesting web log post by Sonia Jackson who wrote concerning trendy teaching strategies for obtaining sensible states: "The ancient "chalk and talk" methodology of teaching that's persisted for many years is currently exploit inferior results when put next with the additional modern and revolutionary teaching methods that are obtainable to be used in faculties nowadays. Larger student interaction is inspired, the boundaries of authority are being lessened, and attention on enjoyment over grades is emphasized." (Jackson, 2014).

Thus, the findings gave the impression that technology contributes to students' performance, provided that it is used in an adequate way.

Conclusion

Based on the findings, there is a significant difference in the performance among the Grade Seven students in the two groups. It is then safe to conclude that with the use of Video-Based Instruction, (VBI), the students had shown promising performance in Mathematics. Hence, the study shows that Video-Based Instruction is an effective teaching strategy in teaching Mathematics to Grade 7 students.

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