Teacher-Made Multimedia Instruction: Its Effect on Students' Academic Growth in Mathematics

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ABSTRACT

This study seeks to investigate whether there is a significant difference in the students' growth in mathematics before and after the implementation of teacher-made multimedia instruction. It has been known that multimedia increases students' academic growth and makes lessons more enjoyable and understandable. In this study, teacher-made multimedia instructions were used to supplement the printed modules provided by the school in modular distance learning. True experimental research design was used in the study to the grade 11 HUMSS students of Tamlang National High School. There were 30 respondents, and they were divided into two. The first 15 respondents belonged to the control group and the other 15 is in the experimental group. For data collection, a teacher-made test which was validated with experts' opinion and Pearson's R Correlation Coefficient to determine the reliability index were used. The data from the teacher-made formative test was analyzed with SPSS program. The study revealed that both the control and experimental group has a significant difference from their pretest to posttests scores. It can be further exemplified that in the control group, only a slight increase happened but in the experimental group where the pre-test and post-test has a p-value of .000 which is below the 0.05 level of significance is interpreted as "Significant". An increase from the pretest to posttests mean scores of the experimental group after the implementation of teacher-made multimedia instruction denotes a significant difference in their academic growth in mathematics. At the end of the study, it has been concluded that the effect of teacher-made multimedia instruction has greatly increased the academic growth of students in mathematics compared to the printed modules. It is hereby recommended to supplement the printed modules with the teacher-made multimedia instructions and provide teachers an avenue to develop their technological skills.

Keywords: Teacher, Academic Growth, students, multimedia, Philippines

INTRODUCTION

Background of the Study

Teachers have been using the traditional method of teaching the lessons to the students, the use of chalk and talk method (Fernandez, 2019). However, face to face learning has been put on hold due to the COVID-19 pandemic. In today's new normal, many schools opted to adopt the printed modular distance learning which resulted to lack of interest, boredom, and minimal learners' participation. This may not help in addressing students' difficulty in learning mathematics.

Other distance learning modalities are not feasible because of internet connectivity problem which pushes the school to provide tablet to selected learners. This tickles my mind to innovate new strategies to aid and enhance distance learning through a teacher-made multimedia instruction. The use of Teacher-Made Multimedia Instruction will be initiated to provide a more meaningful learning experience to the students. Through this, an offline multimedia instruction can be uploaded, and they can study their lesson anytime of their convenience. With the support of advanced technology, distance learning can become more flexible and effective (Abas, 2015; Rehn, 2017).

Nowadays, media devices become increasingly portable and reach even further through every student's home. The use of technology during the teaching-learning process can improve students' learning meaningfully (Hermawan et al., 2018). Using technology-based applications such as learning video, the learning process can still be done even at home (Wijaya,2021). Targeting these things that has become a part of their day-to-day living is more helpful in improving their academic performance.

Students appear to find videos including the instructor's image to be more engaging (Pi et al.,2017). Furthermore, evidence suggests that the act of watching video-modelling where an instructor performs a task has been shown to increase the confidence of students in believing they could also perform the same task (Hoogerheide et al.,2016). It does seem that most learners state a preference for video with the instructor's image present, and that this can have positive impact. The learners can access videos at different times suitable for their need (Bao, 2020).

Tamlang National High School, as a far-flung area of the Division of Escalante City, opted the Printed Modular Distance Learning. Printed Modular distance Learning is the most appropriate modality to provide quality education to Tamlang learners amidst the pandemic. However, there has been generally a growing awareness of the need to improve the preparation of printed modules and still look for a more effective ways to improve students' performance.

Turning my full attention as researcher to this fact requires harnessing the power of multimedia for teaching and learning. Using multimedia in instructional delivery aims to enhance students' academic performance while keeping them the things that interest them the most. In this light, the researcher is motivated to determine the effect of using teacher-made multimedia instruction in improving Grade 11 HUMSS students' academic performance in mathematics.

Statement of the Problem

This study focuses on the effect of teacher-made multimedia instruction on Grade 11 HUMSS students' academic growth in mathematics during the second quarter of school year 2021-2022.

Specifically, it intends to answer to the following research questions:

1. What are the levels of academic growth in the pretest and posttest scores of the control group?
2. What are the levels of academic growth in the pretest and posttest of the experimental group?
3. Is there a significant difference between the pretest and posttest mean scores of the students in the control and experimental group?

Hypothesis

There is no significant difference between the pretest and posttest mean scores of the students in the control and experimental group.

THEORETICAL FRAMEWORK

This study is anchored to the Cognitive Theory of multimedia learning by Richard E. Mayer. Mayer's multimedia principle states that "people learn more deeply from words and pictures than words alone" (Mayer, p.47). According to him, pictures and texts entering the eyes and ears are held in the visual and auditory modalities of the short-term memory. The cognitive model culminates at integration which brings verbal and pictorial models together with prior knowledge in the long-term memory, as learning consolidates (Mayer,2002).

This theory proposes three main assumptions when it comes to learning with multimedia. First, there are two separate channels (auditory and visual) for processing information (sometimes referred to us the Dual-Coding Theory). Second, each channel has a limited capacity. Third, learning is an active process of filtering, selecting, organizing, and integrating information based upon prior knowledge. Mayer's cognitive theory of multimedia learning presents the idea that the brain does not interpret a multimedia presentation of words, pictures, and

auditory information in a mutually exclusive fashion; rather, these elements are selected and organized dynamically to produce logical mental constructs.

In the implementation of multimedia, it is accepted that the human mind is a two-channel system of information processing with limited capacity. It has visual/pictorial and verbal/auditory processing channels (Mayer, 2003). Once the human mind receives information for cognitive processing, it selects, organizes, and integrates the mental representations promoting meaningful learning.

It has been pointed out that audio-visual aids are beneficial to learning due to the audio-visual processing channels of human mind which register pictures, words and sounds in the sensory memory. Hence, Richard E. Mayer supports the framework of the study.

CONCEPTUAL FRAMEWORK

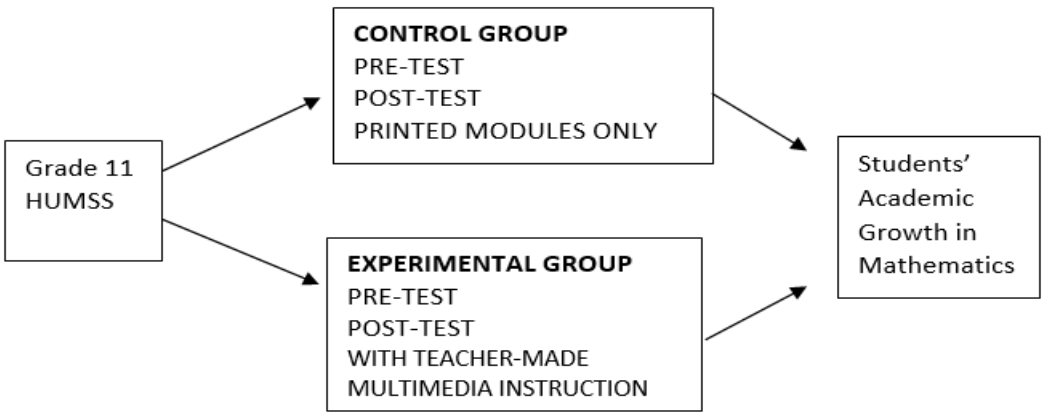
The input of the study will be the Grade 11 HUMSS students of the researcher. Out from 63 enrollees, the researcher will randomly select 15 students for the control group and another 15 students for the experimental group. Both the control and experimental group will undergo the pretest and posttest which covers the topic about the key concepts of random variables and probability distributions.

The control group will only use the printed modules provided by the school while the experimental group will be supplemented with teacher-made multimedia instruction. This teacher-made multi-media instruction is the treatment to enhance students' performance in mathematics. The duration of the study will start from the first week up to the second week of the third quarter. The effect of the teacher-made multimedia instruction will be determined through the conduct of a teacher-made summative test. This is a 20-item multiple choice type of test.

The growth of the students in mathematics will be measured by comparing the pretest and posttest mean scores of each group, the control and experimental. The posttest mean scores of the control and experimental mean scores will then be compared to determine if there is a significant difference between students who studied with printed modules only and those with teacher-made multimedia instruction. Based on the result, recommendations will be made accordingly.

Presented below is the schematic diagram for a better understanding of the flow of the study.

Figure 1 The schematic diagram of the conceptual framework of the study



SCOPE AND LIMITATIONS

This action research studies the effect of the teacher-made multimedia instruction in enhancing students' academic growth in mathematics. This will be conducted to 30 Grade 11 HUMSS students of Tamlang National High School for school year 2021-2022. The topic will cover the first two weeks of the third quarter in Statistics and Probability, specifically it focuses on the key concepts of random variables and probability distributions.

There will be two groups of respondents, the control and experimental group. Both groups will be chosen randomly from the 63 officially enrolled students of Grade 11 HUMSS, in which the control group and experimental group must have 15 respondents each.

Results and findings of the study are exclusively dependent on the responses of the participants and the strategies and statistical tools employed.

Significance of the Study

The following individuals, groups, and organizations are the beneficiaries of the results of the study:

Department of Education. The result of this study will provide data to the Department of Education on how effective teacher made multi-media instruction is. They can identify proper intervention and find ways to address whatever needs that will be determined.

School Administrators of Tamlang National High School. The result of this study will provide data for the school heads to make plans about training and seminars to teachers to support this instructional delivery.

Curriculum Planner. The result of this study will give the curriculum planner an information about the importance of the use of multi-media in teaching mathematics and plans program to further improve the strategy.

Teachers. The result of this study will give teachers an idea on how to teach the students with the use of teacher-made multimedia and be creative in delivering the lessons.

Parents. The result of this study could lessen the burden of the parents in assisting their child to learn in the printed modules for teacher-made videos are given. This could further give them an idea in supporting their child in watching educational videos at home.

Students. The result of this study will motivate students to study with the use of multimedia instruction and an opportunity to learn more through the different teaching strategies.

Researcher. The result of this study will help the researcher to decide an appropriate method in teaching the students amidst the pandemic.

Future Researcher. The result of this study will provide other researchers base-line data of conducting similar studies utilizing other variables which is not yet explored in this study.

Definition of Terms

The following terms are defined conceptually and operationally for readers to grasp the content of the study.

Academic Growth – Conceptually, it is a collection of definitions, calculations, or rules that summarizes student performance over two or more time points and supports interpretations about students, their classrooms, their educators, or their schools (Bennette,2019). Academic Growth means the calculation to determine the change in student achievement over two or more moments in time (https://www.lawinsider.com/dictionary/academic-growth). It also refers to academic progress made over a period of time, as measured from the beginning to the end of the defined period (https://www.edglossary.org/achievement-growth/).

Operationally, it is the progress of students' level of performance from pre-test to post-test of the study.

Distance Learning – Conceptually**,** it is a form of learning that takes place between a teacher and students who are geographically separated during instruction (Llego,2020). Distance learning, also called distance education, is a form of education in which the main elements include physical separation of teachers and students during instruction and the use of various technologies to facilitate student-teacher and student-student communication (Berg and Simonson, 2016). Distance learning is defined as education where instruction and learning take place at a distance or not in the same physical space. Often this type of education spans temporal boundaries since it is predominantly delivered asynchronously or not in real time using an array of digital technologies (Allen, 2017).

Operationally, distance learning is the education of students who may not be physically present at school. This refers to the printed modular distance learning that Tamlang National High School is adopting during this pandemic time.

Mathematics – Conceptually, is the science of structure, order, and relation that has evolved from elemental practices of counting, measuring, and describing the shapes of objects (Knorr, et.al., 2020). It is also the study of numbers, shapes, and related structures (Stewart,2020). It is the science that deals with the logic of shape, quantity, and arrangement. It is the building block for everything in our daily lives, including mobile devices, computers, software, architecture (ancient and modern), art, money, engineering and even sports (Hom and Gordon, 2021).

Operationally, mathematics refers to the subject statistics and probability that the students are taking during the conduct of this study.

Multimedia – Conceptually, is a multisensory, interactive and integration of various digital contents acts by conveying information or message to the audience (Agnew, Kellerman, & Meyer, 1996). Schnotz and Lowe (2003) define the term multimedia as the combination of multiple technical resources for the purpose of presenting information represented in multiple formats via multiple sensory modalities. It is also the field concerned with the computer-controlled integration of text, graphics, drawings, still and moving images (Video), animation, audio, and any other media where every type of information can be represented, stored, transmitted, and processed digitally (Marshall,2001).

Operationally, multimedia is the use of audio-visual presentation in teaching the students.

Multimedia Instruction – Conceptually, this refers to a lesson containing both words and pictures, where the words can be in spoken form or printed form and the pictures can be in static form (such as illustrations, charts, graphs, or photos) or dynamic form (such as animation or video) (Mayer,2019). Multimedia Instruction is also known as learning media, which involves information technology in the form of computer or Android, by bringing together two or more elements consisting of voice, video, text, and images incorporated in a multimedia software for students interactively (Iskandar, et.al., 2018).

Operationally, multimedia instruction is the use of teacher-made videos to supplement the printed modules given by the students.

REVIEW OF RELATED LITERATURE

This section presents related literature and studies which have importance to the current study. These literature and studies will provide the researcher a broader knowledge and background on the effect of teacher-made multimedia instruction to students' academic growth in mathematics.

Nowadays, many researchers embark into the study of the effectiveness of integrating multimedia to make teaching and learning more conducive, because modern world would not be modern without the influence of multimedia in which digital natives spend most of their lives. With this great influence on the teaching and learning environment, especially during the COVID 19 pandemic where a lot of modalities are being adopted, many teachers in the division of Escalante City are also strengthening their methodologies and strategies in teaching mathematics to keep abreast of ever-changing world.

There are recent studies that have similarities with the present study. In fact, the study of Woolfitt Z. (2015) is relevant to this study because it talks about the integration of multimedia instruction especially video-assisted instruction to determine the effects in the teaching learning process. The same is true with the study of Abragan (2017) whose study is all about the use of technology to improve and enhance the performance of learners. Despite the challenge to address the problems in teaching the students in todays new normal, the discoveries of the printed modular distance learning which replaces the conventional chalk and talk method, and multimedia instructions greatly contributed to the realization of the present study.

However, according to Dargo, J. (2021) who studied the effect of modular distance learning in the academic performance of students in the new normal, printed module is an additional workload to working parents, there

is limited teacher-learner interaction, learners lack socialization with other children and have no exposure to significant school activities but are rather exposed to many distractions at home. In his study, there was a significant decrease in the academic performance of the students. In addition, simplifying of modules accompanied by video lessons and audio recordings are recommended to bridge the gaps brought by the modular distance learning.

On Multimedia and Modular Distance Learning

Foreign Related Studies

Multimedia instruction is very effective to teach students a wide range of discipline (Islam,2020). It is self-paced and students usually enjoy watching videos. The learning achievement of the multimedia learning class student is better than the conventional class student (Iskandar, et. al., 2018). That is why an integration of multimedia in teaching is very vital.

The study of Berk (2009) on multimedia teaching with video clips enumerated potential outcomes to ponder. It says that this approach grab students' attention, focus students' concentration, draw on students' imagination and improve attitudes toward content and learning. This could also further increase understanding, foster creativity and stimulate the flow of ideas. This is just some of the good points that multimedia can do to inspire students and make learning fun.

Gebre Yohannes also embarked into the study of the "Impact of Multimedia in Teaching Mathematics". In this study, it was concluded that multimedia-based teaching and learning process changes dramatically the performance of the students. In multimedia teaching, the presentation of the lesson can be more organized and comprehensive. It is an effective tool in teaching modules which have complex difficult concepts to understand using the theoretical way of teaching. This study emphasized that multimedia teaching is more effective than traditional way of teaching.

A lot of students' achievement have improved through the application of realistic mathematical education assisted interactive multimedia (Rahayu and Natsir, 2020). The use of multimedia elements in learning materials had much-improved students' learning experiences. Multimedia learning materials allow students to learn at their own pace and address their different senses. Through the learning with integration of multimedia-mediated content, students' learning achievement was improved, and it had helped students to develop a better understanding of the concept and ideas (Kiat, et.al.,2020).

The use of multimedia brings teaching methods into the 21st century and helps students catch the dream of success in the 90s and beyond (De Sausa,et.al.,2017). Prior to the advent of technology and the use of multimedia in various fields, it has been a dream of our forefathers to create a more effective strategy to teach the young ones. And it is the ultimate goal of the researchers to turn those dreams into reality.

Local Related Studies

Education in the new normal is a backbreaking endeavor in the Philippines to push through education amidst the fatal pandemic caused by covid-19. According to San Antonio (2020), the Undersecretary for Curriculum and Instruction, distance learning may be implemented through the following delivery modalities, namely Modular Distance Learning (Digital or Printed), Online Distance Learning, TV-Video (SLM-based or MELCs Mapped)/Radio-based Instruction, and Blended Distance Learning. Of all the alternative learning modalities offered, most students prefer to use the "modular" distance learning option (Malipot, 2020).

The study of Anzaldo (2021) entitled "Modular Distance Learning in the New Normal Education Amidst Covid-19" conducted at Talisay Elementary School, Talisay Calatagan, Batangas, enumerated advantages and disadvantages of distance learning. The advantages of distance learning include the realization of parents in the important role in their children's education and teachers become open-minded with the challenges brought by the pandemic. However, there are also disadvantages that distance learning has during these times. These include that not all learners do their modules committedly and parents are having a hard time teaching their children. The study recommended that it would be better if there would be ample time for the quality checking of its

content. There should also be areas, particularly in Mathematics, where the lessons should be presented in a more comprehensive manner to be best understood by students.

The study of Fernandez (2019) conducted to grade six pupils of Pasima Elementary School in Pangasinan on the effectiveness of Video Assisted Instruction emphasizes that "video assisted instruction can help teachers to enhance their students' performance, but it is best if it is combined by the traditional instruction". In her study, it was highlighted that video assisted instruction should be combined with the chalk talk method but since we are already in the new normal in which face to face instruction is not allowed, the printed modular distance learning in which Tamlang National High School adopted, replaces the traditional method of teaching. Furthermore, she noted that video materials should be recommended for use and teacher should use conventional instruction combined with the video assisted instruction to enhance better the performance of the learners.

However, Cortez (2020) studied the 342 senior high school students of different strands from STI College Global City about Blended, Distance, Electronic and Virtual-Learning for the New Normal of Mathematics Education. The result indicates that the subjects' perception on the effectivity of online learning and their capability to attend the e-learning sessions is independent of their lifestyle and available e-learning tools despite the result analysis of variance showing that their perceived mathematical capability is significantly different.

From the studies above, it is obvious that there is a need to innovate strategies to lessen the disadvantages brought by the distance learning. This is not to prohibit distance learning in the field, but to supplement the present learning modality with a more interactive strategy.

On Multimedia Instruction and Academic Growth

Foreign

Several studies focused on the significant difference in the performance of students after being exposed to a certain intervention. One of which is the study of Thomas and Israel (2013) on the effectiveness of animation and Multimedia teaching on students' performance in Science Subjects. Though mathematics is different, these two subjects are not far from each other in developing critical thinking to students. The findings of the study revealed that there was a significant difference in the performance of student exposed to cartoon style multimedia teaching and those that are conventionally taught. It was therefore recommended that the use of multimedia teaching should be encouraged so as to complement other methods of teaching.

Based on the case study of (De Sousa, et.al.,2017) entitled "The effect of multimedia use on the teaching and learning of Social Sciences at tertiary level", multimedia instruction can be efficient and effective because it is a self-paced learning, it includes video/audio production and provides autonomy in the learning process. Direct learning models supported by learning videos is very effective for the learnings of the students (Warju,2020).

Multimedia also helps to ease learning, by enabling students to learn at home which improve student learning skills (Akinoso, O. 2018). Through multimedia instruction, students have the flexible time to study whenever they want with the proper guidance of their parents.

One study of Krishnasamy (2020) developed Multimedia Prob-ability and Statistics System (MMPASS) and determine its effects on students' learning experiences towards performance in Statistics and Probability. It is one of the effective IT capabilities in improving performance of teaching and learning mathematics. The findings of their study showed that students' learning experiences and performances have been improved by using MMPASS.

There was also a study on Incorporating Multimedia as a Tool into Mathematics Education by Ahmad, et.al., (2010). This aimed to compare if there is any difference to students' achievement if they are using more interactive approach as the tools in teaching. The findings of this study showed that students who were exposed to teaching with multimedia aid scored higher compared to the students who were exposed to the traditional method. This showed that teaching students using multimedia can stimulate the students understanding faster and better compared to traditional method. It may be due to factors such as the multimedia treatment provide a visual presentation, 3D shapes, which is more interesting and easier to absorb. In conclusion, integrating

computers or technology is important because we are moving through technological age and computers provide an efficient way and variety of learning.

Local Studies

The studies of Yllano and Tayaben (2019) in Adventist University of the Philippines Academy revealed the positive effect of Multimedia-based Instruction in enhancing achievement and attitude of students. Mathematics teaching and learning with the aid of multimedia technology produces positive learning opportunities for students.

The utilization of media to enhance instructing and learning supplements conventional ways to deal with students' learning. Capuno, et.al., (2019) assessed the extent of instructional media utilization and the academic performance of the Grade 3 pupils in mathematics in a public elementary school in Cebu City, Philippines. With media, it engages students, aids them in knowledge retention, as well as motivates them.

Honrales (2017) of Samar State University quoted that "Audio-visual approach is one of the strategies used in instruction to break the monotony of the usual classroom setting". In this study, audio-visual approach was proven effective in learning Algebra. The study recommended that audio-visual approach be used in remedial instruction in mathematics. Teachers should be encouraged to use varied instructional materials in teaching the subject. There should be a strong support from the government in providing audio-visual facilities for instruction in Mathematics to students in the Philippines.

Synthesis

The COVID-19 pandemic has drastically altered the usual ways of teaching and learning process. We have witnessed a rapid transition from traditional to new normal. This calls a lot of educators to innovate something to keep abreast with the demand to continue delivering instruction despite the health threat of the pandemic. Because of this, the Department of Education, in its wish to continue delivering instruction, resorted to different distance learning delivery modalities – one of which is printed modular distance learning in which Tamlang National High School also adopted. The need to improve the performance of students urges the researcher to study the effectiveness of multimedia instruction to enhance students' academic growth in mathematics.

Various related studies to multimedia instruction were considered. It was concluded in most of the studies that the use of multimedia has strongly influenced the field of education. It was discovered that teaching and learning can be influenced by a multimedia instruction. Students can learn new information due to multimedia provision of easiness and facilities in education.

Multimedia instruction increases student engagement and enhances learning. This technology brought important innovations in education. Integration of technology across the curriculum will provide numerous opportunities for students to learn new things on their own. Indeed, multimedia offers avenues for learning not possible with other methods.

METHOD

This section discusses the research design, the participants, and the instrument/s used in this study.

Research Design

This study uses the action research design and the true experimental research method. There will be two groups of participants, the control and experimental group. The experimental group will still be given printed modules and will be supplemented with teacher-made multimedia instructions while the control group will be utilizing the printed modules only.

This is the most appropriate research design because an existing problem requires true experimentation.

Respondents of the Study

The respondents of this research study are the thirty (30) grade 11 HUMSS students of Tamlang National High

School for school year 2021-2022. Simple random sampling will be utilized wherein participants will be drawn from a fishbowl. There will be fifteen (15) participants for the control group which uses the printed modular distance learning materials. Fifteen (15) participants will also be drawn as experimental group which is exposed to teacher-made multimedia instruction. The levels of their academic performance will be determined through a pretest and posttest which will be done during the third quarter of this school year.

The table below presents the distribution of the respondents of the study.

Table 1 Distribution of Respondents

Group	Section	Population (N)
Control Group	HUMSS	15
Experimental Group		15
Total		**30**

Instruments

The instrument to be used will be the teacher-made summative test based on the competencies of the first two week of the third quarter in Statistics and Probability. A pretest and posttest are to be conducted to thirty (30) grade 11 HUMSS students. It is a 20-item multiple choice type of questionnaire. The research instrument will undergo face and content validity using the Good and Scate's Validity tool by 3 experts in the field of Research and Mathematics. After which, a reliability/pilot test will be given to the non-participant grade 11 students, who shared the same characteristics as the target participants using the Pearson's r Correlation Coefficient.

The materials to be used in the conduct of the study are the teacher-made videos which will undergo quality assurance from one of the experts in the field of ICT.

Validity

The face and content validity were established using Good and Scates' Validity Tool, which asked the validators to identify essential and non-essential test questions. The researcher had three validators who are public-school teachers and have long years in the teaching profession. The first validator is currently the head teacher I of Tamlang National High school. He had served 20 years in teaching mathematics before he became a school head. The second validator is the math coordinator of Tamlang National High School who is teaching mathematics for more than 13 years. The third validator is the Teacher-In-Charge of Tamlang National High School Binaguiohan Extension Class who is a Doctor in Philosophy major in Educational Management.

Using the criteria developed for evaluating survey questionnaires set forth by Carter V. Good and Douglas Scates, the validators rated the questionnaire with 1 as poor and 5 as excellent. The validity status got a rating of 4.96, interpreted as "high validity".

Reliability

Reliability refers to the degree to which an instrument yields consistent result (Li, 2016). The researcher asked permission to the School Head of Tamlang National High School to conduct a reliability test to 30 Grade 11 students who shared the same characteristics with the target participants.

To establish the reliability of the instrument, split half method was used. It is an internal consistency reliability test appropriate for questionnaires that uses a multi-item test where all the items are intended to measure the same variable. The researcher employed odd-even reliability, which means divide the test into halves by assigning odd numbered items to one half of the test and even numbered items to the other. The researcher solved for the correlation of scores between the two halves by using the Split-Half Method, then to test the reliability of the instrument the Pearson r Correlation was used.

A reliability coefficient of .70 or higher is considered "acceptable" in most research situations (Glen, S.,2014). In this study, the obtain value is .803 and is considered as "reliable". It implies further that the items have relatively high internal consistency.

Data Gathering Procedure

In the conduct of the study, a letter of permission was first given to the office of the school head for approval. Then, the consent from the parents and students followed. After which, the implementation in the conduct of the use of teacher-made multimedia instruction will commence.

The respondents are called to take the pre-test in a face-to-face manner. After taking the pre-test, both groups are given printed modules but only the experimental group was being supplemented with teacher-made multimedia instructions. After two weeks, respondents will come back to take the post-test. Students were only given 30 minutes to answer in both pre-test and post-test.

The minimum health standards such as social distancing, wearing of face mask and face shield are observed upon administering the test. The test scores of the two groups will be tallied, computed, and interpreted using SPSS software.

Statistical treatment

All the gathered data will be tabulated and analyzed using a variety of statistical tools.

For problem 1, To determine the levels of students' academic performance in the pretest and posttest of the control group, mean must be used.

For problem 2, To determine the levels of students' academic performance in the pretest and posttest of the experimental group, mean must be used.

To determine the level of academic growth of grade 11 students in the control and experimental group, verbal interpretation of the mean will be applied based on Deped's Grading System.

Verbal Interpretation	Range of the Mean Score
Outstanding	18-20
Very Satisfactory	17-17.9
Satisfactory	16-16.9
Fairly Satisfactory	15-15.9
Did not meet Expectations	15 below

For problem 3, To determine if there is a significant difference in the pretest and posttest mean scores of the control and experimental group, the following are to be used:

a. To determine if there is a significant difference in the pretest and posttest of the control group, paired samples t-test must be used.
b. To determine if there is a significant difference in the pretest and posttest of the experimental group, paired samples t-test must be used.
c. To determine if there is a significant difference in the post test mean scores of the control and experimental group, independent samples t-test must be used.

Ethical Considerations

During the conduct of the study, strict observation of ethical considerations was done. Starting from the consent of the respondents up to the approval from higher authorities. Respondents should participate on the basis of informed consent. The principle of informed consent involves researchers providing sufficient information and assurances about taking part to allow individuals to understand the implications of participation and to reach a fully informed, considered and freely given decision about whether or not to do so, without the exercise of any pressure or coercion. Voluntary participation of respondents in the research is important. Moreover, participants have rights to withdraw from the study at any stage if they wish to do so. Privacy and anonymity of respondents is of a paramount importance.

Citations to acknowledge the sources of information will be employed to avoid plagiarism. The use of offensive,

discriminatory, or other unacceptable language needs to be avoided in the formulation of questions. Maintenance of the highest level of objectivity in discussions and analyses should be observed throughout the research.

RESULTS AND DISCUSSIONS

This section presents the data gathered in relation to the objectives of the study. The data collected were organized in tabular forms. The researcher's analysis and interpretation of the data are presented as well as the implications of the results of this study.

The Levels of Academic Growth in the Pre-Test and Post-Test of the Control Group

Table 2 Levels of Academic Growth in the Pre-Test and Post-Test of the Control Group

Control Group	Mean	Interpretation
Pre-Test	15.33	Fairly Satisfactory
Post-Test	16.93	Satisfactory

Table 2 presents the levels of academic growth in the pre-test and post-test of the control group when mean was computed and analyzed based on the first objective of this study. During pre-test the control group got the mean of 15.33 which is interpreted as "Fairly Satisfactory", while post-test got the mean of 16.93 which is interpreted as "Satisfactory". Based on the two mean scores, it revealed that there is only a 10.44% increase of their scores. The pre-test and post-test of the control group has a closer level of academic growth in the sense that printed materials were used in learning mathematics.

It is supported in the similar study of Dargo, J., and Dimas M. (2021) who studied the effect of modular distance learning in the academic performance of students in the new normal. According to their study, printed module is an additional workload to working parents, there is limited teacher-learner interaction, learners lack socialization with other children and have no exposure to significant school activities but are rather exposed to many distractions at home. In addition, simplifying of modules accompanied by video lessons and audio recordings are recommended to bridge the gaps brought by the modular distance learning.

It implies that although printed materials were utilized in the control group, there is still a capability to increase the level of academic growth of the students.

The Levels of Academic Growth in the Pre-Test and Post-Test of the Experimental Group

Table 3 Levels of Academic Growth in the Pre-Test and Post-Test of the Experimental Group

Experimental Group	Mean	Interpretation
Pre-Test	15.53	Fairly Satisfactory
Post-Test	19.20	Outstanding

As revealed in Table 3, which determine the levels of academic growth in the pre-test and post-test of the experimental group as stated in the second objective of this study, the mean was computed using SPSS. The computed mean of the pre-test is 15.53 which is interpreted as "Fairly Satisfactory".

Whereas, after the teacher-made multimedia instruction given by the teacher as the intervention for this study to the experimental group, the level of students' academic growth in mathematics reached to 19.20 which is interpreted as "Outstanding". In this case, there is a 23.63% increase of their mean scores which indicates that the teacher-made multimedia instruction used by the teacher to the experimental group of the respondents was an effective method to help students understand the lesson and equip more in learning mathematics concepts.

Based on the results of the two tests of experimental group, as seen on the mean results, there is an improvement and development of the level of the academic growth of the students in mathematics. Therefore, the teacher-made multimedia instruction is one way to help students improve their academic growth.

In the similar study conducted by Yllano and Tayaben (2019) in Adventist University of the Philippines Academy revealed the positive effect of Multimedia-based Instruction in enhancing achievement and attitude of students. Mathematics teaching and learning with the aid of multimedia technology produces positive learning opportunities for students.

The study of Woolfitt Z. (2015) is also relevant to this study because it talks about the integration of multimedia instruction especially video-assisted instruction to determine the effects in the teaching learning process. The same is true with the study of Abragan (2017) whose study is all about the use of technology to improve and enhance the performance of learners.

It implies that the participants' post-test in the experimental group shows the effectiveness of the intervention used in this study.

The Difference between Pre-Test and Post-Test of the Control and Experimental Group

Table 4 Difference between Pre-Test and Post-Test of the Control and Experimental Group

		Mean	t-value	Level of Significance	*p*-value	Interpretation
Control Group	Pre-Test	15.33	-3.685	0.05	.002	Significant
	Post-Test	16.93				
Experimental Group	Pre-Test	15.53	-7.143		.000	Significant
	Post-Test	19.20				
Post-Test	Control Group	16.93				
	Experimental Group	19.20	-5.264		.000	Significant

Table 4 shows the difference between the Pre-test and Post-test of the Control and Experimental Group. The pre-test and post-test of the control and experimental group were compared and analysed using the paired sample *t-test*. The comparative analysis showed a computed *p*-value 0.002 of the pre-test and post-test of the control group which was below the 0.05 level of significance and is interpreted as "Significant". This implies that there is a significant difference in the pre-test and post-test. scores of the control group.

The pre-test and post-test of the experimental group has a *p*-value of .000 which is below the 0.05 level of significance and was interpreted as "Significant". This also implies that there is a significant difference in the pre-test and post-test scores of the experimental group.

The post-tests of the control and experimental group was compared and analysed using the independent sample *t-test*. The result showed a *p*-value of .000 which is below the 0.05 level of significance and was interpreted as "Significant". This simply indicates that there is a significant difference in both post-tests of the control and experimental group.

Based on the results above, both paired sample tests and independent sample test are significant. Therefore, the null hypothesis is "rejected". The result of this study reveals that there is a significant difference in the pre-test and post-test of the control and experimental group.

Furthermore, the p-value .002 on the compared pre-test and post-test of the control group is much higher that the p-value .000 on the compared pre-test and post-test of the experimental group. This reveals that the experimental group is far enough from the 5% level of significance which shows a big difference on their pre-test and post-test scores. It only indicates that the intervention used by the researcher on this group is effective in enhancing the academic growth of the students in mathematics.

It is supported in the study of Honrales (2017) of Samar State University who emphasized that audio-visual approach or the use of multimedia is one of the strategies used in instruction to break the monotony of the usual classroom teaching. In this study, audio-visual approach was proven effective in learning mathematics. Multimedia instruction is very effective to teach students a wide range of discipline (Islam, 2020).

CONCLUSIONS

This section presents the summary of findings and conclusions of the study based on the gathered results, their interpretations and implications. The recommendations are also given in advance.

SUMMARY OF FINDINGS

The findings of the study were as follows:

The level of academic growth during the pre-test of the control group when it was computed and analyzed based on the first objective of this study was interpreted as "Fairly Satisfactory" with the mean of 15.33 while the posttest is "Satisfactory" with the mean of 16.93. The results of the mean scores shows that there is a slight increase on their academic growth.

The level of academic growth of the experimental group has greatly increased after the intervention was conducted. The pretest was interpreted as "Fairly Satisfactory" with the mean of 15.53 while the post-test was interpreted as "Outstanding" with the mean of 19.20. This simply shows that the intervention which is the teacher-made multimedia instruction greatly affects the academic growth of the students in mathematics.

The pre-test and post-test of the control and experimental group showed a significant difference after being compared using the paired sample t-test while their post-tests which was being compared using an independent sample t-test also revealed that they are significant.

The result of the study shows that the significance difference in the post-test of the experimental group indicates that the intervention given was effective in enhancing the academic growth of the students in mathematics.

CONCLUSIONS

According to the result of this study which aims to put forward the effect of teacher-made multimedia instruction on the academic growth of students' performance in mathematics, the researcher arrived at the following conclusion:

The level of students' academic growth in the control group showed a slight increase from the pretest to post mean scores. This only indicates a slight effect on their academic growth. It has been concluded that the concretization of abstract topics had made the students in the control group's learning process harder.

The level of students' academic growth in the experimental group showed a significant increase from pret-est to posttest mean scores. It goes without saying that the materials used in the experimental group were more interesting, eye catching and enjoyable than the ones used in the control group.

The significant difference between the control and experimental group is found to be in the benefit of the experimental group. Results showed in the experimental group that the intervention was effective as reflected by the great increase on the posttest scores of the participants against the pre-test scores. In other words, the use of teacher-made multimedia instruction is a much better strategy than merely printed modules.

Therefore, this study concludes that the given intervention on teacher-made multimedia instruction helped increase the academic growth of the grade 11 HUMSS students in mathematics.

RECOMMENDATIONS

In the light of the findings and conclusions drawn from the study, the following recommendations are made:

For the Department of Education, may allocate more funds for teachers' trainings especially on the use of technology to keep teachers abreast on the new applications. The technological groundwork of the schools should be designed in a way to present opportunities for multimedia use.

For the School Administrators, may conduct a Learning Action Cell (LAC) session to help develop teachers' pedagogical approach in teaching. They may spearhead the implementation of the intervention used in this study to sustain the performance of the students.

For the Curriculum Planner, may include the integration of teacher-made multimedia instructions in the curriculum. They should plan program to further improve the strategy.

For the teachers, should not be behind in terms of technological skills. For this, In-Service Training Courses that emphasizes the use of Information and Communications Technology (ICT) should be prioritized.

For the parents, may be knowledgeable enough and capacitated in terms of instructional support so that they would serve as alter ego of the teachers at home. There shall be programs to assist parents on how to help their children at home particularly on the use of multimedia instruction.

For the students, should be engaged more into the learning process by enabling them to prepare some multimedia materials.

For the researcher, may spread the information on the effects of teacher-made multimedia instruction so that others may also integrate this strategy in their teachings.

For the future researchers, are advised to construct the same research in a new context, location or culture. It is to address same research problem in a different setting.

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