Video integration in teaching Mathematics and students' mathematical performance

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Abstract

In the classroom, a good teacher is more vital than technology, thus teachers must know their topic both academically and practically. As a result, one must be well-versed in both content expertise and delivery methods. The research used an experimental methodology to see if incorporating technology into classroom education has a substantial impact on students' mathematical performance in terms of analytical, computational, and comprehension abilities. The data for this study was gathered using a questionnaire, as well as a pre- and post-test aligned to the video courses that were to be used for eight weeks by selected instructors and students in the District of Victoria. The research questions were based on the video lesson requirements. For the third quarter, the selected Grade IV teachers used the video lessons to teach mathematics. The researcher's movies were evaluated using mean and standard deviation to determine their acceptability. The statistical result of the effects of video integration on students' mathematics ability was determined using the T-test. The null hypothesis was rejected in all sub-variables of video lesson components and video lesson characteristics, indicating that there is a significant effect on students' mathematical performance with a 95% confidence level. As a result, teachers may consider using video lessons as intervention and remedial purposes for incoming grade seven and other grade levels. Similar research on video integration should be undertaken not only in Mathematics but also in other subject areas, and it is proposed that other factors be used in addition to those addressed in the study.

Keywords: Mathematics, performance, video, integration, teaching

1. Introduction

In the twenty-first century, technology has been widely used in the classroom. Various studies appeared that advocated for the use of computers as a teaching aid in mathematics. According to Barlis and Fajardo (2013), using computers to teach mathematics is an excellent alternative technique.

Schools and other educational institutions who are responsible for preparing pupils to live in "a knowledge society" must incorporate ICT into their curriculum (Ghavifekr, Afshari & Amla Salleh, 2012). Teachers are seen as crucial players in employing ICT in their daily classes, in addition to educating pupils for the contemporary digital environment. This is because ICT can provide a dynamic and proactive teaching-learning environment (Arnseth & Hatlevik, 2012). ICT integration in education is seen as a critical component of improvement and development.

Several studies and research projects have been conducted to investigate the effectiveness of computer integration in mathematics education, particularly computer-aided instruction. Various CAI programs have been tested around the world to see if they are effective. Some of these studies recommend that CAI be used in the classroom, particularly in mathematics. Digital technology in education and information sourcing are supposed to provide students with an academic advantage (Delen & Bulut, 2011).

Teachers were provided new instructional tools in general and in particular, which students could utilize to improve their understanding of the subject. Furthermore, these tools enable professors to collaborate with students while increasing student engagement. Modern tools enable students to take active roles and become self-sufficient. It also allows students to observe scientific phenomena being examined in a variety of ways, allowing them to get a deeper understanding of the topic at hand.

There are already some teachers who use videos to present their courses. Others have argued that video integration in the classroom is effective. However, there was no reason to make it mandatory in class. Nonetheless, teachers continue to develop new teaching tactics for the benefit of their students.

The majority of video integration research is conducted outside of the country. As a result, the researcher decided to undertake a study on the use of Computer-Aided Instruction, specifically the use of video integration in teaching mathematics, and students' mathematical performance in public schools in the Victoria District.

1.1. Background of the Study

Teachers are encouraged to enrich lessons with simple integration strategies utilizing Information and Communication Technology (ICT) that are developmentally appropriate. This is one of the provisions stated in D.O. 35, s. 2016. Instruction and assessment processes can be made more collaborative with ICT, which teachers can implement with the tools and equipment available in their schools.

Another DepEd Order was issued to provide public schools with appropriate technologies that would enhance the teaching-learning process and meet the challenges of the 21st Century and also integrate ICT into the school system. (D.O. 78, s. 2010)

Students' mathematics performance is one of the main concerns in mathematics education.

According to Rameli, M.R.M. (2016), many students see mathematics as one of the most difficult fundamental topics to master. Many variables that obstruct their maths learning can cause negative thinking. Five main themes and thirteen sub-themes can be found in the sources of challenges: a) self-factors (negative perception, low self-regulation), b) teachers (behaviors, practices, characteristics), c) parents (lack of cognitive, emotional, and financial support), d) friends (negative attitudes, behaviors, lack of support), and e) other factors (nature of math and assessment pressure).

Math curriculum frequently builds on prior years' knowledge. If a student does not master the necessary skills, it will be difficult for him or her to cope with the new ones. The mathematical underpinnings would be shaky. Teachers must choose between remediation and seeking new ways to reinvent their strategies in order to develop an approach that would solve the problem. Teachers may now employ technology in their classrooms because to the advancement of technology. Because most kids are already exposed to technology making it easy for them to cope with teachnology-based teaching strategy. Video integration is an intriguing technique to attract students. Teachers and students benefit greatly from video, which boosts course performance in a variety of ways and significantly affects student motivation, confidence, and attitudes, Carmichael (2019).

It is on the mentioned background that this research will study the integration of computer-aided instruction (video lessons). A good teacher is more important than technology in the classroom thus, teachers must master their subject both theoretically and practically. Effective use of video as an educational tool is enhanced when teachers consider three elements: how to manage cognitive load of the video; how to maximize student engagement with the video; and how to promote active learning from the video, Brame, (2016). In teaching, therefore, one needs to have content knowledge, and how to structure and present it.

The researcher was inspired to conduct this research because she feels that video integration can help improve the quality of mathematics instruction. Because of the change in medium of instruction, most Grade IV students struggle with transitioning abilities in mathematics. This prevents pupils from fully comprehending the material. The video integration could address the concern because there would be enough illustrations and the medium of instruction to be used is mixed with Tagalog.

This study aims to develop and validate videos for the enhancement of the mathematical skills of grade four students. These videos were made with accordance to the content of learner's modules mandated by the Department of Education.

1.2. Theoretical Framework

The study is anchored to the Cognitive Theory of Multimedia Learning of Mayer (2014The cognitive theory of multimedia learning is based on three cognitive science principles of learning: the human information processing system includes dual channels for visual/pictorial and auditory/verbal processing (i.e., dual-channel assumption), each channel has a limited capacity for processing (i.e., limited-capacity assumption), and active learning entails carrying out a coordinated set of cognitive processes during learning (i.e., limited-capacity assumption), and active learning entails carrying out a (i.e., active processing assumption). In multimedia learning, the cognitive theory specifies five cognitive processes: selecting relevant words from the presented text or narration, selecting relevant images from the presented graphics, organizing the selected words into a coherent verbal representation, organizing selected images into a coherent pictorial representation, and integrating the pictorial and verbal representations and prior knowledge. Extraneous processing (which is unrelated to the instructional objective), essential processing (which is required to mentally represent the essential material as provided), and generative processing are three demands on the learner's cognitive capacity during learning (which is aimed at making sense of the material). Reduce unnecessary processing (for extraneous overload circumstances), manage essential processing (for essential overload situations), and stimulate generative processing are three educational goals (for generative underuse situations).

The study is also connected on Sweller’s Cognitive Load Theory, It implies that learning occurs best in environments that are compatible with human cognitive architecture. While the structure of human cognitive architecture is unknown, it can be discerned through experimental investigation. Rather than a collection of rote learned information, the contents of long term memory are "complex systems that empower us to observe, comprehend, and solve issues." Schemas are the frameworks that allow us to treat many components as a single element. Sweller's theories are most useful in the design of instructional materials that are cognitively or technically hard. An example of this is the use of computer-aided instruction since cognitive load theory has many implications in the design of learning materials which must if they are to be effective, keep the cognitive load of learners at a minimum during the learning process.

The study is also connected to the Constructivism Theory of American International Journal of Contemporary Research (2015). The Constructivism idea emphasizes that good and true learning information is not relied on what instructors say or what students hear, even if students repeat it over and over. Furthermore, constructivism emphasizes that learners construct and build information in their minds depending on their existing knowledge and experiences. Furthermore, the learners' surroundings, culture, and language are all influenced by this information structure. Similarly, each learner has their own methods, ways of comprehending, and experiences for gaining knowledge, all of which influence learning. Instructors, on the other hand, will spend a lot of time repeating and confirming facts, but this will not assist learners keep the information in their minds. Learners get to learn on their own as they validate the knowledge they are gaining, just like they do when using video integration in mathematics. They progress at their own rate in terms of self-efficacy. They can look back in video teaching and see where they can improve the abilities they need to learn.

It is relevant to the study in that, as constructivist theory states that teachers should encourage students to discover principles on their own, the usage of video courses can assist students in learning on their own and being encouraged to discover principles. Students will be more interested in learning since they can learn mathematics through video tutorials, as the majority of today's learners are 21st-century learners. They are more exposed to technology nowadays than they were in the past. Furthermore, students' attention is drawn to innovative teaching rather than traditional instruction.

1.3. Conceptual Framework

The researcher had constructed the following figure to represent the relationship among the variables used in the current study.

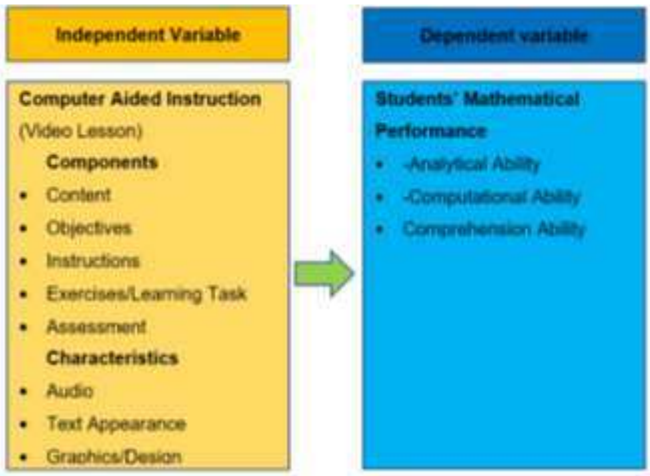

Fig. 1. Research paradigm of the study

Figure 1 illustrates the paradigm of the study. The independent variable which includes the video integration with the following components: content, objectives, instructions, exercises/learning task and assessment, and the characteristics: audio, text appearance, and graphics/design. The dependent variable is the Mathematics Performance (Analytical Ability, Computational Ability, and Comprehension Ability) based on their pre-test and post-test while the independent variable is the Computer-Aided Instruction integration in teaching Mathematics.

1.4. Statement of the Problem

The purpose of the study is to determine the effectiveness of Video Integration in Enhancing the Mathematical Performance of Grade Four Pupils of Victoria District, Elementary Schools.

Specifically, this study answers the following questions:

• What is the level of acceptability of video lessons in teaching mathematics in terms of components with regards to:

* Content
* Objectives
* Instructions
* Exercises/Learning Task
* Assessment

• What is the level of acceptability of video lessons in teaching mathematics in terms of characteristics with regards to;

* Audio
* Appearance/Text
* Graphics/Design

• What is the level of students' Mathematical performance as to:

* Analytical ability;
* Computational mathematical ability;
* Comprehension ability?

• Is there a significant difference between the students' mathematical performance with regards to students', analytical ability, computational mathematical ability and comprehension ability?

• Does the video integration in teaching mathematics have a significant effect on the students' mathematical performance?

1.5. Research Hypotheses

In relation to the stated problems, the researcher formulated a hypothesis for the study. Below are the hypotheses formulated:

- There is no significant difference between the students' mathematical performance with regards to analytical ability, computational mathematical ability, and comprehension ability.
- Video integration in teaching mathematics instruction has no significant effect on the mathematics academic performance of the students.

1.6. Scope and Limitation of the Study

The general objective of the study is to determine the effect of video integration in teaching Mathematics on the students' mathematical performance in terms of comprehension ability, and analytical and computational mathematical ability. Since mathematics skills have different abilities, this study will only focus on comprehension, analytical and computational skills. The ability will be based on the pre-test and post-test of the students.

This study is limited to grade 4 pupils from selected elementary public schools in Victoria District, Laguna, and their ability in comprehension, analytical and computational skills. The study will use video lessons as CAI or Computer Aided Instructions to teach Mathematics. The respondents will be subjected to the use of the video lessons as integration in learning mathematics for eight-weeks.

1.7. Significance of the Study

This section will provide a brief description of the various significance of the study to the following:

DepEd Sector. With the study, officials from the DepEd can strengthen and further improve instruction not only in Mathematics but also in different subjects to improve learning.

School Heads. With this study, the school heads will have an idea of how to develop their instructional supervisory plan for their teachers, especially in mathematics where they can integrate videos.

Teachers. They will benefit from the study in a way they can develop their professional skills by integrating videos and improving their teaching style. It can also help them catch the attention of the students.

Students. Students will benefit from the study in a way that they will learn to appreciate Mathematics more and fulfill their needs in order to improve their performances. And have fun while learning Mathematics and end the fear of learning the said subject.

1.8. Definition of Terms

Terms here are conceptually and operationally defined for a better understanding of the readers.

Computer Aided Instruction. It is an interactive instructional technique whereby a computer is used to present the instructional material and monitor the learning that takes place. It uses a combination of text, graphics, sound and video in enhancing the learning process. It is the used of spreadsheet, PowerPoint and presentation in presenting mathematics instruction.

Video Integration in Teaching Mathematics. It is a video that presents educational material for a topic that is to be learned. The format may vary. It might be a video of a teacher speaking to the camera, photographs, and text about the topic, or some mixture of these. In this study, it is the use of video lessons made by the researcher in teaching mathematics.

Components. Merriam defined component as constituent part. Components in this study are sections of the video lesson.

Content. According to Wikipedia it is all contained in something; everything inside. In the study it refers to the lessons contained in the video.

Objectives. A thing aimed at or sought; a goal. In the study it refers to the most essential competencies of Grade IV Mathematics in particular with the Third Quarter.

Instructions. A direction or order. In the study it refers to the medium of speech used to narrate the lesson and the way each activity was constructed.

Exercises/Learning Tasks. IGI Global defined learning task as a set of steps with a defined learning goal addressing specific training needs identified within business processes driving the definition of proper instructional design and e-learning system requirements. In this study it refers to activities used to measure the understanding of the pupils in the lesson.

Assessment. Oxford languages defined assessment as the evaluation or estimation of the nature, quality, or ability of someone or something. In this study it refers to evaluation of the knowledge acquired by the students.

Characteristics. Oxford languages defined characteristics as a feature or quality belonging typically to a person, place, or thing and serving to identify it. In this study, characteristics are the features shown in the video lesson.

Audio. Oxford languages described audio as a sound, especially when recorded, transmitted, or reproduced. In this study it refers to the sound of the voice of the researcher narrates the content of the video.

Text Appearance. The attributes of a text such as the font color, font size and font style.

Graphics/Design. According to Wikipedia, it is the visual images or designs on some surface such as wall, canvas, screen, paper, or stone, to inform, illustrate, or entertain. In this study it refers to the overall look of the video.

Mathematical Performance. It refers to the result of the pre-test and post-test result of the respondents which is divided into 3 abilities; analytical ability, computational ability, and comprehension ability.

Analytical Ability. Observing and researching a problem or topic to develop more complex ideas about it. It is the ability of the students to quickly identify cause and effect relationships in mathematics.

Computational Mathematical Ability. It is a human construct, which may be defined cognitively or pragmatically, depending on the purpose of definitions. It can be defined as the ability to perform mathematical tasks and to effectively solve given mathematical problems.

Students' Comprehension Ability. It is the ability of someone to summarize, sequence, infer, compare, and contrast, draw conclusions, self-questioning, problem-solving, and relate background knowledge. It is the skills of the students to comprehend mathematics problems to be able to solve it.

Students' Computational Ability. The selection and application of arithmetic operations to calculate solutions to mathematical problems. It is the skills of the students to solve mathematical problems.

2. Review of Related Literature and Studies

This chapter presents the related literature and studies of recognized experts, both of which have significant bearing or relation to the problem under investigation.

2.1. Related Literature

Computer-assisted instruction is widely used all over the world. Indeed, the Developing Mathematics Programmes (DMP) in Turkey advocated for the use of computers in education, citing computer-aided instruction (CAI) as an alternative teaching methodology that could improve students' mathematical skills. It advised teachers to use a variety of resources and equipment, including technology, to support classroom teaching. According to DMP's survey, 42 percent of teachers use Information and Communication Technology

(ICT) in their classrooms to teach mathematics by graphing and generating statistics, while the remaining 58 percent use traditional methods.

According to Mitchell, K. and Manzo, W. R. (2018) assessment and instructional design strategies revolve around the use of learning objectives. Faculty, instructional designers, accreditors, assessment offices, and students all use learning objectives. Even as the use of learning objectives becomes more common, the definition and purpose remain ambiguous. Learning objectives, according to instructional designers, exist to provide a focused mindset for students engaging in the content, whereas faculty frequently view learning objectives as an administrative requirement with little impact on teaching or student performance. In their study, they discovered that there is no shared understanding of definitions and purposes, and that using an experimental design and learning objective wording and use in the classroom has no effect on student performance.

As Adams (2015) explained, taxonomy is useful in two important ways. For starters, using the taxonomy encourages instructors to think of learning objectives in behavioral terms, focusing on what the learner can do as a result of the instruction. A learning objective written with action verbs will indicate the best way to evaluate the skills and knowledge taught. On the Internet, you can find lists of action verbs that are appropriate for learning objectives at each level of Bloom's taxonomy. Second, considering learning objectives in light of Bloom's taxonomy highlights the importance of including learning objectives that necessitate higher levels of cognitive skills, resulting in deeper learning and transfer of knowledge and skills to a wider range of tasks and contexts.

Bloom's taxonomy can be used by information professionals who train or instruct others to create learning objectives that describe the skills and abilities they want their learners to master and demonstrate. Bloom's taxonomy distinguishes cognitive skill levels and draws attention to learning objectives that necessitate higher levels of cognitive skills and, as a result, lead to deeper learning and transfer of knowledge and skills to a wider range of tasks and contexts.

Eiriksdottir, E. and Catrambone, R. (2011) stated that specific instructions help initial performance, whereas more general instructions, requiring problem-solving, help learning and transfer. Learning from instructions requires cognitive effort, and research indicates that most learners prefer low effort. However, using methods such as fading and combining different types of instructions, it is possible to meet both goals of good initial performance and learning. If the goal is good initial performance, instructions should closely resemble the task at hand (e.g., detailed procedural instructions and examples), but if the goal is good learning and transfer, instructions should be more abstract, inducing learners to expend the necessary cognitive effort for learning.

This is related to the study since it emphasized the relevance of well-written instructions in improving student performance.

Fiorella and Mayer (2018) identified what works and what does not work with instructional video based on previous research findings. With instructional video, two strategies can help improve learning outcomes: (1) segmenting (cutting a video into smaller, more meaningful portions with learner control) and (2) mixed viewpoint (filming from a combination of first-person and third-person perspectives). Matching the instructor's gender to the learner's gender, presenting the instructor's face on the screen, placing pauses in the video, and adding practice without feedback are all features that do not work with instructional video.

According to Clark, R. & Mayer, R. (2016), people learn more effectively when content is given with both words and pictures rather than just words, and words should be delivered as audio narration rather than onscreen text. (Clark & Mayer, 2016; Mayer, 2009, 2014). (2) Using prepared images allows for more visual iteration and refinement. Before recording, the teacher and course developer went through several iterations of scripting course content, discussing optimal visualizations, and prototyping them, resulting in a better finished product than what could be generated live during recording. (3) During the recording process, it minimizes cognitive load. Instructors may devote all of their cognitive resources to narrating course content to students rather than paying attention to the visual layout of the screen, pen color choices for specific sorts of content, or handwriting legibility.

The approaches to mathematics teaching described in this book are based on a review of the goals of mathematics education, current approaches to teaching mathematics used by many teachers, and recommendations for what actions are most likely to produce experiences that are accessible to all students and engage them in learning and creating mathematics.

We argue that identifying the types of tasks that prompt engagement, thinking, and the formation of cognitive connections, as well as the associated teacher actions that support the use of such tasks, including addressing the needs of individual learners, is an important part of understanding teaching and improving learning. The objective for mathematics teachers is to promote mathematical learning, and the activities that students complete are the primary medium for pedagogical interaction between teacher and students.

The basic assumption is that mathematical learning experiences are built on tasks; that the better the problem (when used effectively), the better the teaching possibilities; and that the better the task, the better the learning.

Ou, C., Joyner, D.A., & Goel, A.K. (2019) a lthough strong course videos cannot guarantee a course's success, courses that use videos with poor design and quality are more likely to receive low ratings from students overall. To ensure student satisfaction and improve the online learning experience, the instructional design and video production teams must follow defined guidelines while creating and producing videos. While no one-size-fits-all model exists, we think that the seven-principle model serves to establish that the three fundamental components of instructional methods, presentation, and sequence should be combined when planning and constructing video courses for online learning.

Leacock and Nesbi (2007) stated that learning process is influenced by aesthetics, production values, and overall design. It demonstrates that delivering low-quality visual media has a greater negative impact on learning than delivering high-quality visual media.

According to Molnar (2017), students learn better from crisp, high-resolution video lectures than from less clear ones, according to studies. Students in e-learning have expressed concern about the visual quality of the videos, which may have a negative impact on how they perceive and eventually grasp instruction. When it comes to engaging with the students, the quality of video lectures is crucial.

A study performed by Doolittle, Bryant, & Chittum (2015) showed that students who got a video lecture divided into 28 manageable chunks outperformed students who received a presentation with the same content but a drastically decreased number of segments. Although segmentation tends to aid with cognitive load reduction, keep in mind that not everyone processes information at the same rate.

Guo et al., (2014) stated that it is critical for instructors to speak at an appropriate pace so that students can successfully assimilate information. Ultimately, speech rates have an impact on learning and engagement.

According to Cunningham, Fägersten, & Holmsten, (2010) when pupils are unable to understand what is being said owing to the volume of the sound, the mechanical character of the speech, or technical flaws that cause the sound to be distorted, audio issues concerning intelligibility arise. Unintelligible audio can disrupt the learning process, causing pupils to go back and replay the audio.

Mayer (2014) explains that when different types of media are given, online learners can receive the material via dual coding, which uses both verbal and nonverbal cognitive channels to analyze the information. Using both aural and visual modalities to give teaching facilitates learners' ability to connect disparate pieces of knowledge.

Heribanova et al. (2011) emphasize that poor visual and auditory quality does not prevent learners from correctly recognizing content, but it does cause them to get alienated from it. Rather than the inability to see or hear the content accurately, all of the media quality research reviewed in the current study referenced quality in a way that negatively affects student learning by causing a loss of interest, motivation, engagement, and so on.

Nielsen, J. (2015) stated, users will not read web content unless the writing is clear, the words and sentences are short, and the information is straightforward. When the default font is a reasonable size, the contrast between letters and backdrop is high, and a clean typeface is used, the text is said to conform to readability requirements.

Lonsdale, MDS (2016) concluded that text layout has an impact on academic reading performance in both timed and untimed contexts. In particular, a text layout with a combination of typographic characteristics that adhere to readability requirements appears to facilitate efficient search reading in both timed and untimed settings. This implies that the superiority of the layout that adheres to readability criteria is due to the search reading tactics utilized to fulfill the reading assignment rather than time constraints.

According to Williams (2006), "Readability refers to whether an extended amount of text—such as an article, book, or annual report—is easy to read." A novel or short story would be an example of text that needs to be readable. "Legibility refers to whether a short burst of text…a headline, catalog listing, or stop sign-is instantly recognizable". We may spend a significant percentage of our reading time scanning the text fast in our daily contacts with texts, both in print and online. We can easily extract relevant information from a text because it is legible.

Lege, R (2014) stated that simple design offers strategies to improve and make texts better suited to their intended function. Learners are exposed to a wide range of texts, each with its own set of text kinds, aesthetics, and genres. Educators can improve the instructional impact of their materials by using typography and design, not just for aesthetic reasons. Typography and design have a demonstrable impact on how learners interact with a text, both favorably and adversely. He also stated that when more than one typographical cue, such as a change in font style and size, is applied to text, language learners are more likely to notice and dwell on the changing text. It achieves the text's intended goals in this manner.

The National Institute for Literacy defined comprehension as the ability to understand and get meaning from spoken and written language. It is made up of a series of steps that include information, experience, thinking, and teaching. To help students understand, retain, and communicate with others about what is read to them and what they read, effective comprehension education is required.

Reading is done for the purpose of comprehension. Students are not reading if they can read the words but cannot comprehend or connect to what they are reading. Good readers are both deliberate and active, with the ability to absorb, evaluate, make sense of, and personalize what they read.

Knowing the meaning of words, the ability to comprehend the meaning of a term from its context, the ability to follow the organization of a passage and find antecedents and references in it, the ability to draw inferences, the ability to identify the primary thought, and the ability to answer questions are all necessary for solving mathematical problems.

Understanding opens the door to learning new things. It is beneficial for youngsters to understand how to solve verbal issues in contexts that are meaningful to them in order to learn mathematics. To do so, kids must engage in a reflective process, which is not automatic for all youngsters.

Another talent to examine is analytical skills, which enable youngsters to tackle difficult issues by filtering out irrelevant data and detecting patterns or trends. These abilities are critical in the professional, social, and academic life of students.

These analytical skills are required for a wide range of professions in many fields. It doesn't matter how good your analytical skills are if you can't share your findings with others. You must be a good communicator who can describe the patterns you notice in the data. When it comes to analytical skills, creativity is equally vital. Students with good analytical skills will think outside the box to find practical answers to complex situations. Critical thinking is required for good analytical skills; it assists pupils in making decisions that aid in issue solving. Being good at analysis entails being able to look over a huge amount of data and spot trends.

Analytical abilities include the ability to analyze information, solve issues, and program. The capacity to evaluate a huge amount of data, assess trends, and provide a result is known as analytic ability. Dealing with problems entails demonstrating problem-solving techniques, while programming entails creating a system program that produces accurate outcomes.

To increase one's analytical skills, one must be attentive, read books, discover how things function, ask questions, play brain games, practice problem-solving skills, and consider their choices.

Analytical abilities are problem-solving abilities. They enable you to assess challenges that are simple or complex. This skill combines a variety of abilities to examine questions or problems and come up with a solution.

Computational skills are another important skill to master when learning mathematics. It is the ability to quickly and accurately solve simple addition, subtraction, multiplication, and division problems using mental processes, paper and pencil, and other resources like a calculator. This necessitates the use of the proper arithmetic procedures.

Despite the advent of current technology, arithmetic computational skills remain an important aspect of a student's math education because they provide the groundwork for subsequent math courses such as algebra, geometry, trigonometry, and calculus. They're also crucial since they'll make it easier for students to complete routine chores like determining the pricing of discounted products.

Addition, subtraction, multiplication, and division are the most common computational abilities introduced in primary school. Teachers frequently use games, scheduled tests, and drills to reinforce math computational skills.

Computational skills apply to decimals, fractions, percentages, ratios, and proportions in addition to whole numbers. They include both arithmetic operations and conversions between various types of numbers.

The mental work necessary to solve issues is lowered with math and estimate skills, allowing pupils to focus on meanings and linkages. The educators believe that refocusing on mental computation will help students better understand arithmetic subjects and develop higher-order thinking skills.

Pre- and post-testing can be used to assess such abilities. A pre-test is a test used to establish a student's baseline knowledge or readiness for a particular educational experience or course of study.

A pre-test can be used at the start of a course to establish a baseline of topic knowledge, and then linked to an end-of-course exam to assess new information. Pre-tests can also be used to determine how well students grasp necessary information. A third goal, which we'll look at now, is to test students just before they learn the material in the course. Pre-tests cover material that the instructor has not presented and that the student is not expected to know, which is counterintuitive. The purpose of the pre-tests is to provide students a sense of the material that will be covered and the level of knowledge that will be required, thereby serving as a "road map" for the topics. In addition, the instructor gets a quantifiable measure of the knowledge that students already possess for a particular topic (Berry, 2008).

The pre-tests provide instructors with an indication of the overall prior knowledge on each key topic covered, as well as the variance of that knowledge, allowing them to tailor their presentations accordingly. This is preferable to just relying on class responses to determine background because certain students may already be familiar with particular topics, leading the instructor to believe the class as a whole has a better comprehension of the content than it actually does.

2.2. Related Studies

A study of Jalober, J.A. (2017), entitled “Assessment of Students’ Performance Using Traditional and CAI in Teaching Mathematics” which focused on the performance of the Grade 3 pupils of Baliuag University. The researchers used a specially constructed program to compare the teaching outcomes of the standard technique with the CAI. The Integrated Mathematical Courseware (IMC) application is designed to help Grade 3 pupils improve their arithmetic skills, particularly in multiplication, division, and fractions. The courseware's content was created using the topic manual recommended by Baliuag University's Mathematics Teacher.

A set of methods were followed to construct the program, and numerous measures were taken to assess its suitability for Math instruction. After Computer Application Developers had thoroughly reviewed the courseware, it was used in the classroom to teach the same subject content in Mathematics as the traditional technique to teaching the topic.

The overall achievement scores of the students were significantly different between traditional and computer-aided instruction, according to the results of the abovementioned quasi-experiment, with test scores demonstrating significant improvement utilizing CAI. It should be noted that the two groups of students in the study were of similar intelligence, had the same number of male and female students, and were subjected to the identical conditions, including time and room. The CAI group has a higher percentage of students who pass than the traditional technique group. Furthermore, the results of a test comparing traditional and computer-aided instruction in multiplication, division, and fractions demonstrated that CAI, utilizing the Integrated Mathematical Courseware, is beneficial in raising students' test scores based on pre- and post-test results. And, as the results of the experiment reveal, division improves scores the greatest, followed by fractions and multiplication.

As stated in the study of Baya'a, N. and Daher, W. (2013), ICT integration in mathematics education provides mathematics teachers with integrative teaching methods that motivate students to learn, support their independent learning and active participation in the discovery of mathematical concepts and topics, and, as a result, assist them in having a deeper understanding of mathematical ideas. As a result of ICT educational affordances, the integration of ICT in the teaching and learning of mathematics aids students' achievement in mathematics. Teachers' perceptions of their ability in ICT, teachers' attitudes toward ICT contribution to mathematics teaching, teachers' attitudes toward ICT contribution to students' mathematics learning, teachers' emotions toward the use of ICT in the mathematics classroom are all factors that influence the success of this practice. The goal of this study was to see if Arab instructors in Israel's primary and middle schools were ready to integrate ICT into the classroom, and hence their interest in the six components listed above. More than seventy percent of the participating instructors have good perceptions of their competency in technology and technology integration in their teaching, according to the data. They also have good attitudes and feelings about the integration of ICT in teaching and learning, as well as positive self-esteem in the presence of technology. As a result of the findings, instructors are ready to integrate technology into their teaching, and this readiness is reflected not only in the participating teachers' opinions of and attitudes toward technology integration in teaching and learning, but also in their intention to do so.

These studies and experiments, as well as the findings of our research, demonstrate the usefulness of CAI in mathematics. These studies have demonstrated the value of technology in today's educational environment. Also according to Chesitit, P. (2015), his research's key findings were that in all five schools, the experimental group outperformed the control group. These findings revealed significant changes in ICT-integrated classes due to flexibility and focused interest. According to the findings, using ICT into mathematics instruction improves conceptual understanding and skill transfer from abstract to tangible. Integration of ICT in mathematics teaching and learning, particularly for abstract concepts like as waves, helps to overcome these restrictions, resulting in improved exam scores. The study proposed that technological skills be integrated across the entire educational process using a holistic approach, and that ICT be used to assist the full mathematical content and learning experience. In-service training on new innovations in teaching abilities and approaches are required for math teachers on a regular basis. MOEST should accelerate its resource mobilization and curriculum and content digitization plans, according to the report.

Cramer and Whitney (2010) studies shows that the most common model for teaching fractions is to employ the part-to-whole construct. Students must learn fractions in real-life situations that are relevant to them. One of its advantages is that it emphasizes the part-to-whole fraction notions and the meaning of the relative size of the component to the whole. Students must be able to recognize and grasp the link between numerous conventions of fractions, including proper, improper, and mixed number fractions, decimals, and percentages, in order to have a complete understanding of fractions.

Singley and Taylor (2016) study found that part of the reason why youngsters have trouble learning fractions through video courses is that they have trouble connecting relationships between mental representations. Furthermore, children who did not understand fraction ideas had identical eye movements to those who did well, implying that they encoded the important numerical relations even if they were unable to interpret them correctly.

Aksoy and Yazlik (2017) finding shows that through video lessons, pupils make misconceptions and misunderstandings concerning fractions. Students are not modeling fractions, which leads to errors and misunderstandings regarding fractions. It is critical to recognize fraction-related errors as well as the causes of these errors. Students' blunders are frequently attributed to a lack of information, carelessness, and misunderstandings. It's very vital to concentrate on the students' misunderstandings. Because these misunderstandings have a negative impact on not just the student's learning but also their future learning.

Fazio and Siegler (2011) research suggests that one of the most significant challenges students face while learning to grasp fractional operations through video classes is that they are frequently taught procedures and rules without developing a conceptual understanding of why these rules and procedures operate. "One method to boost students' conceptual understanding is to employ manipulates and visuals," they added. Students' computational skills have improved in studies where fraction arithmetic was taught using visual representations.

Tambychik, T. and Meerah, S. M. (2010) shows that In Malaysia, like many other countries, one of the most important aspects of the mathematics curriculum is problem solving, which requires students to use and integrate a variety of mathematical concepts and skills, as well as make decisions. However, kids were said to be having difficulty solving math problems. The results revealed that respondents lacked a variety of math skills, including number-fact, visual-spatial, and information skills. The ability to get information was the most important. Mathematical problem-solving is hampered by a lack of these talents, as well as cognitive capacities in learning. This knowledge of how deficiencies influenced problem-solving is likely to provide useful guidelines for developing diagnostic instruments and learning modules to improve arithmetic skills.

According to Aksu (2016), students performed best on operations and worst on problem solving tests when it came to fractions. The easiest word issue to solve was addition, while the most difficult was multiplication. Solving problems involving fractions, according to Hecht and Vagi (2010: 843), is one of the most persistent obstacles for youngsters with arithmetic difficulties. This implies that students have difficulties completing word problems in fractions, which most teachers find tough and challenging to teach, particularly to students with learning disabilities.

Moreover, Hecht & Vagi (2010) findings shows that both conceptual knowledge and classroom attentiveness appear to explain why students with arithmetic challenges have trouble with fractions. Inattention in the classroom has an impact on students' performance. Topics will not be learned effectively if they do not listen to their teacher, concepts may become confused, and learning will be evident.

Telaumbanua (2017) study shows that the students' capacity to solve mathematical problems is still limited. According to the findings of the study, this is due to the fact that students' instructional materials pay less attention to them, are not equipped with tests of mathematical problem-solving skills, or still contain routine questions.

Melati (2019) says that during an investigation or problem solving, a student worksheet can be used as a guide to help students achieve their learning objectives. The worksheet's validation revealed that it was exceptionally valid in terms of construct (presentation), content, grammar, and language. Validation tools provide findings for factors such as purpose, engineering procedures, accuracy of use, and functioning principles.

Marunung, K. (2017) says that instructional materials are one of the most significant aspects of the learning process. The instructional resources are used to help students achieve the curriculum's stated aims and the syllabus's stated objectives. Goals are developed or translated into instructional objectives, which are formulated using measurable or operational verbs based on Bloom Taxonomy. The instructional objectives serve as a guide for preparing and designing instructional materials, ensuring that the resources are developed and planned to meet the needs of learners, society, and learners in relation to society.

Espinar & Ballado (2017) study shows that the two groups of respondents agreed that the developed work text has content validity and is in line with the Basic Mathematics 2 course syllabus; the lesson objectives are content valid and follow the SMART principle and are relevant to the course topics of Basic Mathematics 2; the lesson inputs section has content validity and the lessons clearly present the key concepts and background information needed to understand the lesson; and similiarly, the developed work text has content validity and is in line with the Basic Mathematics 2 course syllabus; This section's tasks and exercises are relevant and in line with the course content. To the intended users, all activities are acceptable, sufficient, and appropriate. The content validity of the lesson enrichment part is equally valid. This section of the work text is hard and helps pupils improve their math skills.

Susanti, L. B. et. al (2018) study explain the validity of the guided inquiry and mind mapping-based worksheet created in this study. To train students' creative thinking skills, the worksheet used the phases of guided inquiry teaching approaches. Fluency, adaptability, originality, and elaboration were among the creative thinking qualities taught in this study. Content and construct validity were the types of validity used in this investigation. The worksheet's validity varied from 82.5 percent to 92.5 percent, indicating that it is quite valid and could be utilized as a learning medium.

Terano, H.J. (2015) study says that in a classroom setting, instructional material is a critical component of the teaching-learning process. This includes textbooks, reference texts, chalk and blackboards, computer-assisted presentations, and other items that are vital and useful during discussions and lectures. It followed the same structure and format as the other research evaluated in terms of structure and format. In terms of conformity with the numerous CHED CMOs for engineering, the material is acceptable. The material is highly acceptable to various evaluators in terms of its contents and structure and format.

Zulfaneti, Rismen, S. , & Suryani, M. (2016) says that the compatibility of the student worksheet's presentation with the scientific approach and realistic mathematical approach is an indicator on features of content presentation. Experts believe the Student Worksheet has been presented in a scientifically sound manner. It means that a Student Worksheet allows students to observe, ask questions, gain knowledge, associate with others, and/or articulate an idea. Based on the realistic mathematics approach, experts agree that the Student Worksheet has been presented using realistic mathematics principles, which means that the Student Worksheet has been presented beginning with contextual problems, which allow students to bridge from the real world to the abstract, encouraging them to construct knowledge.

Habibi et al., (2018) suggest that the strategy employed in packaging educational material such that it is easily comprehended and engaging for pupils is referred to as the presentation aspect of learning material. In terms of presentation, the training materials are organized methodically and in accordance with learning indicators for writing poetry. Students will become accustomed to thinking critically as a result of the presentation of cohesive and organized material.

Sulastri, R. et al., (2018) study about six mathematics-training modules met the valid and practical criteria after being developed. The consistency of the resources and concepts for mathematics with instructors' problems and the curriculum indicated the validity. The practical criteria were based on the consistency of the training modules' execution; the efficiency, utility, and beauty of the modules, which were divided into numerous elements, including instructions and time estimation; and the readability and ease of use.

Ulandari, L. and Amry, Z., and Saragih, S. (2019) study about the development of learning materials was examined in class VII of SMP Negeri 17 Medan and found to meet relevant requirements, according to experts. The findings revealed that learning materials based on a realistic mathematics education method matched the criteria and enhanced mathematical problem-solving abilities as well as student self-efficacy. According to the findings, mathematics teachers should make an effort to teach mathematical learning utilizing learning materials based on a realistic mathematics education method.

Funa, A. & Ricaforte, J. (2019) say that it is critical to validate instructional materials to assure quality in order to provide better education. According to his research, gamified instructional material is a successful technique for encouraging and engaging pupils to learn.

Markovic, M. (2012) says that regression analysis was used to determine the extent to which students' grades of presentational design for multimedia learning materials predicted the grade of multimedia learning material quality. Favorable improvements in presentational design grades for multimedia learning material lead to positive changes in quality grade for multimedia learning material, according to the findings, especially for higher qualitative multimedia learning content.

Cristobal, A. (2015) cited that as to the level of validity of the attributes of the test papers in terms of the different sub-variables such as appearance, and attractiveness with the average weighted mean of 3.79 with spacing and uniformity of elements are rated QV, quite valid.

Plass et al., (2014) initial research has already shown that evoking positive emotions in learners through an attractive visual design (layout, colors, imagery, etc.) can help facilitate a successful learning experience.

The aforementioned pieces of literature are relevant to the study in that the appearance, quality, and validity of the materials used for intervention should be weighted in order for them to be effective.

Pursuant to Section 10.3 of Republic Act 10533 as approved by Br. Armin A. Luistro FCS, Dr. P. B. Licuanan and Sec E.J Villanuvea "The Production and Development of Materials." It will be encouraged to create and develop locally created teaching and learning materials. The Department of Education and other organizations are working hard to encourage instructors to develop instructional resources that will benefit students and promote greater learning, particularly in mathematics, where most pupils struggle.

Nance, M. S. (2018) identifies a priori codes that characterize quality mathematical education and allows for emergent codes. Students are not provided opportunity to generate and share their own solutions for solving exercises aimed to assist them learn equivalent of fractions, according to a careful examination of the teacher editions of the textbook series. They aren't provided any opportunities to link strategies either. The teacher makes all of the connections.

The literature cited above demonstrates how pupils comprehend fractions and their difficulties with fraction ideas. It's relevant to the current study because these were the primary concerns in developing educational materials. The video lesson is utilized as a learning tool for integrating mathematics into the classroom. This also discusses the validity, application, significance, and efficacy of instructional materials in the classroom, particularly in mathematics.

According to Miller (2010) the dependability of growth or difference of scores, defined as post-test minus pre-test in classical test theory, is unreliable, and growth is adversely connected with the pre-test. Other researchers, on the other hand, have pointed out that low dependability for difference of scores does not always imply lower power for group comparisons, and that difference scores may be the construct of interest.

Achenbach (2017) states that many educational and clinical psychologists' agendas include evaluating intervention programs. Collecting data at multiple periods in time is necessary from a methodological standpoint to test the long-term strength of intervention effects once the treatment is done, such as in a classic design with pre- and post-testing and follow-up assessment.

Keleijan (2017) state that pre-test processes are common in applied economics and generally involve statistical issues that are overlooked. Pre- and Post-tests, according to Mestre (2012), are similar to checklists in that they can assess students' needs prior to a tutorial and assess how well the tutorial addressed those needs. With the same pupils, a pre- and post-test is utilized to determine whether the student was able to execute a task, process, or function as a result of the tutorial.

The above literatures mention are related to the study because Tests are useful in gauging pupils' abilities, according to the literature. It is used to assess the learning results of students. The pre-test determines the strengths and weaknesses of students, while the post-test assesses what they have learned. This will identify the learning outcome for possible intervention or course progression. It is critical to establish whether the goals were met.

Acuram, J. (2015) provide the acronym SMART when writing the objectives of Module. That is Specific, Measurable, Attainable, Realistic and Time- Bounded. He also stated that objectives and topic should be presented together. The suggested format is to present all the objectives at the beginning and the presentation of content follows based on the stated objectives.

UNESCO (2014), EFA Global Monitoring Report states that age, aptitude, culture, gender, social class, religion, occupation, and sexual orientation all have equal access to learning materials. They are as objectively free of bias as possible, and they are appropriate for the audience's overall age and maturity level. In addition, there is no advertising on instructional resources.

Roman, A. G. (2016) study shows that in terms of specific objectives, content, language used, and evaluation activities, the designed Statistics module has a very high level of validity. The application of the developed module results in pupils achieving excellent results. This performance demonstrates that they are not only familiar with the subject's fundamentals, but also have the ability to use statistics in real-life circumstances. Students' performance has also improved as a result of using the designed module, which can be linked to the achievement of stated objectives in each module lesson as well as the language utilized. Furthermore, if students were given a step-by-step approach that was simple to understand, their performance would improve.

Naval (2014) study revealed that the designed modules in Physics improved students' content-knowledge acquisition performance. Experts grade the generated modules on a scale of "acceptable" to "very acceptable" in terms of objectives, content, design characteristics, learning activities, adaptability, clarity, and evaluation. According to the findings, the produced module could be a useful tool for teaching and learning basic physics.

Blaich et al., (2016) stated that instructional clarity and organization plays a powerful role in promoting student growth on important liberal education outcomes.

Vergara (2017) study reveals that he produced module in problem solving and critical thinking abilities for the alternative learning system was deemed to be quite acceptable by the teacher responders, with presentation being the most important factor.

Tyler, C. W. & Likova, L. T., (2012) study about the role of arts in learning performance says that such form of inspiration is the opportunity to go beyond the pre-digested material that is presented to develop original insights and contributions to the domain of interest. This form of creativity can be highly motivating to the learner, who feels part of the enterprise of accumulating the knowledge, rather than a passive recipient of the structured material.

The instructional module or material has a significant impact on student achievement. It is vital for the teacher to create instructional materials in order to assist pupils in their learning. It is critical for the development of the least mastered talents. It assists the teacher in the development of these abilities. The studies above demonstrate how the module is developed. It went over the components to examine as well as the impact of modules on students' math achievement. Teachers utilize modules as one of the teaching materials to help students with learning issues. When designing the module, take into account factors such as the learners' interests, their abilities, the objectives, the presentation, and the exercise. This module was also used at home for children who were unable to attend school. These are crucial factors in determining how effective the content was.

Misquitta, R. (2011) cited that overall benefits of intervention design on fraction achievement and effective instructional kinds for students with mathematical challenges are explained. Types of interventions and their effectiveness (e.g. graduated sequence, anchored instruction and direct instruction). The results show that direct instruction and graduated sequence instruction were the most effective methods for improving fraction outcomes for difficult students.

Abdalla (2017) study found that the challenges facing teaching and learning mathematics in Pemba secondary schools include a severe shortage of teachers, a language barrier, large classes, teacher-centered methods, inadequate practices, a lack of relevance of the subject to students' daily lives, a lack of motivation, and negative attitudes among students, parents, and teachers. Employing more mathematics teachers, motivating students to learn mathematics, providing adequate teaching and learning resources, including ICT, motivating teachers, minimizing class ratios, covering the syllabus on time, frequent exercises and feedback, providing equal opportunities to all students, and employing modern methods of teaching for good performance were all suggested strategies for improving the quality of teaching-learning mathematics.

Tali (2016) states in his study that student achievement in mathematics is a source of concern, with consequences for individual student success as well as the nation's overall success (National Mathematics Advisory Panel, 2008). Despite the fact that tier 2 intervention has been found to be beneficial in resolving math difficulties, 3–8% of pupils do not respond (Fuchs & Compton, 2012). This suggests that specific intervention components that can improve academic achievements should be identified. The use of behavioral methods in math intervention is one possible intervention component for improving academic achievement. Academic engagement has been found to be improved through behavioral techniques.

Riikka (2014) study shows that majority of the interventions, the mathematics skills of the participating children improved more than the skills of the children in control groups, with effect sizes varying from small to large. Progress in mathematics learning was evident when instruction included one or more of the following instructional features: explicit instruction, peer-assisted instruction, applying a concrete-representational-abstract sequence, computer assisted instruction, or games.

Another study seen related is from Haerlermans, C., Rogge, N., and Witte, K. (2014), where students' learning results may be improved using computer-assisted instruction (CAI) programs. However, nothing is known about the schools that implement such programs or the efficacy of similar ICT-programs. They conduct a literature review that focuses on the available causal evidence for the effects of computer-assisted programs on learning outcomes. The study depends on a large dataset that includes I pupil-level data on the usage of a Dutch computer-assisted program and (ii) extensive school-level data on national exam results, among other things. The findings show that schools with lower educational attainment employ computer-assisted instruction tools more frequently. This suggests that they use CAI programs to make up for lost time in school. Furthermore, we argue that, given participation in the CAI-program, doing more exercises leads to better test outcomes, using an instrumental variable design. As a result, using a CAI-program appears to be beneficial.

The study made by Pascual (2021) about supplemental materials this time of pandemic offers insights on how teacher-made instructional materials aid both the teachers and the learners. On the part of the learners, the theme developed is “Easy access is a key to understanding and learning.” Twenty-first century learners are fond of exploring things which is available at the palm of their hands, or those things in which they can explore using technology. On the other hand, the theme developed on the part of the teachers is “Less time to browse, more time to help and teach.” When there are resource materials that they can provide to learners, their time of explaining the concepts to learners are facilitated with the resource materials, whether it is a brochure, a leaflet, a videoclip, infographics, or concept map.

And lastly, seen related is the study of Ahiatrogah, P., Bervell, B. and Yakubu, A. (2012), where their study focused on the “Integration of Technology in Teaching Senior High School Social Studies: The Impact of Computer-Assisted Instruction on Student Performance." The study discovered that there was a substantial difference in the mean scores of students who were exposed to Computer-Assisted Instruction versus those who were exposed to the traditional style of instruction. The experimental group outperformed those exposed to the traditional method of instruction, and the study also discovered that there was a statistically significant difference in performance after treatment for both groups; however, it was much greater for the experimental group exposed to Computer-Assisted Instruction than for the Control group exposed to the traditional method of instruction. This indicates that students who receive Computer-Assisted Instruction outperform pupils who receive traditional instruction.

All of the previous research are viewed as being connected in the current investigation since it will also examine the impact of video lessons integration in mathematics education on student mathematical performance. Another feature of this study is that it will use computer-aided education (video lesson) to teach the selected respondents from primary schools in Victoria District, Laguna.

3. Research Methodology

This chapter discusses the research methodology used in the study. It contains the research design, respondents of the study, research procedure, and research instrument.

3.1. Research Design

The researcher used the experimental design as it helps to make better decisions. It has scientific approach using two sets of variables. The dependent variable is composed of video integration while the independent variable is the students’ mathematical performance. The study will determine the level of acceptability of the video integration in terms of its components and characteristics to teaching mathematics. It would also seek to find the effectiveness of on the students mathematical performance in terms of analytical ability, computational ability, and comprehension ability.

According to Williams, Y. (2021), a true experiment is a type of experimental design and is thought to be the most accurate type of experimental research. This is because a true experiment supports or refutes a hypothesis using statistical analysis. A true experiment is also thought to be the only experimental design that can establish cause and effect relationships. The researcher found the method useful in getting the relevant information about the effectiveness video integration in teaching mathematics in elementary pupils of the selected public elementary school in Victoria District.

3.2. Respondents of the Study

The respondents of the study will be taken from selected Grade IV pupils of Victoria District. The pupils will be composed of 120 members, male and female. The study will be utilized simple random sampling.

The researcher will use the Simple Random Sampling technique to gather the sample respondents. According to Cristobal, A. P. and Cristobal, M. C. (2013), simple random sampling is a method of choosing samples in which all the members of the population are given an equal chance of being selected. It is an unbiased way of selection as samples are drawn by chance. There are various ways of getting the samples through the simple random sampling. The simple random sampling is found accurate since it will greatly help the researcher in conducting the study.

3.3. Research Procedure

After securing a permit from the Office of the Schools Division Superintendent to conduct the study, the proponent underwent the following stages, and then monitored its development until the completion of the study.

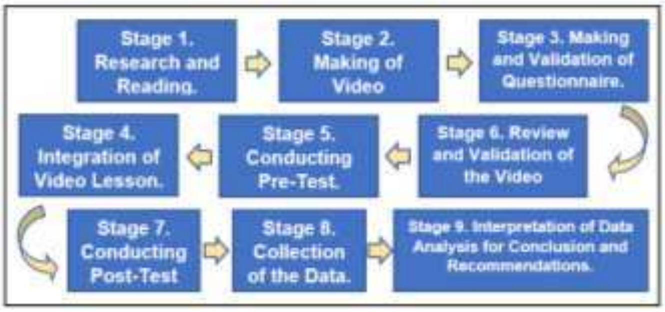

Fig. 2. The research procedure of the study

Stage 1. Research and Reading. Book reading was done to ensure that every author's idea about Mathematics topics was taken into consideration. The researcher researched on how to make a video lesson that is appropriate to the age level of the pupils.

Stage 2. Making of Video Lessons. Taking into consideration the ideas and activities about the topics in Math IV, the researcher decided to pattern the video lessons to the most recent modules used by the Grade IV pupils. The video lesson is composed of objectives, content, activities, and assessment. The said video lessons are good for 8 weeks that is for the Third Quarter. The audio was composed of Tagalog and English instruction in order to ensure the understanding of the pupils.

Stage 3. Making and Validation of Questionnaire. To validate the research made questionnaire, it was given to 5 people who have expertise in the related study and were not the actual respondents of the study. Suggestions and comments from them are considered in making the final revisions and editing of the questionnaire intended for the samples

Stage 4. Review and Validation of the Video Lessons. The status of the developed video lessons was reviewed and validated by the Master Teacher, ICT Coordinators and Grade IV Math teachers with the permission of the school heads.

Stage 5. Conducting Pre-Test. A 30-item test will be given to the respondents to be used as data to the study. This test is segmented according to analytical ability, computational ability, and comprehension ability in mathematics.

Stage 6. Integration of Video Lesson. The selected teachers used the video lessons in teaching mathematics for 8 weeks. They would answer the questionnaire in line with the video lessons to know the level of acceptability of the said instrument.

Stage 7. Conducting Post-Test. At the end of the Third Quarter same 30-item test will be given to the respondents to be used as data to the study.

Stage 8. Collection of the Data. The selected teachers provided test result of both the pre-test and the post test given. That is after using the video lessons was integrated in teaching mathematics. This data was used to know if the integration of video lessons has a significant effect on the mathematical performance of the pupils.

Stage 9. Interpretation of Data Analysis for Conclusion and Recommendations. The gathered data were treated statistically and results were tabulated and analyzed. After that, the researcher drew the conclusions and recommendations.

3.4. Research Instrument

A researcher-made questionnaire was employed as the instrument for gathering the data.

Video lessons were focused on the third quarter topics of K – 12 Mathematics 4 were devised by the researcher. Questionnaire was made to generate the acceptability of the video lessons among the grade IV teachers. The questionnaire has 2 parts; in terms of components as to content, objectives, instructions, exercises/learning tasks, and assessment, and in terms of characteristics as to audio, text appearance and graphics/design.

Questionnaire’s contents were answered by the grade IV teachers in Victoria – Victoria District, in the Division of Laguna.

In the process, the questionnaires underwent the process of validation to determine its capacity to achieve the specific objectives of the study.

The video lessons were also validated by the experts in the field of ICT, Master Teacher, and Math Teachers to ensure the quality and clarity of the instrument.

A 30-item test that is segmented into 3 parts (analytical, computational, and comprehension) was created by the researcher to be used as an instrument to test the effectiveness of the video integration on students’ mathematical performance. Since the questionnaire is from the DepEd K to 12 Curriculum, reliability and validity of the questionnaire is not necessary, since it is part of the curriculum mandated by the Department of Education

After the pretest, video lessons will be integrated in teaching mathematics for eight weeks. After eight weeks of applying video integration, a post-test will be administered. The post-test is the same 30-item test and will be given to the same set of students after being subjected to computer aided instruction (video lesson).

3.5. Statistical Treatment of Data

The data gathered were subjected to statistical treatment to test the hypothesis and for analysis and interpretation using the tools: frequency, mean, standard deviation and t-Test.

Frequency, to compute the number of pupils in the group, mean and standard deviation were used to determine the level of acceptability of the video integration in terms of its components as to content, objectives, instructions, exercises/learning tasks, and assessment.

Mean and standard deviation were also used to determine the level of acceptability of the video lessons in terms of its characteristics as to audio, text appearance, and graphics/design.

Mean was used to identify the level of mastery of students' mathematical performance as to analytical ability, computational ability, and comprehension ability in their pre-test and post result.

t-Test was used to determine the difference between the students mathematical performance with regards to students' analytical ability, computational ability, and comprehension ability.

Lastly, t-test was used to determine if the video integration made a significant effect on the students' mathematical performance.

4. Presentation, Analysis and Interpretation of Data

This chapter presents the data gathered based on the research questions, the analysis, and interpretation relative to the subproblems and hypotheses stated in chapter 1.

The validation for the video lessons were tested and analyzed. The findings for the level of acceptability of video lessons in terms of components with regards to content, objectives, instructions, exercises/learning tasks, and assessment were tabulated and shown in this chapter.

Table 1 presents the level of acceptability of video lessons in terms of components as to content.

The table show the mean level of teachers' perception on the level of acceptability of video lesson components in terms of content. The teachers were convinced that the video content was highly acceptable because it was explained in a clear manner (M=3.90, SD=0.31) and it is relevant to the objectives (M=3.90, SD=0.31. The teachers perceived that the content is highly acceptable because it has consistency (M=3.85, SD=0.37), it was presented with both audio narration and graphics (M=3.90, SD=0.31) and the content was segmented meaningfully (M=3.90, SD=0.31).

The overall mean of 3.89 indicates that the teachers find the video content highly acceptable. From the way it was presented to how it is relevant to each topic and the way the content was segmented.

Table 1. Level of acceptability of video lesson in terms of components as to content

Statement	Mean	SD	Verbal Interpretation
1. The content was explained in a clear manner.	3.90	0.31	High Level of Acceptability
2. The content was relevant to the objectives.	3.90	0.31	High Level of Acceptability
3. The contents have consistency as they are related to each other.	3.85	0.37	High Level of Acceptability
4. The content was presented both in audio narration and graphics.	3.90	0.31	High Level of Acceptability
5. The contents were segmented meaningfully for the accommodation of pupils to learn.	3.90	0.31	High Level of Acceptability
Weighted Mean	**3.89**	**0.18**	**High Level of Acceptability**

Legend:
3.26 – 4.00 High Level of Acceptability
2.51 – 3.25 Moderate Level of Acceptability
1.76 – 2.50 Low Level of Acceptability
1.00 – 1.75 Not Acceptable

Well-tailored video content could make a positive effect on learners especially if the teacher would use it appropriately. However, there were still reasons why there were students who couldn't grasp the lesson well. Examples of these are; the poor internet connection, and the availability of the gadget. Parents' encouragement could also be a factor. Some of the students feel the need to learn when their parents encourage them to do so. This could mean that the teachers should find ways how to remedy the lapses.

The findings for the validation of the learning resource material in terms of its content are supported by Naval (2014) stressed the importance of content organization of topics in the development of instructional materials like the innovative learning resource material which helps the learners' weaknesses become their strength. Same with the study of Clark, R. & Mayer, R. (2016), who found out that people learn better when content is presented with both words and graphics rather than words alone, and words should be presented as audio narration rather than onscreen text.

The major findings for the level of acceptability of video lesson in terms of components as to objective as perceived by Mathematics teachers are shown below.

Table 2. presents the level of video lesson in terms of components as to objectives.

Table 2. Level of acceptability of video lesson in terms of components as to objectives

Statement	Mean	SD	Verbal Interpretation
1. It has a focused mindset for students engaging in the content.	3.80	0.41	High Level of Acceptability
2. The researcher used appropriate verbs that indicate the best method in assessing the skills/knowledge to be taught in the objectives.	3.85	0.37	High Level of Acceptability
3. The objective was presented at the beginning of the lesson to optimize learning.	3.90	0.31	High Level of Acceptability
4. The objective shows the clear purpose of the lesson.	3.95	0.22	High Level of Acceptability
Weighted Mean	**3.88**	**0.21**	**High Level of Acceptability**

Legend: 3.26 – 4.00 High Level of Acceptability
2.51 – 3.25 Moderate Level of Acceptability
1.76 – 2.50 Low Level of Acceptability
1.00 – 1.75 Not Acceptable

The table above shows the mean level of teachers' perception of the level of acceptability of video lesson components in terms of objectives. The teachers find the objectives highly acceptable because it has focused mindset for students engaging in the content (M=3.80, SD=0.41) and the verbs used indicate best method in assessing the skills/knowledge of the students (M=3.85, SD=0.37). The teachers observed that the objective is highly acceptable because it was presented at the beginning of the lesson to optimize learning (M=3.90, SD=0.31), and it shows the clear purpose of the lesson (M=3.95, SD=0.22).

The overall mean of 3.88 indicates that the teachers find the objective highly acceptable. The appropriateness of the verbs used in the objective. The way it was presented at the beginning of the lesson and its clear purpose.

The standard deviation, being lower than 1, signifies harmony in the decision or perception of the respondents. The respondents almost have the same score given which can be concluded as they all agreed that the objectives were well constructed. With that being said, a well-constructed objective could improve the learning process of the learners as well as the teaching strategy of the teachers.

The findings for the validation of the teachers on objectives of the innovative learning material are supported by Adams (2015) proposes the use of the taxonomy encourages instructors to think of learning objectives in behavioral terms to consider what the learner can do because of the instruction. Objectives should include a statement of the teacher's intended learning outcomes. Considering Bloom's taxonomy highlights the need for including learning objectives that require higher levels of cognitive skills that lead to deeper learning and transfer of knowledge and skills to a greater variety of tasks and contexts. Bloom's taxonomy can be used to write learning objectives that describe the skills and abilities that they desire their learners to master and demonstrate.

Below are the major findings for the level of acceptability of video lessons in terms of components as to instruction as perceived by Mathematics teachers.

Table 3. presents the level of video lesson in terms of components as to instructions.

Table 3. Level of acceptability of video lesson on the components in terms of instructions

Statement	Mean	SD	Verbal Interpretation
1. The words used in each instruction were specific which helps pupils' initial performance.	3.90	0.31	High Level of Acceptability
2. The instructions were constructed in a procedural manner where they induce learners to expend the necessary cognitive effort for learning.	3.80	0.41	High Level of Acceptability
3. The instruction is age appropriate.	3.95	0.22	High Level of Acceptability
4. The researcher used both auditory and visual media to deliver instructions.	3.85	0.22	High Level of Acceptability
5. The instruction gives learners time to process.	3.85	0.37	High Level of Acceptability
Weighted Mean	**3.89**	**0.12**	**High Level of Acceptability**

Legend:		
	3.26 – 4.00	High Level of Acceptability
	2.51 – 3.25	Moderate Level of Acceptability
	1.76 – 2.50	Low Level of Acceptability
	1.00 – 1.75	Not Acceptable

The table above shows the mean level of teachers' perception of the level of acceptability of video lesson components in terms of instructions. The teachers find the objectives highly acceptable because the words used in each instruction were specific which helps pupils' initial performance (M=3.90, SD=0.31) and the instructions were constructed in a procedural manner where they induce learners to expend the necessary cognitive effort for learning. (M=3.80, SD=0.41). The teachers believed that the objective is highly acceptable because it is age appropriate (M=3.95, SD=0.22), the researcher used both auditory and visual media to deliver instructions (M=3.85, SD=0.22), and it gives learners time to process. (M=3.85, SD=0.37).

The overall mean of 3.89 indicates that the teachers find the instruction highly acceptable. The words used in each instruction were specific which helps pupils' initial performance. The instructions were constructed in a procedural manner, and it is age-appropriate.

The standard deviation, being lower than 1, signifies harmony in the decision or perception of the respondents. This could mean that the instruction offers sufficient opportunities for successful students' knowledge acquisition. Also, a high rate of response from students could be expected. An instruction that is constructed in a procedural manner makes it easy for the students to execute the task. Being considerate with the age of the students when it comes to the choice of words in instructions assures understanding and focus on the learning goals.

The findings on the teachers' instruction on the learning material in terms of format and language are supported by Eiriksdottir, E. and Catrambone, R. (2011) stated that specific instructions help initial performance, whereas more general instructions, requiring problem-solving, help learning and transfer. Learning from instructions takes cognitive effort, and research suggests that learners typically opt for low effort. However, it is possible to meet both goals of good initial performance and learning with methods such as fading and by combining different types of instructions. The Language used must be clearly understood by the learners. It is essential in developing instructional material for it helps the learner to work independently and if the material is easy to follow, confidence will be built among learners making Mathematics easy for them.

The major findings for the level of acceptability of video lessons in terms of components as to learning tasks as perceived by Mathematics teachers are shown below.

Table 4 presents the level of acceptability of video lessons in terms of components as to learning task.

Table 4. Level of acceptability of video lesson on the components in terms of exercises/learning task

Statement	Mean	SD	Verbal Interpretation
1. The learning tasks prompt engagement among learners.	3.95	0.22	High Level of Acceptability
2. The learning tasks were tallied to the lesson.	3.95	0.22	High Level of Acceptability
3. The learning tasks elaborate the understanding of the learners.	3.85	0.37	High Level of Acceptability
4. The learning tasks offer practice in problem-solving and critical thinking	3.85	0.37	High Level of Acceptability
5. The learning tasks lead to increase retention.	3.85	0.37	High Level of Acceptability
Weighted Mean	**3.89**	**0.15**	**High Level of Acceptability**

Legend:	3.26 – 4.00	High Level of Acceptability
	2.51 – 3.25	Moderate Level of Acceptability
	1.76 – 2.50	Low Level of Acceptability
	1.00 – 1.75	Not Acceptable

The table above shows the mean level of teachers' perception of the level of acceptability of video lesson components in terms of exercises/learning tasks. The teachers find the learning task highly acceptable because it prompts engagement among learners (M=3.95, SD=0.22) and it is tallied to the lesson (M=3.95, SD=0.22). The teachers perceived that the learning tasks is highly acceptable because it elaborates the understanding of the learners (M=3.85, SD=0.37), it offers practice in problem-solving and critical thinking (M=3.85, SD=0.37), and it leads to increase retention (M=3.85, SD=0.37).

The overall mean of 3.89 indicates that the teachers find the learning tasks highly acceptable. The learning tasks prompt engagement among learners and were tallied to the lesson. It elaborates the understanding of the learners; it offers practice in problem-solving and critical thinking and it leads to increase retention.

The standard deviation, being lower than 1, signifies harmony in the decision or perception of the respondents. Having a high acceptable learning activity is likely to result in achieving the intended learning outcomes. Learning tasks are said to be effective if the scores of the students resonate with the learning goals of the lesson. The teachers would be able to find the extent of what the students understood in line with the objectives. The teachers could also increase the level of learning tasks depending on how far the students could respond. The high order thinking skills of the learners would be developed as well.

The findings of the teachers on the learning material in terms of learning tasks are supported by Espinar & Ballado (2017) the activities and exercises in this section are relevant and in consonance with the course syllabus. All activities are adequate, sufficient, and appropriate to their intended users. The lesson enrichment section also holds content validity. This part of the worktext is challenging and enhances the mathematical skills of the students.

The major findings for the level of acceptability of video lessons in terms of components as to assessment as perceived by Mathematics teachers are shown below.

Table 5 presents the level of acceptability of video lesson in terms of components as to assessment.

Table 5. Level of acceptability of video lesson in terms of components as to assessment

Statement	Mean	SD	Verbal Interpretation
1. The questions were objective and focused on pupils' performance.	3.80	0.41	High Level of Acceptability
2. The assessment analyzes the results of the outcomes assessed.	3.85	0.37	High Level of Acceptability
3. The questions were fit for the pupils' level of understanding.	3.85	0.37	High Level of Acceptability
4. It presents a clear and definite task to be performed.	3.90	0.31	High Level of Acceptability
5. It is appropriate for the intended learning outcomes.	3.80	0.41	High Level of Acceptability
Weighted Mean	**3.84**	**0.15**	**High Level of Acceptability**

Legend:	3.26 – 4.00	High Level of Acceptability
	2.51 – 3.25	Moderate Level of Acceptability
	1.76 – 2.50	Low Level of Acceptability
	1.00 – 1.75	Not Acceptable

The table above shows the mean level of teachers' perception of the level of acceptability of video lesson components in terms of assessment. The teachers find the assessment highly acceptable because the questions were objective and focused on pupils' performance (M=3.80, SD=0.41) and it analyzes the results of the outcomes assessed (M=3.85, SD=0.37). The teachers perceived that the assessment is highly acceptable because the questions were fit the pupils' level of understanding. (M=3.85, SD=0.37), It presents a clear and definite task to be performed (M=3.90, SD=0.31), and It is appropriate for the intended learning outcomes (M=3.80, SD=0.41).

The overall mean of 3.84 indicates that the teachers find the assessment highly acceptable. The questions were objective and focused on pupils' performance. It analyzes the results of the outcomes assessed and whether the questions were fit for the pupils' level of understanding. It presents a clear and definite task to be performed and it is appropriate for the intended learning outcomes.

Assessment helps teachers see how the lesson is connected to the objectives. At another level, it may help the teachers to aid students to understand why they need to undergo an assessment before proceeding to another lesson. Students learn to appreciate what they do if they know its purpose. Same with the teachers, the purpose of the lesson is not just to assess but to find fault for what did not work with the learners so that revisions could be made. A well-crafted assessment tool could give the teachers the results they intend to achieve at the beginning of the lesson. It would give them the idea whether to reteach or to proceed to the next lesson.

The findings on the assessment of the learning material in terms of use are supported by Shultz (2015) said that many definitions of usability exist, but most of these are brief and imprecise. Usability describes systems as technologies that are self-explanatory to untrained users. Defining attributes were learned ability, efficiency, and user satisfaction. Empirical referents of usability were exemplified by the measures of the ability to use technology in a satisfying, meaningful, and productive way to meet desired outcomes. The learning material is useful for students learning outcomes for it satisfies the needs of the learners.

The validation for the video lessons with regards to characteristics were tested and analyzed. The findings for the level of acceptability of video lessons in terms of characteristics as to audio, text appearance, and graphics/design were tabulated and shown.

Table 6 presents the level of acceptability of video lessons in terms of characteristics as to audio.

Table 6. Level of acceptability of video lessons in terms of characteristics as to audio

Statement	Mean	SD	Verbal Interpretation
1. The instructor's voice was intelligible.	3.85	0.37	High Level of Acceptability
2. The audio encourages the teaching-learning process	3.80	0.41	High Level of Acceptability
3. The audio makes the lesson easier and more interesting	3.85	0.37	High Level of Acceptability
4. The instructor's voice is at an appropriate pace and in moderation.	3.95	0.22	High Level of Acceptability
5. The audio is supported by text, mathematical symbols, and graphics.	3.75	0.44	High Level of Acceptability
Weighted Mean	**3.84**	**0.17**	**High Level of Acceptability**

Legend:

3.26 – 4.00	High Level of Acceptability
2.51 – 3.25	Moderate Level of Acceptability
1.76 – 2.50	Low Level of Acceptability
1.00 – 1.75	Not Acceptable

The table above shows the mean level of teachers' perception of the level of acceptability of video lessons in terms of characteristics as to audio The teachers find the video audio highly acceptable because the voice was intelligible (M=3.85, SD=0.37) and it encourages the teaching-learning process (M=3.80, SD=0.41). The teachers perceived that the video audio is highly acceptable because it makes the lesson easier and more interesting (M=3.85, SD=0.37), the voice is at an appropriate pace and in moderation (M=3.95, SD=0.22), and it is supported by text, mathematical symbols, and graphics (M=3.75, SD=0.44).

The overall mean of 3.84 indicates that the teachers find the video audio highly acceptable. It means that the audio applied by the researcher reached the standard quality expected by the teachers. The audio is one of the important aspects of a video lesson. It needs to be audible to enable learners' listening ability. A supporting text maximizes the effectiveness of the audio since there are learners who prefer reading texts rather than just listening to them.

The findings are supported by Duh, M. and Krasna, M. (2014) who stated that different research has confirmed that attractive learning materials with sufficient audio are easier for the learners. Learning materials should not just be attractive; they need to address the topics of semantic noise (legibility, readability, navigation, and visual effects).

Table 7 presents the level of acceptability of video lessons in terms of characteristics as to text appearance.

Table 7. Level of acceptability of video lessons in terms of characteristics as to text appearance

Statement	Mean	SD	Verbal Interpretation
1. The researcher used a reasonably large font to make the text readable.	3.85	0.37	High Level of Acceptability
2. The text color was contrasting to the background making it look legible.	3.85	0.37	High Level of Acceptability
3. The researcher used a simple text design.	3.90	0.31	High Level of Acceptability
4. There was more than one typographical cue applied to the text.	3.95	0.22	High Level of Acceptability
5. The text's appearance draws pupils' attention.	3.85	0.37	High Level of Acceptability
Weighted Mean	**3.88**	**0.15**	**High Level of Acceptability**

Legend: 3.26 – 4.00 High Level of Acceptability
2.51 – 3.25 Moderate Level of Acceptability
1.76 – 2.50 Low Level of Acceptability
1.00 – 1.75 Not Acceptable

The table shows the level of teachers' perception of the level of acceptability of video lesson characteristics in terms of text/appearance. The teachers find the text/appearance highly acceptable because the researcher used a reasonably large font to make the text readable (M=3.85, SD=0.37) and the text color was contrasting to the background making it look legible (M=3.85, SD00=.37). The text/appearance is highly acceptable because the researcher used a simple text design (M=3.90, SD=0.31), and there was more than one typographical cue applied to the text (M=3.95, SD=0.22), and it draws pupils' attention (M=3.85, SD= 0.37).

The overall mean of 3.88 indicates that the teachers find the text appearance highly acceptable. This could mean that it could positively affect the presentation of the lesson as the learners won't have difficulty in reading the text. Having a clean, simple, well-spaced, and appropriate size of the texts make learners feel what they are reading/studying. It helps them to easily understand the message or content as they don't need to worry about other disturbances (e.g. the distracting color, the excessive style of the texts). Choosing the appropriate font improves the learner's reading experience as they focus on the content and what it conveys

The findings are supported by Lege, R (2014) stated that simple design provides ways to enhance and make texts more suitable for achieving their intended purpose. He also indicated that when more than one typographical cue is applied to text, such as a change in font style and size, language learners are more likely to notice and fixate on the altered text. In this way, it reaches the intended objectives of the text.

Below are the major findings for the level of acceptability of characteristics of video lessons as to Graphics/Design as perceived by Mathematics teachers.

Table 8 presents the level of acceptability of characteristics of video lessons as to Graphics/Design.

Table 8. Level of acceptability of video lessons in terms of characteristics as to graphics/design

Statement	Mean	SD	Verbal Interpretation
1. The video shows clarity in the design.	3.90	0.31	High Level of Acceptability
2. The graphics create visual interest.	3.90	0.31	High Level of Acceptability
3. Important ideas and concepts were highlighted in the design.	3.75	0.44	High Level of Acceptability
4. The graphics generate emotions.	3.85	0.37	High Level of Acceptability
5. The overall design show quality that affects the learning process positively.	3.85	0.37	High Level of Acceptability
Weighted Mean	**3.85**	**0.14**	**High Level of Acceptability**

Legend: 3.26 – 4.00 High Level of Acceptability
2.51 – 3.25 Moderate Level of Acceptability
1.76 – 2.50 Low Level of Acceptability
1.00 – 1.75 Not Acceptable

The table above shows the mean level of teachers' perception of the level of acceptability of video lesson characteristics in terms of graphics/design. The teachers find the graphics/design highly acceptable the video shows clarity in the design (M=3.90, SD=0.31) and it creates visual interest (M=3.90, SD=0.31). The teachers perceived that the text/appearance is highly acceptable because the researcher used a simple text design (M=3.75, SD=0.44), and there was more than one typographical cue applied to the text (M=3.85, SD=0.37), and it draws pupils' attention (M=3.85, SD=0.37).

The overall mean of 3.85 indicates that the teachers find the graphics/design highly acceptable. The video shows clarity in the design and it creates visual interest. The researcher used a simple text design, there was more than one typographical cue applied to the text and it draws the pupils' attention.

The standard deviation, being lower than 1, signifies harmony in the decision or perception of the respondents. The teachers agreed upon the idea that the video graphics/design was suitable for the learners. A well-designed video could provide many benefits than simply making it look good. It could persuade the learners to sustain their interest. It could create a conducive ambiance for learning, making them want to learn more. It could help the teacher draw the attention of the learners. The overall quality of the video ensures clarity in the delivery of the teaching and learning process. In conclusion, the design could attribute to the improvement of students' mathematical performance.

The findings were supported by Leacock and Nesbi (2007) stated that esthetics, production values, and overall design all influence the learning process. It shows that the delivery of poor-quality visual media has more of a negative effect on the learning process compared to the delivery of high-quality visual media. Poor quality of the video also attributed to poor interest of the learners. The findings were also reinforced by Molnar (2017), who found out that visual media that are not clearly displayed is a critical design flaw, as research has found that students learn better from clear video lectures with higher resolution compared to less clear ones, Molnar (2017)

Below are the major findings for the average of students' mathematical performance before and after the video integration in teaching mathematics. The results were tabulated and shown in the table.

Table 9 presents the level of students' mathematical performance.

Table 9. Level of students' Mathematics performance

TESTS	**Mean**	**SD**	**Verbal Interpretation**
Analytical			
Pre-Test	5.56	2.10	Average Mastery
Post Test	7.74	1.66	Moving Towards Mastery
Computational			
Pre-Test	5.37	2.26	Average Mastery
Post Test	7.69	1.58	Moving Towards Mastery
Comprehension			
Pre-Test	5.09	2.20	Average Mastery
Post Test	7.49	1.68	Moving Towards Mastery

Legend:

Legend:	9.6 - 10	Mastered
	8.6 - 9.5	Closely Approximating Mastery
	6.6 - 8.5	Moving Towards Mastery
	3.6 - 6.5	Average Mastery
	1.6 - 3.5	Low Mastery
	0.5 - 1.5	Very Low Mastery
	0 - 0.4	Absolutely No Mastery

The table shows the average of students' Mathematics performance as of analytical ability, computational and comprehension ability. As for the analytical ability result, it can be seen that pre-test result received an average mastery (M=5.56, SD=2.10) while the post test result achieved a moving towards mastery (M=7.74, SD=1.66) The computational ability pre-test result received an average mastery (M=5.37, SD=2.26) while the post test result achieved a moving towards mastery (M=7.69, SD=1.58). The comprehension ability shows the pre-test result received an average mastery (M=5.09, SD=2.20) while the post test result achieved a moving towards mastery (M=7.49, SD=1.68)

Based on the table, it is apparent that there was a positive change in students' mathematical performance. However, it wasn't that big of a difference. Teachers have encountered difficulties in video integration. There were learners who did not have consistent internet connectivity. Some of the pupils did not open their cameras during online class which did not give assurance that all of them are listening while the class was going on. 100% participation of the learners was not guaranteed in the study due to the said reasons. Even the teachers had trouble integrating the videos in teaching mathematics like technical issues. There were also times when online classes were interrupted due to webinars, training, and programs mandated by the Department of Education. These incidents could be the probable cause as to why the improvement of the students' mathematical performance was not too evident in the result.

The findings were supported by Berry (2008), who stated that the idea behind the pre-tests is to give the students an indication of the material that will be covered and the depth of knowledge required, thus it serves a 'road map' for the topics. In addition, the instructor gets a quantifiable measure of the knowledge that students already possess for a particular topic. The idea of the results was maintained by Shivaraju (2017), who stated that voluntary participation in such tests provides feedback on teachers teaching effectiveness and adequacy of knowledge gained by learners. These tests serve as an indicator of whether or not the student shows the improvement that is essential to students' progress in learning. In addition, the result are used as basis to innovate teaching strategies.

Below are the major findings for the difference between the students' mathematical performance with regards to students' comprehension ability, analytical ability, and computational mathematical ability

Table 10 presents the difference between the students' mathematical performance with regards to students' comprehension ability, analytical ability and computational mathematical ability.

Table 10. Difference between the students' Mathematical performance with regards to students' comprehension ability, analytical ability and computational Mathematical ability

Variables	**Mean**		**Mean Difference**	**t-value**	**P-value**	**Anlaysis**
	Pre-Test	Post-Test				
Analytical Ability	5.56	7.74	2.18	23.821	0.000	Significant
Computational Ability	5.37	7.69	2.32	25.542	0.000	Significant
Comprehension Ability	5.09	7.49	2.40	26.537	0.000	Significant

alpha = 0.05

The table depicts the t-test treatment result on the Difference Between the Students' Mathematical Performance with regard to Students' Comprehension Ability, Analytical Ability, and Computational Mathematical Ability. Based on the analytical ability computed (t-value = 23.821) being higher than the (critical value = 1.960) signifies a significant difference. When it comes to computational computed (t-value = 25.542) being higher than the (critical value = 1.960) signifies a significant difference. And the comprehension ability computed (t-value = 26.537) being higher than the critical value (1.960) also signifies a significant difference. This is supported by the P-value (0.000) being lower than the (alpha value = 0.05). With 95% level of confidence, it can be said that there is enough evidence to claim that the Students' Mathematical Performance has a significant difference based on the pre-test and post test result with regards to students' analytical, computational, and comprehension ability.

There are different skills in mathematics. analytical, computational, and comprehension are just some of these skills. There are learners that excel in analytical, some only enjoy computing numbers. Others avoided problem-solving because it is difficult for them to comprehend the text. They preferred numbers rather than decoding the content. There are learners that can easily perform the given activity if it is in a number form, even if there are no instructions at all. There were times where the assessment result was below average because some of the learners did not understand the problem. They tended to just answer it based on their understanding and ended up getting a low score. Lack of comprehension can affect the performance of the learners even if they are good in computing numbers. It gives a conclusion as to why there is a difference in the students' mathematical performance in terms of analytical, computational, and comprehension ability.

Tyler, C. W. & Likova, L. T., (2012) study about the role of arts in learning performance says that such a form of inspiration is the opportunity to go beyond the pre-digested material that is presented to develop original insights and contributions to the domain of interest. This form of creativity can be highly motivating to the learner, who feels part of the enterprise of accumulating the knowledge, rather than a passive recipient of the structured material.

Below are the major findings of the effects of video lesson components and characteristics on students' mathematical performance

Table 11 presents the effects of integration of video lesson in students' mathematical performance.

Table 11. Effects of integration of video lesson in students' Mathematical performance

Variables	Mean		Mean Difference	t-value	P-value	Analysis
	Pre-Test	Post-Test				
Analytical Ability	5.56	7.74	2.18	23.821	0.000	Significant
Computational Ability	5.37	7.69	2.32	25.542	0.000	Significant
Comprehension Ability	5.09	7.49	2.40	26.537	0.000	Significant
Weighted Mean	**5.34**	**7.64**	**2.30**	**25.300**	**0.000**	**Significant**

The table highlights the summary of the t-Test treatment result on the Effects of Integration of Video on Students' Mathematical Performance. Based weighted mean of the computed (t-value = 25.300) being higher than the (critical value = 1.960) signifies a significant effect on the students' performance. This is supported by the (P-value = 0.000) being lower than the (alpha value = 0.05). With 95% level of confidence, it can be said that there is enough evidence to claim that the integration of video lessons in teaching mathematics has a significant effect on students' performance.

The quality and validity of the videos contribute to the effectiveness of the integration in teaching mathematics. Having a high acceptability in terms of its components and characteristics makes it very useful as a teaching tool. The result implied that video integration has helped to improve the student's mathematical performance. However, it wouldn't be successful without the guidance of the teacher. There were also things to be considered in using videos as integration to teaching to maximize its usefulness.

The result of the study was supported by Torrefranca (2017), study showed that video lessons on two content areas of Algebra taught to second-year high school students were developed and validated. That is no relationship in integration but its effectiveness uplifts the academic performance of pupils. Specifically, the video lesson consisted of lessons on rational expressions, and module two consisted of nine lessons on variations. Findings revealed that all the evaluators strongly agreed that instructional video lessons satisfied the criteria for evaluation. Meanwhile, the significant change in the pre–test and post–test scores of student – participants before and after they were exposed to the modules signify that the video lessons brought out improvement in their knowledge of rational expressions.

The study is definitely related to the current study of the researcher. The result of the study about video lessons greatly influence why there is a need for intervention and the same scenario was also observed in other countries. Different learning materials have already been developed and validated and are being used in different schools even abroad yet video lessons are still one of the most difficult topics to master even for adults. These innovative learning resource materials are undeniably found effective and beneficial to the learners. As shown in the different studies conducted by different researchers, learning material is an effective tool a teacher and students can use to provide additional exercises needed for their development. Some studies also show how the material is being created especially its parts and components. Different components were shown and somehow the same as used in the study.

5. Summary, Conclusion and Recommendations

This chapter presents the summary, conclusions and recommendations based on the data gathered.

5.1. Summary

The study entitled "Video Integration in Teaching Mathematics on Students' Mathematical Performance" aimed to determine the effectiveness of video lessons in teaching mathematics on students' Mathematics performance of selected grade four students of public elementary schools in Victoria District, Victoria Laguna, Year 2021-2022.

The study specifically seeks to answer the following: 1. What is the mean level of acceptability of video lessons in terms of components with regards to; Content, Objectives, Instructions, Exercises/Learning Task, Assessment? 2 What is the mean level of acceptability of video lessons in terms of characteristics with regards to; Audio, Appearance/Text, Graphics/Design? 3 What is the mean level of students' Mathematics' academic performance as of; Analytical ability, Computational mathematical ability, Comprehension ability? 4. Is there a significant difference between the students' mathematical performance with regards to students' comprehension ability, analytical ability and computational mathematical ability? 5. Does the integration of video lessons in teaching mathematics have a significant effect on the students' mathematical performance?

The respondents of the study will be taken from selected Grade IV pupils of Victoria District. The pupils will be composed of 120 members, male and female.

A researcher-made questionnaire was employed as the instrument for gathering the data. The questionnaire aimed to generate the acceptability of the video lessons among the grade IV teachers.

Video lessons supplementary focusing on the third quarter topics of K – 12 Mathematics 4 were devised by the researcher. A 30-item test that is segmented into 3 parts (analytical ability, computational ability, and comprehension ability) was created by the researcher to be used as an instrument to test the effectiveness of the video integration on students' mathematical performance.

Weighted mean distribution and standard deviation were used to determine the level of acceptability of video integration in terms of components (content, objectives, instructions, learning task/exercises, and assessment) and characteristics (audio, text appearance, and graphics/design). Weighted Mean Distribution and standard deviation were also used to determine the level of students' Mathematics' academic performance in terms of analytical ability; computational mathematical ability and comprehension ability.

t-Test was used to examine whether there are significant differences between the students' mathematical performance with regards to students' comprehension ability, analytical ability, and computational mathematical ability. To determine the significant effect of Integration of Videos on Students' Mathematical Performance t-test was used.

5.2. Findings

Based on the data presented, analyzed and interpreted the following findings are enumerated according to the statement of the problem:
Specifically, this study answers the following questions:

- The mean level of acceptability of video lessons in terms of components with regards to:

* The mean level of acceptability of the teacher-respondents to the video lesson component in terms of content is 3.88, standard deviation of 021., interpreted as high level of acceptability. The standard deviation, being lower than 1, signifies harmony in the decision or perception of the respondents.

• The mean level of acceptability of the teacher-respondents to the video lesson component in terms of objectives is 3.89, standard deviation of 0.18, interpreted as high level of acceptability. The standard deviation, being lower than 1, signifies harmony in the decision or perception of the respondents.

* The mean level of acceptability of the teacher-respondents to the video lesson component in terms of instructions is 3.89, standard deviation of 0.12, interpreted as high level of acceptability. The standard deviation, being lower than 1, signifies harmony in the decision or perception of the respondents.

* The mean level of acceptability of the teacher-respondents to the video lesson component in terms of exercises/learning tasks is 3.89, the standard deviation of 0.15, interpreted as a high level of acceptability. The standard deviation, being lower than 1, signifies harmony in the decision or perception of the respondents.

* The mean level of acceptability of the teacher-respondents to the video lesson component in terms of assessment is 3.84, the standard deviation of 0.15, interpreted as a high level of acceptability. The standard deviation, being lower than 1, signifies harmony in the decision or perception of the respondents.

• The mean level of acceptability of video lessons in terms of characteristics with regards to;

* The mean level of perception of the teacher-respondents to the video lesson characteristic in terms of audio is 3.84, the standard deviation of 0.17, interpreted as a high level of acceptability. The standard deviation, being lower than 1, signifies harmony in the decision or perception of the respondents.

* The mean level of perception of the teacher-respondents to the video lesson characteristic in terms of appearance/text is 3.88, the standard deviation of 0.15, interpreted as a high level of acceptability. The standard deviation, being lower than 1, signifies harmony in the decision or perception of the respondents.

* Overall, the mean level of perception of the teacher-respondents to the video lesson characteristic in terms of graphics/design is 3.85, the standard deviation of 0.14, interpreted as a high level of acceptability. The standard deviation, being lower than 1, signifies harmony in the decision or perception of the respondents.

• The mean level of students' Mathematics' academic performance as of analytical, computational, and comprehension ability.

* The average of students' Mathematics performance as of analytical ability is (5.56) denoting average mastery with a standard deviation of (2.10) while the post-test result achieved a moving towards mastery of an average (7.74) with a standard deviation of (1.66).

* The average of students' Mathematics performance as of computational ability is (5.37) denoting average mastery with a standard deviation of (2.25) while the post-test result achieved a moving towards mastery of an average (7.69) with a standard deviation of (1.58).

* The average of students' Mathematics performance as of comprehension ability is (5.09) denoting average mastery with a standard deviation of (2.20) while the post-test result achieved a moving towards mastery of an average (7.49) with a standard deviation of (1.68).

• Is there a significant difference between the students' mathematical performance with regards to students' comprehension ability, analytical ability, and computational mathematical ability?

Based on the analytical ability computed t-value (23.821) being higher than the critical value (1.960) signifies a significant difference. When it comes to computational computed t-value (25.542) being higher than the critical value (1.960) signifies a significant difference. And the comprehension ability computed t-value (26.537) being higher than the critical value (1.960) also signifies a significant difference. This is supported by the P-value (0.000) being lower than the alpha value (0.05).

With 95% level of confidence, it can be said that there is enough evidence to claim that there is a significant difference in the Mathematical performance of the learners with regard to Students' Comprehension Ability, Analytical Ability, and Computational Mathematical Ability

• Does the integration of video lessons in mathematics instruction have a significant effect on the students' mathematical performance?

Based weighted mean of the computed t-value (25.300) being higher than the critical value (1.960) signifies a significant effect on the students' performance. This is supported by the P-value (0.000) being lower than the alpha value (0.05). With 95% level of confidence, it can be said that there is enough evidence to claim that the integration of video lessons in teaching mathematics has a significant effect on students' performance.

5.3. Conclusion

Based on the findings, it was concluded that:

1. There is a significant difference between the students' mathematical performance of pupils in regard to students' comprehension, analytical and computational mathematical ability.
2. Integration of video lessons in mathematics instruction has a significant effect on the mathematics academic performance of the students.

5.4. Recommendations

From the findings and conclusions drawn, the following are hereby recommended for consideration.

- Department of Education should encourage school heads to encourage teachers to create video lessons that can aid different types of learners and as supplementary material for those students who lack mastery. They can also initiate seminars that will provide teachers with more knowledge in doing such materials.
- School heads may include in their seminars, workshops, and SLAC how to create video lessons for the teachers to be familiar with the different techniques thus helping their students to cope with the lessons by creating their own material.
- Teachers may consider the use of the video lessons as intervention and remedial purposes for incoming grade seven and also in other grade levels.
- Similar studies about the use of the video lessons as intervention not just only in Mathematics but also in other subject areas should be conducted and use other variables aside from those considered in the study.

References

Abdalla, Y. M. (2017): Assessment of the Challenges Facing Mathematics Teaching-Learning in Secondary Schools in Pemba Island, Zanzibar, Thesis (Masters), http://repository.out.ac.tz/id/eprint/2209

Acuram, J. (2015): Setting Goals and Developing Specific, Measurable, Achievable, Relevant, and Time-bound Objectives

Adams, N.E. (2015): Bloom's Taxonomy of Cognitive Learning Objectives, v.103(3); 2015 July, https://www.ncbi.nlm.nih.gov/pmc/issues/255676/

Ahiatrogah, P. Bervell, B. and Yakubu, A. (2012): Integration of Technology in Teaching Senior High School Social Studies: The Computer Assisted Instruction Effect on Students' Performance, Volume No. 2 (2012), Issue No. 12 (December), ISSN 2231-1009, https://www.researchgate.net/ publication/317166181_INTEGRATION_OF_TECHNOLOGY_IN_TEACHING_SENIOR_HIGH_SCHOOL_SOCIAL_STUDIES_THE_COMPUTER_ASSISTED_INSTRUCTION_EFFECT_ON_STUDENTS'_PERFORMANCE

Aksoy, N.C. and Yazlik, D.O. (2017) Student Errors in Fractions and Possible Causes of These Errors, Journal of Education and Training Studies, Vol. 5, No. 11; November 2017, ISSN 2324-805X E-ISSN 2324-8068, https://files. eric.ed.gov/fulltext/EJ1161215.pdf

Aksu, M., (2012): Student Performance in Dealing With Fractions, The Journal of Educational Research 90(6):375-380, December 2012, DOI:10.1080 /00220671.1997.10544595

Barlis, J. M. and Fajardo, J. D. (2012): Effectiveness of Simulation and Computer Assisted Instruction (CAI) on the Performance of Students under Regimental Training on Selected Topics in Physics II, Proceedings of the 30th Samahang Pisika ng Pilipinas Physics Congress, SPP2012-2A-3 (2012), https://proceedings.spp-online.org/ article/view/SPP2012-2A-3

Baya'a, N. and Daher, W. (2013): Mathematics Teachers' Readiness to Integrate ICT in the Classroom: The Case of Elementary and Middle School Arab Teachers in Israel. International Journal of Emerging Technologies in Learning (iJET), 8(1), 46-52. Kassel, Germany: International Journal of Emerging Technology in Learning. Retrieved May 11, 2022 from https://www.learntechlib.org/p/111884/

Blaich et al., (2016): Instructional Clarity and Organization: It's Not New or Fancy, But It Matters. The Magazine of Higher Learning, 48:4, 6-13, DOI:10.1080/00091383.2016.1198142, https://dx.doi.org/10.1080/0009 1383.2016.1198142

Brame, C.J., (2016): Effective Educational Videos: Principles and Guidelines for maximizing Student learning from Video Content, CBE Life Sci Educ. 2016 Winter; 15(4): es6. Doi: 101187/cbe.16-03-0125

Carmichael, M., (2019): Assessing the Impact of Educational Video on Student Engagement, Critical Thinking and Learning: The Current State of Play, A Sage White Paper.

Chesitit, P. C. B. (2015): Impact of ICT Integration on Mathematics Performance in Kenya: A Case Study of Public Secondary Schools in West Pokot County, A Case Study, December 2015, http://erepository.uonbi.ac.ke/bitstream/handle/11295/93064/Chesitit_Impact%20of%20ICT%20integration%20on%20mathematics%20performance%20in%20kenya:%20a%20case%20study%20of%20public%20secondary%20schools.pdf?isAllowed=y&sequence=1

Clark, R. & Mayer, R., (2016): e-Learning and the Science of Instruction: Proven Guidelines for Consumers and Designers of Multimedia Learning, ISBN: 978-1-119-15866-0, March 2016, https://www.wiley. com/en-us/e+Learning+and+the+Science+of+Instruction:+Proven+Guidelines+for+Consumers+and+Designers+of+Multimedia+Learning%2C+4th+Edition-p-9781119158660

Cramer and Whitney (2010): Developing Fraction Concepts, Pages 340-370, https://www.pearsonhighered.com/content/dam/region-na/us/higher-ed/en/products-services/course-products/vandewalle-9e-info/pdf/0133 768937.pdf

Cristobal, A. (2015): Attributes of Test Papers and Level of Performance of Students: Basis for the Formulation of the Guidelines on Test Paper Construction, International Journal of Education and Research, Vol. 3 No. 2 February 2015, https://www.ijern.com/journal/2015/February-2015/51.pdf

Cunningham, U. M., Fägersten, K. B., & Holmsten, E. (2010): "Can you hear me, Hanoi?" Compensatory mechanisms employed in synchronous net-based English language learning, The International Review of Research in Open and Distributed Learning, 11(1), 161-177. Doi:10.19173/irrodl.vllil.774, https://ir.canterbury.ac.nz/bitstream/handle /10092/17351/12658385_hanoi.pdf?sequence=1

Delen, E. and Bulut, O. (2011): The Relationship between Students' Exposure to Technology and their Achievement in Science and Mathematics. Turkish Online Journal of Educational Technology, January 2011, Volume 10 Pages 311-317.

D. O. 35, s 2016 "The Learning Action Cell as a K to 12 Basic Education Program School – Based Continuing Professional Development Strategy for the Improvement of Teaching and Learning."

D. O. 78, s 2010 "Guidelines on the Implementation of the Dep Ed Computerization Program"

Doolittle, P. E., Bryant, L. H., & Chittum, J. R. (2015): Effects of degree of segmentation and learner disposition on multimedia learning. British Journal of Educational Technology, Vol 46 No 6 2015, Pages 1333–1343, doi:10.1111/bjet.12203, https://www.peterdoolittle.org/ publications/publication-3.pdf

Eiriksdottir, E. and Catrambone, R. (2011): Procedural Instructions, Principles, and Examples How to Structure Instructions for Procedural Tasks to Enhance Performance, Learning, and Transfer. Human factors. Vol. 53. Pages 749-770. DOI:10.1177/0018720811419154. https://www. researchgate.net/publication/221738861_Procedural_Instructions_Principles_and_Examples_How_to_Structure_Instructions_for_Procedural_Tasks_to_Enhance_Performance_Learning_and_Transfer

Espinar, M. J. T. & Ballado, R. S., (2017): Content Validity and Acceptability of a Developed Worktext in Basic Mathematics 2. Asia Pacific Journal of Multidisciplinary Research, Vol. 5, No. 1, February 2017, http://www. apjmr.com/wp-content/uploads/2016/12/APJMR-2017.5.1.10.pdf

Fazio, L. and Siegler, R. (2011): Teaching Fractions. International Academy of Education, 2011, IBE/2011/ST/EP22 https://unesdoc.unesco.org/ark: /48223/pf0000212781

Fiorella and Mayer, (2018): What works and doesn't work with instructional video. Computers in Human Behavior, Vol. 89, Pages 465–470. https://doi.org/10.1016/j.chb.2018.07.015

Fuchs, L. S. & Compton, D. L. (2012):The early prevention of mathematics difficulty: Its power and limitations.Journal of learning disabilities, 45(3), 257–269. https://doi.org/10.1177/0022219412442167

Funa, A. & Ricaforte, J., (2019): Validation of Gamified Instructional Materials in Genetics for Grade 12 STEM Students. International Journal of Sciences: Basic and Applied Research (IJSBAR), July 2019, https:// www.researchgate.net/publication/334684697_Validation_of_Gamified_Instructional_Materials_in_Genetics_for_Grade_12_STEM_Students

Guo, P. J., Kim, J., & Rubin, R. (2014). How video production affects student engagement: an empirical study of MOOC videos. Proceedings of the first ACM conference on Learning, March 2014, DOI:10.1145/2556325. 2566239, https://www.researchgate.net/publication/262393281How_ video_production_affects_student_engagement_An_empirical_study_of_MOOC_videos

Habibi M, Chandra C, Mahyuddin R and Hendri S 2018 Validity of Teaching Materials for Writing Poetry Based on Creative Techniques in Elementary Schools. Mimbar Sekolah Dasar. 5. 145. 10.17509/mimbar-sd.v5i3.14501. https://www.researchgate.net/publication/330250359_ Validity_of_Teaching_Materials_for_Writing_Poetry_Based_on_Creative_Techniques_in_Elementary_Schools

Haerlermans, C., Rogge, N. and De Witte, K., (2014). The Effectiveness of a Computer Assisted Math Learning Program. Journal of Computer Assisted Learning, November 2014, Volume 31, Issue 4, https://doi.org/10.1111/jcal.12090

Heribanova, P., Polec, J., Ondrušová, S., & Hosťovecký, M. (2011). Intelligibility of cued speech in video. World Academy of Science, Engineering and Technology, Open Science Index 55, International Journal of Electronics and Communication Engineering, 5(7), 830 - 834. doi.org/10.5281/zenodo.1070297

Hecht, S.A. & Vagi, K. J. (2010) Sources of Group and Individual Differences in Emerging Fraction Skills. Journal of Educational Psychology, 102(4), 843–859. https://doi.org/10.1037/a0019824

Leacock, T. L., & Nesbi, J. C. (2007). A framework for evaluating the quality of multimedia learning resources. Educational Technology & Society, 10 (2), 44-59. https://www.sfu.ca/~jcnesbit/articles/LeacockNesbit2007.pdf

Lege, R. (2014): Typography's Effect on Language Learners' Reading Processes: An Eye Tracking Study, Asian EFL Journal. 23. 134-153.

Lonsdale, MDS (2016) Typographic features of text and their contribution to the legibility of academic reading materials: an empirical study. Visible Language, 50 (1). Pp. 79-111. ISSN 0022-2224

Markovic, M. G. (2012) Role and importance of presentation design in learning and in quality of multimedia learning material. Technology Innovations in Education, https://www.bib.irb.hr/586812/download/586812.EDUTE-20.pdf

Mayer, R. E. (2014). Multimedia instruction. In Handbook of research on educational communications and technology, (pp. 385–399), DOI: 10.1007/978-1-4614-3185-5_31.

Mayer, R. (2014). Cognitive Theory of Multimedia Learning. In R. Mayer (Ed). The Cambridge Handbook of Multimedia (Cambridge Handbooks in Psychology). Pp. 43-71). Cambridge: Cambridge University Press. Doi:10. 1017/CBO9781139547369.005

Melati, P., et al (20219): Validity of student worksheet based on problem based learning model assisted by practical tools with digital display. Journal of Physics: Conference Series, Volume 1185, The 2018 International Conference on Research and Learning of Physics 5–6 August 2018, Padang, West Sumatra, Indonesia, https://iopscience.iop. org/article/10.1088/1742-6596/1185/1/012057/pdf

Misquitta, R. (2011): A Review of the Literature: Fraction Instruction for Struggling Learners in Mathematics. Learning Disabilities Research & Practice. 26. 109 - 119. 10.1111/j.1540-5826.2011.00330.x.

Mitchell, K. and Manzo, W. R. (2018): The Purpose and Perception of Learning Objectives, Journal of Political Science Education. Journal of Political Science Education, 14:4, 456-472, DOI: 10.1080/15512169.2018. 1433542

Molnar, A. (2017). Content type and perceived multimedia quality in mobile learning. Multimed Tools Appl 76, 21613–21627 (2017). https://doi.org/10.1007/s11042-016-4062-2

Nielsen, J. (2015): Legibility, Readability, and Comprehension: Making Users Read Your Words. https://www.nngroup.com/articles/legibility-readability-comprehension/

Nance, M. S. (2018): Building Procedural Fluency from Conceptual Understanding in Equivalence of Fractions: A Content Analysis of a Textbook Series. Theses and Dissertations. 7331. https://scholars archive.byu.edu/etd/7331

Naval, D. J. (2014): Development and Validation of Tenth Grade Physics Modules Based on Selected Least Mastered Competencies

Ou, C., Joyner, D.A., & Goel, A.K. (2019). Designing and developing video lessons for online learning: A seven-principle model. Online Learning, 23(2), 82-104. doi:10.24059/olj.v23i2.1449, https://files.eric.ed.gov/ fulltext/EJ1218394.pdf

Pascual, E. A. (2021). Getting into learners' pace: QR-coded supplemental materials for SHS learners in the division of Laguna, Philippines. International Journal of Research Publications. Volume 88, Issue 1. https://doi.org/10.47119/IJRP1008811120212391

Plass, J. L., Heidig, S., Hayward, E. O., Homer, B. D., & Um, E. (2014). Emotional design in multimedia learning: Effects of shape and color on affect and learning. Learning and Instruction, 29, 128–140. https://doi.org/10.1016/j.learninstruc.2013.02.006

Rameli, M.R.M. (2016) Student Teachers' Attitude and Self-esteem towards Online Learning: Application of Rasch Measurement Model. 8(11C), 37- 44. DOI: 10.13189/ujer.2020.082305.

Riikka, M. (2014): A Review of Early Numeracy Interventions for Children at Risk in Mathematics. International Journal of Early Childhood Special Education. 6. 25-54. 10.20489/intjecse.14355.

Roman, A. G. (2016): Development and Validation of Statistics Module for Quality Educational Research. International Journal of Science and Research (IJSR) ISSN (Online): 2319-7064 Index Copernicus Value (2013): 6.14 | Impact Factor (2015): 6.391

Singley and Taylor (2016) Bridging Cognitive and Education Research to Gain Insights on Fractions Learning. UC Berkeley. ProQuest ID: MillerSingley_berkeley_0028E_16671. Merritt ID: ark:/13030/ m5m37qh2. Retrieved from https://escholarship.org/uc/item/6t4257rx

Sulastri, R. et al.,(2018): Developing mathematics training modules to enhance teachers' content knowledge. Journal of Physics: Conference Series, Volume 1088, The 6th South East Asia Design Research International Conference (6th SEA-DR IC)27–28 June 2018, Banda Aceh, Indonesiahttps://iopscience.iop.org/article/10.1088/1742-6596/ 1088/1/012103/pdf

Susanti, L. B. et. al (2018): Validity of worksheet-based guided inquiry and mind mapping for training students' creative thinking skills. Journal of Physics: Conference Series. 1006. 012015. 10.1088/1742-6596/1006/1/012015.

Tambychik, T. and Meerah, S. M. (2010): Students' Difficulties in Mathematics Problem-Solving: What do they Say?. Procedia - Social and Behavioral Sciences. 8. 142-151. 10.1016/j.sbspro.2010.12.020.

Telaumbanua (2017): Development of Mathematics Module Based on Metacognitive Strategy in Improving Students' Mathematical Problem Solving Ability at High School. Journal of Education and Practice. 8. 73-80. https://www.researchgate.net/publication/318983738_Development of_Mathematics_Module_Based_on_Metacognitive_Strategy_in_Improving_Students'_Mathematical_Problem_Solving_Ability_at_High_School

Terano, H.J. (2015)Development and Acceptability of the Simplified Text with Workbook in Differential Equations as an Instructional Material for Engineering. Asia Pacific Journal of Multidisciplinary Research, Vol. 3, No. 4, November 2015 Part I, http://www.apjmr.com/wp-content/uploads/2015/10/APJMR-2015-3.4.1.14.pdf

Tyler, C. W. & Likova, L. T. (2012): The role of the visual arts in enhancing the learning process Engineering. Front. Hum. Neurosci., 08 February 2012 | https://doi.org/10.3389/fnhum.2012.00008

Ulandari, L. and Amry, Z., and Saragih, S. (2019): Development of Learning Materials Based on Realistic Mathematics Education Approach to Improve Students' Mathematical Problem Solving Ability and Self-Efficacy. International Electronic Journal of Mathematics Education, 14(2), 375-383. https://doi.org/10.29333/iejme/5721

Vergara, A. (2017): Development Module

Williams, R. (2006). The Non-Designer's Type Book (2nd ed.). Berkeley, California: Peachpit Press

Williams, Y. (2021): True Experiment: Definition & Examples. (2015, July 14). Retrieved from https://study.com/academy/lesson/true-experiment-definition-examples.html.

Zulfaneti, Rismen, S. , & Suryani, M. (2016): Validity analysis of development lesson plan and student worksheet based realistic mathematics education