Flipped Classroom Approach in Teaching Clinical Decision-Making Sequences in Medical Education

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Abstract

This study aimed to investigate the effectiveness of flipped classroom approach in teaching sequences. Also, it envisioned to find out the students' extent of perceptions in the utilization of the flipped classroom approach. The respondents of this study were the 46 Grade 10 students. This study used quasi- experimental method and employed a validated instrument. The data indicated that the pre-test performance of the students was failing while their post-test performance was in the very satisfactory level. The increase in their posttest performance was attributed to the use of flipped classroom approach. Meanwhile, the students' extent of perception of the flipped classroom approach in terms of understanding the concepts, engagement, and enjoyment was high.

Keywords: flipped classroom approach, arithmetic and geometric sequence, perception of students

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(Sgd) EFREN M. BALDADO

Researcher

Chapter 1

The Problem and Its Scope

Introduction

In recent years, teachers have always been faced with a lot of challenges in the teaching profession especially in finding ways to become effective teachers. In order to become an effective teacher, one can make innovations in his/her teaching preparations.

Consequently, the National Council of Teachers of Mathematics encouraged teachers to utilize and prioritize student-centered learning styles and strategies as well as students' independent studies of mathematical ideas in their classes to enhance their performance (NCTM, 2009).

One example of student-centered approach is flipped classroom model. It is a modern teaching strategy which aims to improve students' performance through bringing discussion at home via technology and transferring assignment and exercises with the topics in class via learning interactive activities (Bergmann & Sams, 2012; Tucker, 2012; Young, 2011).

The central concept with this blended strategy is to flip the usual classroom approach in which the instruction that often happens in class is now accessed at home, in advance of class, via teacher created or downloaded videos and interactive

lessons, and work that often occurs at home is now completed in class in the presence of the teacher.

Moreover, using this approach, Tucker (2012) emphasized that the class becomes the place to "work and solve problems, advance concepts, and participate in collaborative learning." The use of class time might provide students the probability to learn how to think for themselves by being actively engaged in the mathematics content.

Further, the traditional lecture/homework model of instruction involves a lecture given by teachers that takes up the majority of the time in class, followed by limited period for practice by students. Consequently, students need to do their assignments practicing course concepts at home. This becomes problematic if students get home and realize that they don't understand what they need to do. Therefore, the perfect time in doing assignments is when students are able to receive help from the teachers and their peers during class time. This led to the question of how to move lecture delivery of course content beyond class hours to allow the primary focus within the classroom to be creating a deeper understanding of course concepts.

On the other hand, lectures, laboratories, homework and exams which are considered traditional activities can be transferred to web technology enabling students to study everywhere beyond class hours. The positive influence of technology has brought change to the growth of instructional technology in education such as the replacement of the use of blackboard with online and recorded video lectures (Evans, 2011). In addition, lots of free learning materials are

provided in the internet for easy access. Richter and McPherson (2012) support the idea and argued that online video lectures as a learning resources can be watched everywhere and at their convenience.

Even more, the old learning approach which focuses on the teacher as the sage on the stage is irrelevant in today's digital and electronic age (Wang & Heffernan, 2010).

Therefore, this research study sought to bring about improvements in students' performance and engagement in solving and dealing problems about sequences through the implementation of flipped classroom model of instruction in the junior high school mathematics classroom.

Theoretical Background of the Study

The study of flipped classrooms is based on Benjamin Bloom's Mastery Learning Theory and revised Taxonomy of Cognitive Domain. Mastery Learning Theory supports how learning occurs at the various stages as explained also by Bloom's Taxonomy.

Flipped learning as a pedagogical approach lends itself to the Mastery Learning Theory as outlined by Bloom (1968). Mastery supports the use of flipped learning in general, it highlights the importance of using flipped learning in a meaningful and structured manner. Using mastery learning, students learn at their own pace. Therefore, learning is differentiated (Eppard and Rochdi, 2017).

Based on the tenets of Mastery Learning, all students are required to learn common, well-structured objectives. When a student does not master an objective, remediation is required. Bergman and Sams (2012) argue that Mastery Learning

supports flipped learning because it provides instruction that is differentiated, asynchronous and student-centered; and it provides a context for remediation and efficient feedback. This aligns with flipped learning where students have the potential to learn in their own time with a certain amount of autonomy in regards to time management (Eppard and Rochdi, 2017).

Mason, Shuman and Cook (2013) also used a semi-Mastery Learning theory in their study of flipped learning in engineering courses. They used a mixture of project work, group work and quizzes during the class. While the study had elements of Piaget and Vygotsky, there were quizzes and elements of assessments which resembled Mastery Learning. They found that the students' performance overall did not change from traditional learning but that there were benefits to using flipped learning techniques in the classroom such as greater student autonomy and differentiated and active learning.

The concept of reinforcement as part of behaviorism and the ideas of operant conditioning, is related to Mastery Learning and the study of flipped learning in several different ways. For one, akin to mastery learning, students have a stimulus, making a good grade or obtaining knowledge, and based on the theory, they will continue to study until they have mastered the concept to an acceptable extent (Eppard and Rochdi, 2017).

Using the flipped classroom scenario, not only do the students need to study the materials (i.e. the videos), they need to be able to study in such a way as to prepare for the classroom activities. According to Bloom, in the initial phase students may be confused but over time they understand the concept or at least the

process needed to understand the stimuli. Like mastery learning, a learner will produce a certain output, based on formative or summative assessments that will determine whether he needs to relearn or move on to another stage or topic.

In addition, Bloom's taxonomy presents six levels of learning. This framework can often be used as a lens through which to view the various stages of learning.

This revised version of Bloom's Taxonomy is relevant to flipped learning in that the transmission of information, which is the basis for learning, is obtained independently and outside of class; while the assimilation of information, which requires greater critical reasoning occurs during class under the guidance of an instructor or mentor. The higher the tier portrayed on the pyramid, the more assimilation is required; whereas, the lower the level, the more transmission of information occurs somewhat independently, but not completely, of assimilation. The areas in the middle may require a more balanced or less skewed combination of the two. The explanation below starts from the bottom level to the topmost level of cognitive domain:

Remembering. This is the lowest level where the students strive to recall and recognize the information they receive. They also try to grasp the basic principles and concepts of the content they have learned.

Understanding. In this level, students try to showcase their understanding, analyze the information and wrap up what they learned.

In the implementation of the flipped classroom, lowest levels of cognitive domain which are remembering and understanding are practiced at home or

beyond the class period (Anderson & Krathwohl, 2010). These levels could be presented through recorded lectures, and videos. Activities like simulations, readings and other materials also provide foundational support for learning.

In contrast, the higher forms of cognitive work which includes applying, evaluating, and creating will be the students focus during class hours.

Applying. This is the level where the knowledge learned by the students will be measured through practicing and relating it to the actual situation.

Analyzing. The critical thinking skills of the students will be used and tested in the activities like problem solving, debating with classmates, comparing answers with peers or producing a summary. The students gain new knowledge and learning after implementing critical thinking activities. In this learning level, the students also construct creative thinking.

Evaluating. This belongs to high level of cognitive domain where students establish peer-review or assessment of knowledge, judge in relational terms. In this level, students' asses the entire learning concepts and they could evaluate or make judgment on how far they successfully learned.

Creating. This pertains to the highest level where students are able to design, make and produce something new from what they have gathered and learned (Bloom, 1969).

In implementing flipped classroom, students start from the lowest level which is remembering to attain the highest level which is creating.

Further, the notion of describing flipped learning in terms of assimilation and transmission was highlighted by Talbert (2012). While Bloom's taxonomy is

valuable at showing the stages of learning and the type of learning that occurs at each stage, it does not explain best practices in how to master each level in a given context. The benefit of flipped learning as it relates to Bloom's taxonomy is that students are actively helped supported during some of the activities that require higher order thinking.

Accordingly, Lankford (2013), as cited by Zainuddin and Halili (2016) in their study entitled "Flipped Classroom Research and Trends from Different Fields of Study," made mention that the flipped classroom is focused on how to support and help the students in achieving a higher level of the taxonomy domain.

Nederveld and Berge (2015) also added that in flipped learning, classroom activity is spent more on higher-level of learning and application rather than just simply listening to lectures and other lower-level thinking activities or tasks. Implementing flipped learning lets the students spend much of the time supporting the higher-level learning tasks and activities such as problem solving and group discussion, while lower-level tasks such as knowledge and comprehension are accomplished independently outside the class.

Indeed, most research on the flipped classroom employs group-based learning activities inside the classroom, based on student centered learning theories grounded in the works of Piaget (1967) and Vygotsky (1930-1934/1978).

The diagram of the theoretical framework of the study is presented to summarize the concepts presented above.

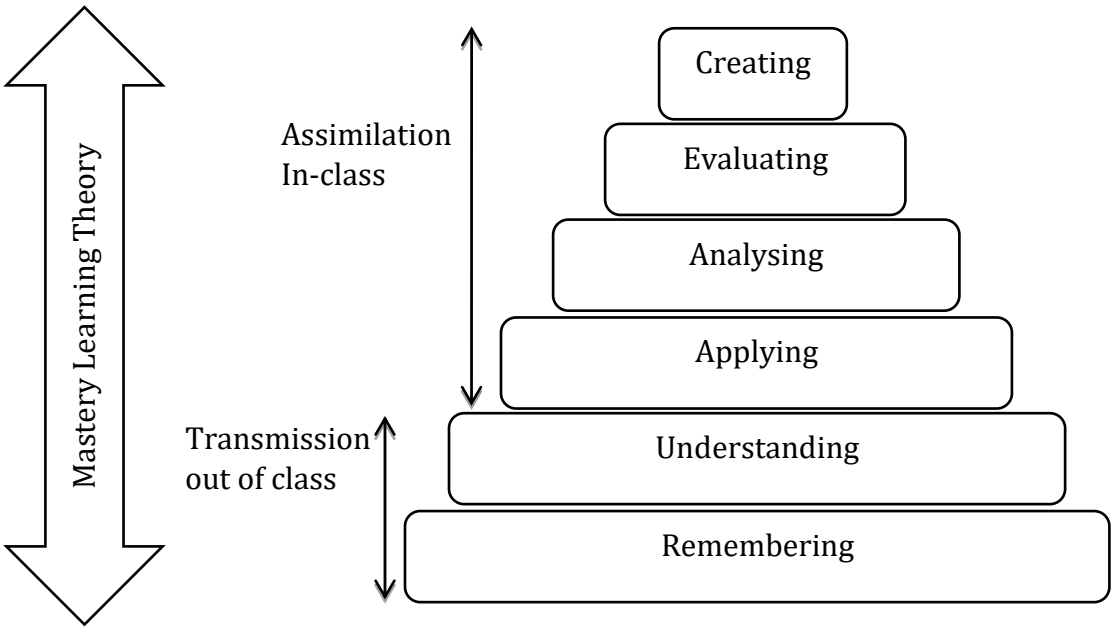

***Figure 1.*Diagram of the Theoretical Framework of the Study Based on Bloom's revised taxonomy and Mastery Learning Theory**

Review of Related Literature and Studies

This part presents the review of related literature and studies in relation to this present investigation. It focuses on flipped classroom approach in teaching sequences in the selected Grade 10 students of Benedicto P. Tirambulo Memorial National High School, Paniabonan, Mabinay Negros Oriental for the school year 2018 – 2019.

Then and now of flipped classroom. According to Berrett (2012) in his study on "How flipping the classroom can improve traditional lecture", it seems that "flipping" the classroom in higher education is not anything new. It has been used for quitea long time by professors but without the use of digital media to distribute content. For example, students in English courses are anticipated to read a novel and then talk over it in class and law professors expect students to study the reading material before being grilled with questions in class. What makes "flipping" innovative today in higher education is that a student has an access to technology where lectures can be recorded as video podcasts and delivered online.

Similarly, Eppard andRochdi (2017) related that inverting the classroom so that the transmission of information (lecture) happens outside of class and the traditional out-of-class work is completed in class with the teacher is not a recent concept. The researchers often credited with first mentioning inverted learning, Lage, Platt and Treglia, published the paper "Inverting the Classroom: A Gateway to Creating an Inclusive Learning Environment" in 2000. In this article they explain

that inverting the classroom is an approach that occurs when “events that have traditionally taken place inside the classroom now take place outside the classroom and vice versa.” (2000). Lage, Platt and Treglia (2000) results indicated that both students’ and teachers’ perceptions of the new methodology were positive.

Meanwhile, Crouch and Mazur (2001) conducted a study where they investigated the concept of peer instruction that is in its essence similar to the flipped classroom in the sense that transmission of information occurs outside of the classroom while class time was devoted to conceptual questions and mini lectures which ideally would include higher order thinking and assimilation.

Strayer (2007) published his dissertation entitled "The effects of the classroom flip on the learning environment: a comparison of learning activity in a traditional classroom and a flip classroom that used an intelligent tutoring system". This study examined students’ comfort with learning in an inverted classroom.

However, the term “flipped classroom” was not readily adopted till Bergman and Sams, two chemistry teachers, started flipping their classroom by providing the students with videos to watch at home and devoting class time to projects. Their book Flip your classroom: reach every student in every class every day (2012) outlines the concept of the flipped classroom and defines its key elements.

From this, it can be noted that the development of flipped learning was organic and that the changes in the method, and therefore the definition, mirrors technological developments in the world at large. Technology and specifically social media has changed the way that information is transferred. Therefore, at one point

flipping the classroom included reading and/or the dissemination of videotapes or even DVDs. However, now it is possible to access, edit and disseminate videos easily so flipped classrooms have adapted to match this technological transformation.

Flipped classroom approach. The flipped classroom is one of the recent changes as far as technologies in education are concerned. It serves as a standard of teaching-learning practice in nurturing students' active learning in higher education (Hamdan, McKnight, &Arfstrom, 2013). Flipping the classroom (a.k.a "flipped classroom," "flipped learning," or "inverted learning") is a blended learning strategy that reverses the usual classroom instruction and out-of class homework (Handam et al., 2013).

Instructional materials are provided to students before class, which commonly involves a video-recorded lecture the teacher prepared in advance (Overmeyer, 2012). The students are required to watch the videos at home or outside the class hours and take notes just as they would be expected to do during a classroom lecture. The students then arrive to class with a basic comprehension of the content knowledge presented from the lecture recorded video and complete what is traditionally known as "homework" in class in collaboration with the teacher. However, teachers are encouraged to not simply have students do the habit of rote paper work in class to fill the classroom time.

In flipped classroom, students have their preferred time and need to scrutinize the video lectures and they can also study independently. This approach to teaching increases students' collaborative learning in distance education outside the classroom. Accordingly, by flipping the class, students will have more time to

practice solve problems individually or cooperatively through distance learning with friends rather than spending more time listening to long lectures and discussion in the classroom.

Applying flipped classroom also aids to better understanding inthe use of technology in teaching-learning activities. The teacher will use varied technology media in their teaching practices while the students use various technology media in learning activities independently (Zainuddin&Attaran, 2015).

Likewise, gadgets and technology in the 21stcentury puts direct access to information, and the internet can be easily reached through several technology tools such as the computer, tablets, and smartphone (Fu, 2013). Today, in particular, students use much of their time using technology tools. By using this technology, it is possible for them to interact with friends, instructors, and learning content almost everywhere, not only class hours but also at home or outside the class through classroom flipping (Fisher, 2009).

According to Halili, Razak, and Zainuddin (2014) in their study entitled “Enhancing Collaborative Learning in Flipped Classroom”, using technology in the teaching learning process can create professional connections through coaching, collaborating, and mentoring for social interactions in sharing ideas. That is to say, by incorporating different technology tools in the teaching learning process, the students will now have an access to study in different places and times through collaborative distance learning. Education is now positively influenced by the new learning instructions that have emerged thereby producing students’ independent learning. Definitely, technology in education isa rapidly-changing process and

demands the teachers and the students to always upgrade themselves with the modern trend in education.

Moreover, Halili and Zainuddin (2015) noted that the flipped or reverse classroom is a part of blended learning, integrating both face-to-face learning in the class through collaborative discussion and distance learning outside the class or at home by watching nonsynchronous video discussions and online collaboration.

Therefore, as technology has progressively been used in teaching-learning process to meet 21st century learning goals (Crippen & Archambault, 2012), incorporating suitable learning opportunities, including the use of technology-enhanced teaching styles and strategies to improve students' learning, has become necessary (ISTE, 2008). To reach this, teachers are anticipated to learn necessary technological developments and use them appropriately in their teaching. If related technology is integrated into teaching-learning process appropriately, students foster more positive attitudes toward the learning subject and become more successful (Moore, 2005).

Role of the teacher in a flipped classroom. There is a transformation of the teacher's role in implementing the flipped classroom. The teacher can be described as the "sage on the stage" in a traditional classroom that presents and gives information in a topic discussion hoping that students will pay attention and digest the information. The flipped classroom moves away from this idea, putting the teacher's role as the "guide on the side" who will work with the students to facilitate them in their distinctive learning experiences (Bergmann, Overmyer, &Wilie, 2012).

In Parslow's (2012) commentary about the Khan Academy and flipped classroom, he mentioned "in the flipped classroom, the teacher shifts from being the "sage on the stage to the guide on the side".

Using Paulo Freire's idea, the "guide" role in education can be illustrated as something that "should not limit one person acting on another, but rather people working with each other," (Smith, 2012).

Further, Nichols (2012) emphasized that in the flipped classroom, the students have more time to review the subject and the students who cannot attend class can obtain the materials for learning. The students need not do homework but instead actively work, discuss and solve problems in a group. On the other hand, Nichols stated that the teacher plays as the facilitator who facilitates the learners with more practice activities. The teacher is also involved in students' learning activity. He acts equal with the students and he always establishes connection with the students both during class hours and outside class hours.

Besides, flipped classroom is a concrete example of student-centered approach to learning. In the classroom activity, the students are more active than the teacher. It implies that the teacher works as a facilitator to guide, motivate, and give feedback on students' performance (Sams & Bergmann, 2012). Hence, by implementing the flipped classroom approach to teaching-learning activities, the teacher can change the traditional lecturer's talk to video discussion and the students can access and watch the lecture on the video someplace outside of class.

There are two reasons or motives why the flipped classroom can help solve the problem of students getting stuck on homework. First, it opens more time in

class for the teacher to go deeper into a topic which allows students to develop a better understanding of the content. Second, the students are doing their homework in class where the teacher is available to help if they get stuck.

The teacher is available to review the material as a group or helps the student one-on-one with specific questions students has about the topic during in-class work. The teacher can use any variety of strategies that a traditional classroom teacher might use. In this way, the flipped classroom is not simply a new technique to instruction that will replace the usual classroom strategies. It is rather a way to stretch the extent of time a teacher has with students doing higher level learning, rather than letting students memorize a set of facts.

Flipped classroom on student's learning. Many educational professionals said that each student is unique and has his or herown style of learning (Ahanbor 2014). While some students prefer to work in groups, it has been shown that some students feel unfairly graded on group projects (Smith 2014). In addition, some students are inspired to be more creative when given more flexibility while other students need more guidance to be able to adequately complete a project.

There are several researches regarding the flipped classroom's effects on student learning and overall effectiveness. One such study by Strayer (2008) entitled "The effects of the flip classroom on the learning environment" showed that students in a flipped classroom environment preferred this approach and they were able to figure out problems in an imaginative ways and displayed cooperation in working with others to solve problems and talk about ideas than students in an old classroom setup.

The results of his study also indicate that compare to students in a traditional classroom, learners in a flipped classroom show a lower level task orientation. From the results of his study, he recommends to implement flipped classrooms by providing a step by step direction for every classroom activity in order to build more structure (Strayer, 2008).

According to Strayer (2008), one of the many effects of flipping the classroom is that students shall be able to monitor his/her own learning. Because of this awareness, students will need time to think upon their activities to make links to the course material.

Another study about the said approach is from Toto and Nguyen (2009) which entitled “flipping the work design in an industrial engineering course”. In this flipped classroom, before going to class, students viewed a 30-minute video lecture. As a result, students have extra free time in class which was utilized in using real-life tools and engaging in practical real life applications. This classroom was found to have increased student engagement.

In addition, students had more chances to know how the tools and ideas they were oriented are used in the real life. The positive results in terms of students’ engagement and performance are undoubtedly because of the flipped classroom and from the effective use of class time (Toto & Nguyen, 2009).

More so, Yee and Hargis (2009) found out that students can study the video lesson virtually on their personal electronic device in an asynchronous environment. Students can pause, rewind, replay, and even fast forward their video

lessons. In the flipped classroom students have increased flexibility to pace the sequencing and delivery of their lessons.

While it is true that there are hundreds of articles and publications that refer to the flipped classroom, the teachers that use the method, or students' positive perceptions about it, but there are still little data to measure just how much a student learns from the approach (Hamdan, McKnight 2013). Of the limited data that exists, some of it opposes each other. Zappe (2009) flipped a college architecture class and Ruddick (2012) flipped a college prep chemistry class and both found that students perceived the flipped instruction as a better or more efficient method of teaching. Additionally, in the study done with an undergraduate world history course, 72% of respondents replied that the videos helped to prepare them either most of the time, or all of the time. 22%responded that the videos helped little to prepare for the following class (Gaughan 2014).

However, Nielson (2012) and Arnold-Gaza (2013) have their negative perceptions with the use of flipped classroom since they found out that a lot of students prefer the traditional classroom over the latter or do not have the appropriate tools at home to perform the flipped classroom. Goodwin (2013) however stated, "There is certainly no scientific research base to indicate exactly how well flipped classrooms work." The problem with understanding and accepting the flipped classroom model as a valid method of instruction is that there are comparatively few researches done on the effectiveness and efficiency of students' learning from using the flipped classroom.

Teaching Mathematics. The failure rate for math subject is around 50% (Brewer, 2009), and much of this problem can be attributed to the case where students do not get adequate time or resources to understand a topic before moving on. The challenge of covering the entire mathematics curriculum guide while accommodating the needs of struggling students creates an almost impossible situation.

Consequently, many students move through math curriculum with deficiencies (Gordon, 2008). In math, if a student does not understand the basic concepts, it is often very difficult for them to catch-up (Gordon, 2008). While there are many possible avenues to pursue while trying to improve these alarming statistics, practical realities often preclude drastic changes to programs and curriculum (Hastings, 2006).

Thus, Hastings (2006) stated that efforts to solve the problem of helping students succeed should focus on interventions that can be implemented within the framework of existing programs. The traditional framework of most math classes includes lectures provided by the instructor and homework completed by the student(Gordon, 2008).If effective pedagogical changes can be made that fit within this traditional lecture-based framework, then it is more likely that these changes will be accepted and consistently used by the mathematics education community. (Brewer, 2009). Because the flipped model does not alter the student- teacher interaction times and maintains an institutions course scheduling, a change to a flipped model is practical and reasonable. The flipped model and technological advances may allow teachers to discover new ways to learn about students, provide

instant feedback, adapt instruction, and generally offer a high quality educational experience to all scholars (Manspeaker, 2011).

In the traditional way of teaching math concepts, students are subjected to plain lectures then giving homework for the students to solve. Generally, traditional methods are based on direct instruction where students are shown one standard method of performing a task such as solving sequences, in a standard arrangement (Berret, 2012). A task is taught in isolation rather than as only a part of a more complex project. Also, Mazur (2012) believed that traditional lecture presentations are almost always delivered as a monologue to a passive disengaged audience. In addition, he stated that lectures simply reinforce students' feelings that the most important step in mastering the material is memorizing a zoo of apparently unrelated examples.

Hence, students learning math in a flipped classroom environment preferred this approach because they are able to figure out problems in an imaginative ways and display cooperation in working with others to solve problems and talk about ideas than students in an old classroom setup (Strayer, 2008).

Arithmetic and Geometric Sequence. According to Stapel (2018),an arithmetic sequence goes from one term to the next by always adding (or subtracting) the same value. For instance, 2, 5, 8, 11, 14,... is arithmetic, because each step adds three; and 7, 3, –1, –5,... is arithmetic, because each step subtracts 4.The number added (or subtracted) at each stage of an arithmetic sequence is called the "common difference" d, because if you subtract (that is, if you find the difference of) successive terms, you'll always get this common value.

A geometric sequence goes from one term to the next by always multiplying (or dividing) by the same value. So 1, 2, 4, 8, 16,... is geometric, because each step multiplies by two; and 81, 27, 9, 3, 1, is geometric, because each step divides by 3. The number multiplied (or divided) at each stage of a geometric sequence is called the "common ratio" r, because if you divide (that is, if you find the ratio of) successive terms, you'll always get this common value (Stapel, 2018).

Perceptions on the use of flipped classroom. The use of video to deliver content has become effective in generating positive perceptions from the students. Lecture-videos, as one of the features of flipped classroom approach, can help students understand mathematical concepts better since they are able to pause, rewind, and replay their lessons any place at any time (Clark,2007). Asselin and Moayeri (2011) related that in some cases, video can be as good as an instructor in communicating facts or demonstrating procedures to assist in mastery learning where a student can view difficult solving procedures as many times as they need to.

Comparatively, Franciszkowics (2008) argued that visual media is critical in courses where there are multiple steps that go into problem solving. Videos can be used to provide scaffolding for students through problems by modeling expert problem-solving strategies (Franciszkowics, 2008). In addition to the videos, technology and social media have given teachers greater opportunities to meet the needs of their learners.

Flipped classroom activities also offer a rich context for structured learning as well as alternative teaching methods to increase student engagement. Bringing material to life by streaming videos opens the classroom up to a wider world where

students can start to see the value of learning. Zainuddin and Attaran (2015) highlighted that increasing engagement through interactive flipped classroom encourages students to become better learners, empowering self-initiated learning as they take an interest in what's going on around them and actively seek to satisfy their own curiosities.

In terms of enjoyment, flipped classroom approach is more enjoyable for the students since it allowed for more interaction with the teacher as well as among their classmates. In class, they engage in higher order thinking skills, such as synthesizing, analyzing, and evaluating material through hands-on projects, group work, problem-solving, discussions, debates, or any multitude of student-centered activities (Doman & Webb, 2017; Kostka& Brinks Lockwood, 2014).

Comparatively, the study by Johnson (2013) stated that students enjoyed the flexibility of the Flipped Classroom. They were able to interact with the teacher more frequently; they enjoyed the increase in learning activities in class; and, they appreciated the reduced amount of homework.

Conceptual Framework of the Study

The variables of this study are presented as input, process, and output.

The input variable is the performance in solving problem involving sequences before the application of flipped classroom approach. The process variable is the use of flipped classroom approach to teaching, pre-test, and post-test. Flipped classroom approach is the intervening program designed to help the respondents learn and improve the students' performance. The output variable is the performance in solving problem involving sequences after the application of flipped classroom approach.

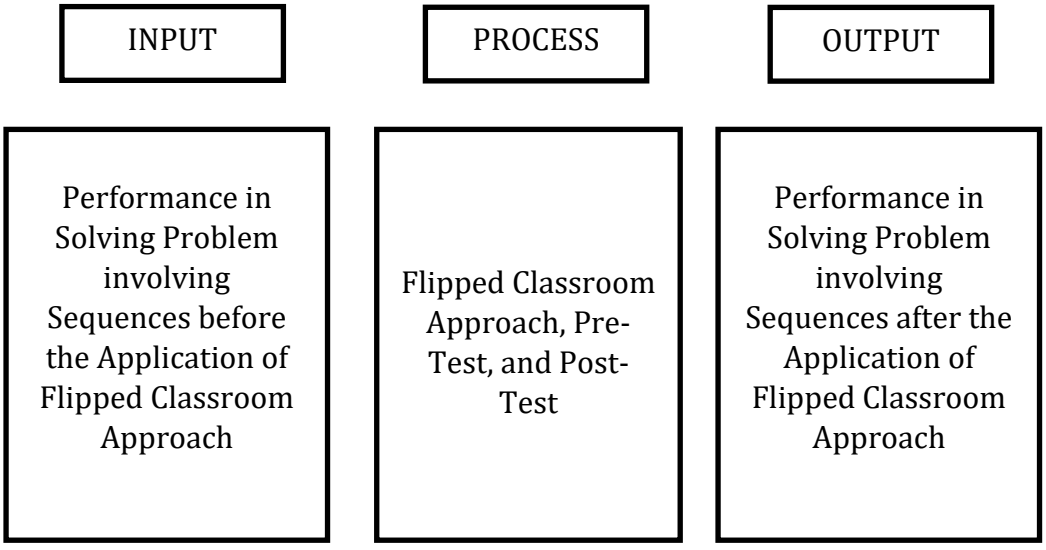

Figure 2: **Schematic Diagram of the Conceptual Framework of the Study**

Statement of the Problem

This study aimed to identify the effectiveness of flipped classroom approach in enhancing the skills of students' in solving problems involving sequences.

Specifically, the researcher sought to determine the answers to the following questions:

1. What is the pre-test performance of the students in solving problems involving sequences?
2. What is the post-test performance of the students of the same topics with the use of the flipped classroom approach?
3. Is there a difference in the pre-test and post-test performance of the students?
4. To what extent do students perceive the utilization of the flipped classroom approach in teaching sequences?
5. Is there a relationship between the perceptions of the students of the flipped classroom approach and their post-test performance?

Significance of the Study

Results of this study showed the effectiveness of flipped classroom approach in enhancing the skills of students in solving problems involving sequences.

Specifically, this study would be beneficial to the following:

Administrators. The outcomes of this study would help them map out the necessary steps to improve students' performance in Mathematics. May they be motivated in planning ways and means in eliminating particular barriers in learning the subject.

Mathematics teachers. This study would become a helpful tool/guidepost in understanding their students' performance. They would be able identify what gaps they need to fill-in in students' conceptual understanding..

Benedicto P. Tirambulo Memorial National High School. The findings of this research would be influential in achieving an increase in the Mean Percentage Score (MPS) in periodical and achievement tests in Mathematics.

Students. This study would help identify clearly causes of student's difficulties in learning Mathematics and will be addressed adequately through the use of flipped classroom approach. This would likely lead to higher respondents' responsiveness and participatory attitude in the subject.

Researcher. This study would make him knowledgeable of the effectiveness of the flipped classroom approach to teaching. This would guide him in helping Grade 10 students improve their performance in the subject. As a teacher, this study would also help him become more effective and efficient in teaching.

Future researchers. The implications and outcomes of this study on the effectiveness of the flipped approach to teaching would be greatly beneficial to them. However, the researcher suggested to test the approach to other topics and even other subjects.

Scope and Limitations of the Study

Scope of the study. This study covered one of the schools in Mabinay District I in the Division of Negros Oriental, Benedicto P. Tirambulo Memorial National High School. The respondents of this study were the 46 students from Grade 10- Sumagaysay enrolled for school year 2018-2019. This research was confined to the determination of the effectiveness of flipped classroom approach and the perception of students in its use.

Limitations of the study.T his study was limited to gather data from 46 Grade 10 section Sumagaysay students of Benedicto P. Tirambulo Memorial National High School. Since this study was confined only to one school, its findings and conclusions could not speak of the other schools with different environment, orientation, and background.

Also, there were some respondents who do not own mobile phones and computer so they utilized the computers available in school and this might affect the perception of the respondents on the utilization of flipped classroom approach.

Other factors such as the physical and emotional aspects of the respondents, the type of learner each student belongs, and the like which could affect the performance and participation of the respondents in this study were beyond the control of the researcher and were also treated as additional limits of the study.

Research Methodology

Research design. This research was an experimental type of study since it aimed to discover the influence of one or more factors upon a condition, group, or situation, purpose of which is to discover "what will be."

Specifically, this was a single group with a pre-test and a post-test design under pre-experimental design. The respondents of this study were given a pre-test about the subject matter to be covered before the start of the experiment. The same pre-test but in a different form, called the post-test, was administered to the group after the experimental period. Observed difference between the pre- and post-tests results was considered as caused by the experimental factor (Calderon & Gonzales, 1993).

The students' performance in problems involving sequences was identified at the beginning of the study through their pre-test results. The use of flipped classroom approach to teaching was conducted with the aim of improving respondents' performance. A post-test was administered later on to see if there was a difference between their performances before and after the approach.

Research environment.T his study was conducted at Benedicto P. Tirambulo Memorial National High School, one of the six secondary schools in Mabinay District I, Division of Negros Oriental. According to the record of district supervisor Vilma S. Sumagaysay, Ph.D., it has the biggest population in terms of number of students and teachers among the schools in the district. They have computer laboratories and all instructional rooms meet the standard specifications. This means that the schools meet the DepEd's guidelines for safety and usability.

This school has an average class size of 55. It has five sections for Grade 7, four for Grade 8, three for Grade 9 and Grade 10. The Grade 10 section Sumagaysay which was the focus of this study has a total population of forty six (46) students.

The accessibility to the secondary school is critical for data collection, and since the researcher is a teacher in the said school, thus the choice of the study locale.

Research respondents. The respondents of the study were the Grade 10 section Sumagaysay students of Benedicto P. Tirambulo Memorial National High School enrolled during the academic year 2018–2019.

Research instruments. The study made use of teacher-made tests which one was for pre-testing and another whose items would be similar to the first was for post-testing. This was to ensure that the respondents' answers were not attributed by simple recall. Since the items in the pretest and post test provided only the correct and usually three incorrect answers, the researcher asked other Mathematics teachers their feedback and considered his own experiences as well in order to come up with the other options needed in the self-made multiple choice test. The pretest and posttest were presented to three experts in the field of Mathematics for content validity and cross checking if the items were aligned with the specific problems of the study. The suggestions of the experts were considered in the refinement of the test items.

The self-made questionnaire on the perception of the students on the use of flipped classroom were based from the readings on the related literature, published and unpublished studies. To ensure item reliability, a dry-run was conducted. There

were 30 selected students who served as the respondents. The items were tested for its reliability using the Cronbach's alpha test with 0.768 in understanding the concepts, 0.740 in engagement, and 0.709 in enjoyment. This test is regarded as the most suitable type for survey research where items were not scored right or wrong and where each item could have different answers (McMillan and Schumacher, 2010). It was found out the items were reliable.

Research procedure. The researcher wrote a letter request for the permission of the conduct of the study and the distribution of the final questionnaire to the Schools Division Superintendent of the Division of Negros Oriental. The signed and approved request was presented to the school head of the concerned school for formal permission regarding the examinations and the use of flipped classroom approach to teaching-learning process. After the permission to conduct the study was secured, parental consent for the respondents was sought and granted.

The researcher administered the pretest on sequences to the respondents before the conduct of the experiment. Then, he personally conducted the use of flipped classroom approach to teaching-learning process that lasted for one and a half month. The teacher provided the downloaded lecture-videos to students before class. The researcher made sure that the students were required to watch the videos at home or outside the class hours and took notes just as they would be expected to do during a classroom lecture. Then, class time is spent on inquiry-based learning and answering of students' homework. Changes in the students' perceptions and

attitudes were verified and evaluated through the completion of the questionnaire on perception.

Statistical Treatment of the Data

The tools used in analyzing and in interpreting the data were the following:

Percentage. This was used to show how a part is related to a whole. It was used in presenting students' performance in both the pre and post-tests.

Mean. This was used to determine students' level of performance.

Weighted mean. This was used in getting the extent of students' perception in the utilization of the flipped classroom approach in teaching sequences.

t-test for dependent data. This was used to identify the significant difference between the pretest and posttest performance of the students. This was utilized since the data were in ratio scale.

The **proficiency level or academic performance** at which the students were performing was based on the following criteria (DepEd Order No. 8, s 2015).

Rating	Verbal Equivalent	Explanation
90% and above	Outstanding	The student at this level exceeds the core requirements in terms of knowledge, skills and understanding, and can transfer them automatically and flexibly through authentic performance tasks.

85% - 89%	Very Satisfactory	The student at this level has developed the fundamental knowledge and skills and core understandings, and can transfer them independently through authentic performance tasks.
80% - 84%	Satisfactory	The student at this level has developed the fundamental knowledge and skills and core understandings, and with little guidance from the teacher and/or with some assistance from peers, and can transfer these understandings through authentic performance tasks.
75% - 79%	Fairly Satisfactory	The student at this level possesses the minimum knowledge and skills and core understandings, but needs help throughout the performance of authentic tasks.
74% down	Did not Meet Expectations	The student at this level struggles with his/her understanding; prerequisite and fundamental knowledge and/or skills have not been acquired or developed adequately to aid understanding.

The following interpretations will also be applied by the researcher to describe the attitude of the students since the original instrument has only strongly agree to strongly disagree verbal descriptions:

Verbal Description	Scale	Explanation
5-Strongly Agree (SA)	(4.21-5.00)	The respondent is 81-100% agree with the effectiveness of flipped classroom.
4- Agree (A)	(3.41-4.20)	The respondent is 61-80% agree with the effectiveness of flipped classroom.
3- Moderately Agree (MA)	(2.61-3.40)	The respondent is 40-60% agree with agree with effectiveness of flipped classroom.
2-Disagree (D)	(1.81-2.60)	The respondent is 21-40% agree with agree with effectiveness of flipped classroom.
1-Strongly Disagree (SD)	(1.00-1.80)	The respondent is 1-20% agree with effectiveness of flipped classroom.

Operational Definition of Terms

The term was defined to facilitate clear understanding of their meanings as they were used in the study:

Flipped Classroom Approach–is a teaching approach in which students view outside the class/at home the lecture- video about sequences downloaded from the internet. Then, class time is spent on inquiry-based learning and answering of students' homework.

Chapter II

Presentation, Analysis and Interpretation of Data

The chapter actualizes the gathered data through presentation, analysis, and interpretation based on the problems specified in the preceding chapter. The researcher shows the results in tabular and textual forms for better understanding.

Table 1
Pre-test Performance of the Students

Rating	Verbal Description	Frequency	Percent
80% - 84%	Satisfactory	3	6.52
75% - 79%	Fairly Satisfactory	18	39.13
Below 75%	Did Not Meet Expectations	25	54.35
Total		46	100.00
Mean	74.33 (Did Not Meet Expectations)		
Sd	3.94		

The data in Table 1 reveal the pre-test results of Grade 10 students in solving problems involving sequences before the use of flipped classroom approach. As reflected, majority (54.35%) of the respondents did not meet the expectations while a considerable percentage (39.13%) of the students performed fairly satisfactorily. Notably, only few (6.52%) performed satisfactorily. The overall data yield a failing performance (74.33) or students have not met the expectations. This signifies that the prerequisite and fundamental knowledge or skills have not been acquired or

developed adequately to aid understanding in solving problems involving sequences. (DepEd Order No. 8, s 2015).

The above ratings of the students are attained after the traditional way of teaching sequences. These students are subjected to plain lectures then giving homework for the students to solve. Generally, traditional methods are based on direct instruction where students are shown one standard method of performing a task such as solving sequences, in a standard arrangement (Berret, 2012). A task is taught in isolation rather than as only a part of a more complex project. Also, Mazur (2012) believed that traditional lecture presentations are almost always delivered as a monologue to a passive disengaged audience. In addition, he stated that lectures simply reinforce students' feelings that the most important step in mastering the material is memorizing a zoo of apparently unrelated examples.

Table 2
Post-test Performance of the Students

Rating	Verbal Description	Frequency	Percent
90% - 100%	Outstanding	10	21.74
85% - 89%	Very Satisfactory	18	39.13
80% - 84%	Satisfactory	7	15.22
75% - 79%	Fairly Satisfactory	9	19.56
Below 75%	Did Not Meet Expectations	2	4.35
Total		46	100.00
Mean	85.07 (Very Satisfactory)		
Sd	6.75		

Table 2 shows the post-test performance of the 46 students after the implementation of flipped classroom approach. It can be gleaned from the data that some students performed very satisfactorily (39.13%). However, there are still 4.35% of the students who did not meet the expectations in their performance. It can be noted in the previous Table that more than half (54.35%) of these students did not reach the passing rate.

The mean of 85.07 which is very satisfactory means students have developed the fundamental knowledge and skills and core understandings, and can transfer them independently through authentic performance tasks (DepEd Order No. 8, s 2015).

It is suffice to say that flipped classroom approach in teaching these students really improved their performance in solving problems involving sequences.This is supported by Strayer (2008) since he found out that students in a flipped classroom environment preferred this approach and they were able to figure out problems in an imaginative ways and displayed cooperation in working with others to solve problems and talk about ideas than students in an old classroom setup.

Also, the result in this study is similar to Hamdan and Arfstrom (2013) who viewed flipped classroom as one of the recent changes as far as technologies in education are concerned. It serves as a standard of teaching-learning practice in nurturing students' active learning in higher education.

Table 3

Difference in the Pre-test and Post-test Performances of the Students

Test	Mean	Verbal Description	Difference
Pre-test	74.33	Did Not Meet Expectations	10.74
Post-test	85.07	Very Satisfactory	

Table 3 reflects that there is a difference of 10.74% on the pre-test and post-test performances of the students. This means that students understand the concepts through the flipped classroom approach of the teacher.

Students in a flipped classroom environment preferred this approach because they are able to figure out problems in an imaginative ways and display cooperation in working with others to solve problems and talk about ideas than students in an old classroom setup (Strayer, 2008).

One such study by Nichols (2012) emphasized that, in the flipped classroom, the students have more time to review the subject and the students who can't attend class can obtain the materials of learning. The students need not do homework but instead actively work, discuss and solve problems in a group. His study also indicated that compare to students in a traditional classroom, learners in a flipped classroom show a lower level task orientation.

Whereas, in the traditional method of learning, the educator first delivers necessary information in the form of lectures and then evaluates the learning of students through examinations, assignments, and quizzes (Berret, 2012).

Besides, students had more chances to know how the tools and ideas they were oriented are used in the real life. The positive results in terms of students'

engagement and performance are undoubtedly because of the flipped classroom and from the effective use of class time (Toto & Nguyen, 2009).

Table 4
Students' Extent of Perception of the Flipped Classroom Approach in Terms of Understanding the Concepts

Indicators	Weighted Mean μ	Verbal Description	Extent of Perception
1. I can be able to watch the lectures at any time of the day and move quickly or slowly depending on my understanding.	4.20	Agree	High
2. I can use my free time to deepen my understanding in the interesting aspect of mathematics.	4.13	Agree	High
3. I like that the lessons are presented through videos and the activities really help me to understand the content.	4.09	Agree	High
4. I can get help with my math problems instead of struggling doing it at home with no help.	4.09	Agree	High
5. I feel that the Flipped Classroom gives me more valuable time in class to practice and work on problems with my classmates.	4.07	Agree	High
Composite	4.11	Agree	High

Legend:	Scale	Verbal Description	Extent of Perception
	4.21 – 5.00	Strongly Agree	Very High
	3.41 – 4.20	Agree	High
	2.61 – 3.40	Moderately Agree	Moderate
	1.81 – 2.60	Disagree	Low
	1.00 – 1.80	Strongly Disagree	Very Low

Table 4 presents the respondents' extent of perception of the flipped classroom approach in terms of understanding the concepts. As reflected in the table, the students highly indicated that they can watch and adjust the videos of the discussion at any time and based from their understanding ($\mu_w = 4.20$). They like that the lessons are presented through videos since they can watch it in their free time and work on math problems together with their classmates without struggling

solving at their homes. This is justified by the composite weighted mean of 4.11 with high extent of perception.

The use of video to deliver content has become effective in generating positive perceptions from the students. Lecture-videos, as one of the features of flipped classroom approach, can help students understand mathematical concepts better since they are able to pause, rewind, and replay their lessons any place at any time (Clark,2007). Asselin and Moayeri (2011) related that in some cases, video can be as good as an instructor in communicating facts or demonstrating procedures to assist in mastery learning where a student can view difficult solving procedures as many times as they need to. Videos can be used to provide scaffolding for students through problems by modeling expert problem-solving strategies (Franciszkowics, 2008). In addition to the videos, technology and social media have given teachers greater opportunities to meet the needs of their learners.

Table 5
Students' Extent of Perception of the Flipped Classroom Approach in Terms of Engagement

Indicators	Weighted Mean μ	Verbal Description	Extent of Perception
1. I try to connect what I learned in mathematics with what I encounter in real life or in other subjects.	4.30	Strongly Agree	Very High
2. I can interact with my classmates, ask the topic that is not well understood, and clarify my question with the teacher.	4.13	Agree	High
3. I can solve problems in the same manner in the video and in the same way the teacher does.	4.11	Agree	High
4. I engage in finding new topics and often spend extra time trying to obtain more information about them.	4.07	Agree	High
5. I really make an effort in understanding the lesson presented in the video.	3.80	Agree	High
Composite	4.08	Agree	High

Legend:	**Scale**	**Verbal Description**	**Extent of Perception**
	4.21 – 5.00	Strongly Agree	Very High
	3.41 – 4.20	Agree	High
	2.61 – 3.40	Moderately Agree	Moderate
	1.81 – 2.60	Disagree	Low
	1.00 – 1.80	Strongly Disagree	Very Low

As shown in Table 5, students have high extent of perception of the flipped classroom approach in terms of engagement ($\mu_w = 4.08$). They perceive that through flipped classroom, they can connect their learnings in real life situations and in other subjects ($\mu_w = 4.30$). They are also engaged in class since they can ask and clarify their classmates and teacher for topics not well understood, solve problems the same way in the video and the teacher does, spend extra time in discovering new topics and information. They also try to be engaged by making way to understand the lessons.

These data further imply that flipped classroom activities offer a rich context for structured learning as well as alternative teaching methods to increase student engagement. Bringing material to life by streaming videos opens the classroom up to a wider world where students can start to see the value of learning. Zainuddin and Attaran (2015) highlighted that increasing engagement through interactive flipped classroom encourages students to become better learners, empowering self-initiated learning as they take an interest in what's going on around them and actively seek to satisfy their own curiosities.

Table 6
Students' Extent of Perception of the Flipped Classroom Approach in Terms of Enjoyment

Indicators	Weighted Mean μ	Verbal Description	Extent of Perception
1. I am often excited to join the class every day.	4.33	Strongly Agree	Very High
2. The flipped classroom offers interesting activities.	4.17	Agree	High
3. I enjoy learning when technology is incorporated.	4.17	Agree	High
4. I enjoyed solving and doing all the activities provided in the flipped classroom.	3.98	Agree	High
5. I generally have so much fun learning math concepts that I gladly volunteer to answers board work activities.	3.78	Agree	High
Composite	4.09	Agree	High

Legend:	**Scale**	**Verbal Description**	**Extent of Perception**
	4.21 – 5.00	Strongly Agree	Very High
	3.41 – 4.20	Agree	High
	2.61 – 3.40	Moderately Agree	Moderate
	1.81 – 2.60	Disagree	Low
	1.00 – 1.80	Strongly Disagree	Very Low

The data in Table 6 display students' extent of perception of the flipped classroom approach in terms of enjoyment. It is reflected in the composite mean of 4.09 that they highly enjoy flipped classroom. They are often excited to come to class because of interesting activities. They also enjoy learning, solving and doing all the activities because technology is incorporated in class and made them participate in board work happily.

It is enough to say that flipped classroom approach is more enjoyable for the students since it allowed for more interaction with the teacher as well as among their classmates. In class, they engage in higher order thinking skills, such as synthesizing, analyzing, and evaluating material through hands-on projects, group work, problem-solving, discussions, debates, or any multitude of student-centered activities (Doman & Webb, 2017; Kostka& Brinks Lockwood, 2014).

Comparatively, the study by Johnson (2013) stated that students enjoyed the flexibility of the Flipped Classroom. They were able to interact with the teacher more frequently; they enjoyed the increase in learning activities in class; and, they appreciated the reduced amount of homework.

Table 7
Relationship between the Perceptions of the Students of the Flipped Classroom Approach and Their Post-test Performance

Variables	Computed r_s	Degree of Relationship
Understanding the Concepts and Post-test Performance	0.032	Very Weak
Engagement and Post-test Performance	0.021	Very Weak
Enjoyment and Post-test Performance	0.010	Very Weak

Legend: **Value of r** **Strength of Relationship** (Statistical Correlation, 2009)

Between	± 0.50 to ± 1.00	± strong relationship
Between	± 0.30 to ± 0.49	± moderate relationship
Between	± 0.10 to ± 0.29	± weak relationship
Between	± 0.01 to ± 0.09	± very weak relationship

Table 7 reflects that there is a very weak relationship between the perceptions of the students in terms of understanding the concepts and their post-test performance. This may imply that their perceptions cannot be considered as determinants of their post-test performance. This is because the perceptions of the students do not vary much. They have high perceptions as reflected in Table 4. The same finding is noted considering students' engagement and interest. This result opposes the findings of Nielson (2012) and Arnold-Gaza (2013) who revealed negative perceptions with the use of flipped classroom since they found out that a lot of students prefer the traditional classroom over the latter or do not have the appropriate tools at home to perform the flipped classroom.

Chapter III

Summary of Findings, Conclusions, and Recommendations

This chapter capsulates the study, shows striking findings, presents the conclusions and offers recommendations to enhance mathematics skills of students in solving problem involving sequences using the flipped classroom approach.

Restatement of the Problem

This study aims to identify the effectiveness of flipped classroom approach in enhancing the skills of students' in solving problems involving sequences.

Specifically, the study sought to answer the following questions:

6. What is the pre-test performance of the students in solving problems involving sequences?
7. What is the post-test performance of the students of the same topics with the use of the flipped classroom approach?
8. Is there a difference in the pre-test and post-test performance of the students?
9. To what extent do students perceive the utilization of the flipped classroom approach in teaching sequences?
10. Is there a relationship between the perceptions of the students of the flipped classroom approach and their post-test performance?

Findings

From the gathered data, the following findings are deduced:

1. **Pre-test Performance of the Students**

   The data revealed that 54.35% of the students are failing and 39.13% of them are in the fairly satisfactorily level in solving problems involving sequences.

2. **Post-test Performance of the Students**

   The data indicated that 39.13% of the students are in the very satisfactory level and 21.74% of them are in the outstanding level in solving problems involving sequences.

3. **Difference in the Pre-test and Post-test Performances of the Students**

   The data delineated that there is a difference of 10.74% on the pre-test and post-test performances of the students.

4. **Students' Extent of Perception of the Flipped Classroom Approach**

   The data indicated the following extent of students' perceptions of the flipped classroom approach:

   4.1 high in terms of understanding the concepts in solving problems involving sequences which obtained a weighted mean of 4.11;

   4.2 high in terms of engagement in solving problems involving sequences which obtained a weighted mean of, 4.08; and

   4.3 highin terms of enjoyment in solving problems involving sequences which obtained a weighted mean of, 4.09.

5. Relationship between the Perceptions of the Students of the Flipped Classroom Approach and Their Post-test Performance

The data revealed the following degrees of realationship:

a. for understanding the concepts and post-test performance, r_s = 0.032 (weak) ;

b. for engagement and post-test performance, r_s = 0.021 (weak); and

c. for enjoyment and post-test performance, r_s = 0.010 (weak).

Conclusions

In the light of the findings, these conclusions are hereby proposed.

1. The pretest performance of the students in solving problems involving sequences is failing.
2. The posttest performance of the students in the same areas introduced by flipped classroom approach is passing and generally in the very satisfactory level.
3. There is a difference between the pretest and posttest performances of the students. The increase in their posttest performance is attributed to the use of flipped classroom approach.
4. The students' extent of perception of the flipped classroom approach in terms of understanding the concepts, engagement, and enjoyment is high
5. The relationship between the perceptions of the students in terms of understanding the concepts, engagement, and interest and their post-test performance is weak.

Recommendations

In the light of the findings and conclusions, the following are hereby recommended.

1. Seminars and workshops may be conducted by the school authorities to expose the teachers to different blended learning strategies and get them ready to implement this innovative teaching strategy.
2. The study may be replicated in other Mathematics subjects using a larger sample to confirm the aforementioned findings.
3. Future researchers on the flipped classroom may employ controlled studies that objectively examine student performance throughout a semester or even the entire school year.

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Appendices

LETTER OF REQUEST TO THE SUPERINTENDENT

Republic of the Philippines
DEPARTMENT OF EDUCATION
Region VII, Central Visayas
Schools Division of Negros Oriental
MABINAY DISTRICT I
BENEDICTO P. TIRAMBULO MEMORIAL NATIONAL HIGH SCHOOL
Paniabonan, Mabinay, Negros Oriental

June 04, 2018

WILFREDA D. BONGALOS, Ph. D., CESO V
Schools Division Superintendent
Division of Negros Oriental

Thru: **VILMA S. SUMAGAYSAY**
District Supervisor
Mabinay District I

Madam:

May I have the honor to ask permission from your good office to conduct my study entitled, **"FLIPPED CLASSROOM APPROACH IN TEACHING SEQUENCES"** to the Grade 10 students in Benedicto P. Tirambulo Memorial National High School, in partial fulfilment of the requirements for the degree of Master of Arts Major in Mathematics at Foundation University, DumagueteCity.

Attached is the copy of the questionnaire for your perusal. Rest assured that data will be confidential in accordance to the ethical standards of research.

I fervently hope for your positive response in this regard.

Thank you and more power.

Respectfully yours,

(sgd) EFREN M. BALDADO
Researcher/ Teacher

LETTER OF REQUEST TO THE PRINCIPAL

June 07, 2018

ROSEMARIE S. BOHOL
School Principal
Benedicto P. Tirambulo Memorial National High School

Madam:

May I have the honor to ask permission from your good office to float my questionnaire regarding my study entitled, "FLIPPED CLASSROOM APPROACH IN TEACHING SEQUENCES" to your Grade 10 students, in partial fulfillment of the requirements for the degree Doctor of Education at Foundation University, Dumaguete City.

Attached is the copy of the questionnaire for your perusal. Rest assured that data will be confidential in accordance to the ethical standards of research.

I fervently hope for your positive response in this regard.

Thank you and more power.

Respectfully yours,

(sgd) EFREN M. BALDADO
Researcher/ Teacher I

Pre-test

Read each item carefully and encircle the letter that corresponds to the correct/best answer.

1. Find the one arithmetic mean between -6 and 14.

a) 1 b) -4 c) 4 d) -8

2. What is the 1st term in the arithmetic sequence __, 9, __, 33, 45.

a) -3 b) -1 c) 3 d) 6

3. Find the 8th term of the sequence $t_n = 1600\ (0.5)^{n-1}$

a) 6.25 b) 8.5 c) 12.5 d) 15.25

4. Find the common difference in the arithmetic sequence $3, \frac{13}{4}, \frac{7}{2}, \frac{15}{4}, \ldots$

a) $\frac{1}{4}$ b) $\frac{3}{4}$ c) $\frac{5}{2}$ d) 4

5. Which value is the missing number in the sequence? 61 57 53 ___ 45 41

a) 52 b) 51 c) 49 d) 47

6. The terms of an arithmetic sequence has a common

a)difference. b) factor. c) product. d)quotient

7. Which term of the arithmetic sequence 8,5,2,-1, ...is -16?

a)12th term b) 11th term c) 10th term d)9th term

8. What are the next two terms of the sequence 5, 1, -3, -7…?

a) -11 & -15 b) -11 & -14 c)11 & 14 d)11 & 15

9. What is the arithmetic mean of 20 and 70?

a) 40 b) 45 c) 50 d) 55

10. If three arithmetic means are inserted between 11 and 39, find the second arithmetic mean?

a) 18 b) 25 c) 32 d) 46

11. Which term of the arithmetic sequence 4, 1, -2, -5 , . . . is -29 ?

a) 9th term b)10th term c)11th term d)12th term

12. The first term of an arithmetic sequence is 2 while the 18th term is 87. Find the common difference of the sequence.

a) 7 b) 6 c) 5 d) 3

13. What is the nth term of the arithmetic sequence 7, 9, 11, 13, 15, 17, . .?

a) 3n + 4 b) 4n + 3 c) n + 2 d) 2n + 5

14. Find p so that the numbers 7p + 2, 5p +12, 2p -1,... form an arithmetic sequence.

a) -8 b) -5 c) -13 d) -23

15. Which of the following is the sum of all the multiples of 3 from 15 to 48?

a) 315 b) 360 c) 378 d) 396

16. What is the next term in the geometric sequence -2,6,-18,

a) 54 b) -54 c) 9 d) -9

17. What is the common ratio in the sequence 12, -18, 27, ...

a) 2/3 b) 3/2 c) -2/3 d) -3/2

18. What is the 7^{th} term of the sequence whose *nth* term is $a_n = \frac{n^2-1}{n^2+1}$?

a) 24/25 b)23/25 c) 47/50 d)49/50

19. What is *k* so that *k*-3, *k*+2, *k*+3 form a geometric sequence?

a) 13/4 b) – 13/4 c) 1/5 d) – 1/5

20. Find the 11^{th} term of the sequence $t_n = n(n - 6)$.

a) 55 b) 65 c) 75 d) 85

21. Find the sixth term of the geometric sequence for which a1 = 5 and r = 2.

a) 320 b) 15 c) 160 d) 6250

22. A Geometric sequence is characterized by a constant

a)difference. b) product. c) ratio. d) sum

23. What is the common ratio in the geometric sequence -18, 54,-162,...?

a) 3 b) 2 c) -2 d) -3

24. What is the sum of the first 6 terms of the sequence 5,15, 45, ...?

a) 5,465 b) 1,820 c) 1,215 d) 135

25. What is the 7th term of the geometric sequence 6, 12, 24, 48, ...?

a) 96 b) 192 c) 384 d) 768

26. What is the geometric mean of 40 and 10?

a) 20 b) 30 c) 1/20 d) 1/30

27. What is the 6th term of the geometric sequence $\frac{2}{25}, \frac{2}{5}, 2, 10, \ldots$?

a) 25 b) 250 c) 1250 d) 2500

28. Find the eighth term of a geometric sequence where the third term is 27 and the common ratio is 3.

a) 2 187 b) 6 561 c) 19 683 d)59 049

29. If three geometric means are inserted between 1 and 256, find the third geometric mean.

a) 64 b) 32 c) 16 d) 4

30. Find the sum of the geometric sequence where the first term is 3, the last term is 46 875, and the common ratio is 5.

a) 58 593 b) 58 594 c) 58 595 d) 58 596

Questionnaire

(for students)

Flipped Classroom Approach in Teaching Sequences

This questionnaire aims to identify and assess the perceptions of students' in the flipped classroom approach. Specifically, it will also determine the effectiveness of flipped classroom as an instructional approach. Please answer the following questions by filling in the blanks and by putting a check in the boxes provided. Please be assured that all responses shall be treated with confidentiality. Thank you very much.

Directions:

1. Read each statement. Please respond as truthfully as you can.

2. Place a check mark (√) on the column of your choice. Be guided with the following scale.

Verbal Description	Scale	Explanation
5-Strongly Agree (SA)	(4.21-5.00)	The respondent is 81-100% agree with the effectiveness of flipped classroom.
4- Agree (A)	(3.41-4.20)	The respondent is 61-80% agree with the effectiveness of flipped classroom.
3- Moderately Agree (MA)	(2.61-3.40)	The respondent is 40-60% agree with agree with effectiveness of flipped classroom.
2-Disagree (D)	(1.81-2.60)	The respondent is 21-40% agree with agree with effectiveness of flipped classroom.
1-Strongly Disagree (SD)	(1.00-1.80)	The respondent is 1-20% agree with effectiveness of flipped classroom.

Indicators	5 (Strongly Agree)	4 (Agree)	3 (Moderately Agree)	2 (Disagree)	1 (Strongly Disagree)
To what extent do students' perceive the following:					
A. Understanding the concepts					
6. I like that the lessons are presented through videos and the activities really help me to understand the content.					
7. I can get help with my math problems instead of struggling doing it at home with no help.					
8. I feel that the Flipped Classroom gives me more valuable time in class to practice and work on problems with my classmates.					
9. I can use my free time to deepen my understanding in the interesting aspect of mathematics.					
10. I can be able to watch the lectures at any time of the day and move quickly or slowly depending on my understanding.					
B. Engagement					
1. I can solve problems in the same manner in the video and in the same way the teacher does.					
2. I really make an effort in understanding the lesson presented in the video.					

3. I try to connect what I learned in mathematics with what I encounter in real life or in other subjects.					
4. I can interact with my classmates, ask the topic that is not well understood, and clarify my question with the teacher.					
5. I engage in finding new topics and often spend extra time trying to obtain more information about them.					
C. Enjoyment					
1. The flipped classroom offers interesting activities.					
2. I enjoy learning when technology is incorporated.					
3. I am often excited to join the class every day.					
4. I enjoyed solving and doing all the activities provided in the flipped classroom.					
5. I generally have so much fun learning math concepts that I gladly volunteer to answers board work activities.					

Pre-test
Table of Specifications

Topic	Competencies	Item Placement	Level of Difficulty			Total
			Easy (60%)	Ave. (30%)	Diff. (10%)	
Arithmetic and Geometric Sequences	Identify terms involving sequences.	6,22	**2**			**2**
	Find the next few terms of a sequence.	2, 8,16	**3**			**3**
	Find the nth term of a sequence.	5,7,11, 13,20	**3**	**2**		**5**
	Determine the nth term of a given arithmetic sequence.	3,28,	**1**	**1**		**2**
	Find the arithmetic mean of an arithmetic sequence.	1, 9,10	**2**	**1**		**3**
	Determine the sum of the first n terms of a given arithmetic sequence.	15		**1**		**1**
	Solve problems involving arithmetic sequence.	4, 12,14, 19	**2**	**1**	**1**	**4**
	Determine the nth term of a given geometric sequence and its common ratio.	17, 21, 23,25,	**3**	**1**		**4**
	Find the geometric mean of a geometric sequence.	26,29,	**2**			**2**
	Determine the sum of the first n terms of a given geometric sequence.	18,27		**2**		**2**
	Determine the sum of the first n terms of the given	24,30			**2**	**2**
Total			**18**	**9**	**3**	**30**

Post-test

Read each item carefully and encircle the letter that corresponds to the correct/best answer.

1. Which of the following is the sum of all the multiples of 3 from 15 to 48?

a) 315 b) 360 c) 378 d) 396

2. Find p so that the numbers 7p + 2, 5p +12, 2p -1,... form an arithmetic sequence.

a) -8 b) -5 c) -13 d) -23

3. What is the nth term of the arithmetic sequence 7, 9, 11, 13, 15, 17, . .?

a) 3n + 4 b) 4n + 3 c) n + 2 d) 2n + 5

4. The first term of an arithmetic sequence is 2 while the 18th term is 87. Find the common difference of the sequence.

a) 7 b) 6 c) 5 d) 3

5. Which term of the arithmetic sequence 4, 1, -2, -5 , . . . is -29 ?

a) 9^{th} term b)10^{th} term c)11th term d)12^{th} term

6. If three arithmetic means are inserted between 11 and 39, find the second arithmetic mean?

a) 18 b) 25 c) 32 d) 46

7. What is the arithmetic mean of 20 and 70?

a) 40 b) 45 c) 50 d) 55

8. What are the next two terms of the sequence 5, 1, -3, -7…?

a) -11 & -15 b) -11 & -14 c)11 & 14 d)11 & 15

9. Which term of the arithmetic sequence 8,5,2,-1, …..is -16?

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a) $\frac{1}{4}$ b) $\frac{3}{4}$ c)$\frac{5}{2}$ d) 4

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15. Find the one arithmetic mean between -6 and 14.

a) 1 b) -4 c) 4 d) -8

16. Find the sum of the geometric sequence where the first term is 3, the last term is 46 875, and the common ratio is 5.

a) 58 593 b) 58 594 c) 58 595 d) 58 596

17. If three geometric means are inserted between 1 and 256, find the third geometric mean.

a) 64 b) 32 c) 16 d) 4

18. Find the eighth term of a geometric sequence where the third term is 27 and the common ratio is 3.

a) 2 187 b) 6 561 c) 19 683 d)59 049

19. What is the 6th term of the geometric sequence $\frac{2}{25}, \frac{2}{5}, 2, 10, \ldots$?

a) 25 b) 250 c) 1250 d) 2500

20. What is the geometric mean of 40 and 10?

a) 20 b) 30 c) 1/20 d) 1/30

21. What is the 7th term of the geometric sequence 6, 12, 24, 48, …?

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22. What is the sum of the first 6 terms of the sequence 5,15, 45, ….?

a) 5,465 b) 1,820 c) 1,215 d) 135

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25. Find the sixth term of the geometric sequence for which a1 = 5 and r = 2.

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27. What is *k* so that *k*-3, *k*+2, *k*+3 form a geometric sequence?

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a) 24/25 b)23/25 c) 47/50 d)49/50

29. What is the common ratio in the sequence 12, -18, 27, ….

a) 2/3 b) 3/2 c) -2/3 d) -3/2

30. What is the next term in the geometric sequence -2,6,-18,

a) 54 b) -54 c) 9 d) -9

GRADES 1 to 12	School:	BPTMNHS	Grade Level:	10

Post-test

Topic	Competencies	Item Placement	Level of Difficulty			Total
			Easy (60%)	Ave. (30%)	Diff. (10%)	
Arithmetic and Geometric Sequences	Identify terms involving sequences.	10, 24	**2**			**2**
	Find the next few terms of a sequence.	14,8,30	**3**			**3**
	Find the nth term of a sequence.	11,9,5,3,26	**3**	**2**		**5**
	Determine the nth term of a given arithmetic sequence.	13,18	**1**	**1**		**2**
	Find the arithmetic mean of an arithmetic sequence.	15,7,6	**2**	**1**		**3**
	Determine the sum of the first n terms of a given arithmetic sequence.	1		**1**		**1**
	Solve problems involving arithmetic sequence.	12,4,2,27	**2**	**1**	**1**	**4**
	Determine the nth term of a given geometric sequence and its common ratio.	29,25,23,21	**3**	**1**		**4**
	Find the geometric mean of a geometric sequence.	20,17	**2**			**2**
	Determine the sum of the first n terms of a given geometric sequence.	28,19		**2**		**2**
	Determine the sum of the first n terms of the given	22,16			**2**	**2**
Total			**18**	**9**	**3**	**30**

Table of Specifications

	Teacher:	Efren M. Baldado	Learning Area:	Mathematics

I. OBJECTIVES	
A. Content Standards:	The learner demonstrates understanding of key concepts of sequences.
B. Performance Standards:	The learner is able to formulate and solve problems involving sequences.
C. Learning Competencies / Objectives: Write the LC Code for each	- evaluate and solve problems involving arithmetic and geometric sequence; - demonstrate understanding of arithmetic and geometric sequences in collaborative work and discussion. - develop teamwork in doing a group activity related to sequences
II. CONTENT	**Arithmetic and geometric sequences**
III. LEARNING RESOURCES	
A. References	
1. Teacher's Guide Pages	pp. 14-30
2. Learner's Materials Pages	pp. 9-33
3. Textbook Pages	
4. Additional Materials from Learning Resource (LR) portal	
B. Other Learning Resources	https://www.youtube.com/watch?v=F4HiKiQ30dM https://www.youtube.com/watch?v=gua96ju_FBk https://www.youtube.com/watch?v=crjEfCtZK_A (more videos from youtube.com about sequences)

IV. **PROCEDURES**	

A. Reviewing Previous Lesson or Presenting the New Lesson	Ask the students who among them still remember the topic about sequences during their grade 8.
B. Establishing a Purpose for the Lesson	Ask the students the sum of numbers from 1-100? Do think-pair-share for this task.
C. Presenting Examples/Instances of the Lesson	Say: There is a secret in finding the sum of nth term of a number in a sequence. Ask: Can you recall how to find the sum of a given sequence of number?
D. Discussing New Concepts and Practicing New Skills #1	Brief Description of Activity: After watching the videos at home about arithmetic and geometric sequences and then coming to class, the teacher and students will create a Venn diagram together comparing the two sequences. Several elements of Bloom's taxonomy are touched upon with this lesson. Students will be: **Creating**—make and create real life situations where sequences can be apply **Evaluating**—evaluate, solve and find the nth term of a sequence **Analyzing**— differentiate and identify the formula in finding the nth term of a sequence **Applying**— apply the knowledge of sequences through solving a problem **Understanding**—recognize examples of arithmetic and geometric sequences **Remembering**—create a Venn diagram that compares and contrasts arithmetic sequence from geometric sequence

E. Discussing New Concepts and Practicing New Skills #2	Group the students. Each student will share their own individual understanding of the content of the lesson, and together, in small groups, they will be able to draw on each other's knowledge and understanding of the material to forge new understandings and better recall the content.
F. Developing Mastery (Leads to Formative Assessment 3)	The teacher and students' will work together to build a Venn diagram comparing and contrasting the two sequences. A Venn diagram - tool that will aid organizes and put the thoughts together in order to see what the students have learned. The teacher will review and guide students as necessary to help them complete the diagram.
G. Finding Practical Applications of Concepts and Skills in Daily Living	Instruct students to practice solving problems involving sequences. Guide students if they have some difficulties in solving. Find the sum of each of the following. 1. integers from 1 to 50 2. odd integers from 1 to 100 3. In the geometric sequence 6, 12, 24, 48, ..., which term is 768? 5. The second term of a geometric sequence is ¾ and its fourth term is 3. What is the first term?
H. Making Generalization and Abstractions about the Lesson	Ask the students how to find the nth term of arithmetic and geometric sequences. With the aid of the Venn diagram, make generalizations of the differences and similarities of the two types of sequences.
I. Evaluating Learning	Let the students do the activity 13: May the best Man win! Give the students opportunities to demonstrate their understanding of arithmetic and geometric sequences by doing a practical task. Give each group enough time to present their respective performance tasks. Use the rubrics for the chosen salary scheme and visual presentation, and for oral presentation in grading or assessing each group's performance. Ask the students also if there are concepts or ideas on

	geometric and other sequences which need to be clarified.
J. Additional Activities for Application or Remediation	Let the students write in their journal the insights they learned in today's discussion.
V. REMARKS	This lesson is properly carried out.

V. REMARKS	
A. No. of learners who earned 80% in the evaluation	46
B. No. of learners who require additional activities for remediation	None.
C. Did the remedial lessons work? No. of learners who have caught up with the lesson	Not applicable.
D. No. of learners who continue to require remediation	None
E. Which of my teaching strategies work well? Why did these work?	Group activities really worked well in this lesson since some of the students were comfortable sharing their understanding among the group.
F. What difficulties did I encounter which my principal or supervisor can help me solve?	There were some students who were not so participative in terms of sharing their knowledge..
G. What innovations or localized materials did I used/discover which I wish to share with other teachers?	The use of flipped classroom approach.

Curriculum Vitae

Personal Profile

Name:	Efren M. Baldado
Date of Birth:	February 18, 1993
Place of Birth:	Bugnay, Mabinay Negros Oriental
Home Address:	Bugnay, Mabinay Negros Oriental

Educational Background

Graduate Studies:	Master of Arts in Education major in Mathematics
	Foundation University
Tertiary:	Bachelor of Secondary Education major in Mathematics
	Foundation University
	March 2019
Secondary:	Mabinay National High School
	March 2010
Elementary:	Manlingay Elementary School
	March 2006
Work Experience	Teacher I
	Benedicto P. Tirambulo Memorial NHS
	Paniabonan, Mabinay Negros Oriental
	2016 – Present
	Technical Specialist
	SPI Global, Dumaguete City
Awards Received:	CVRAA Baseball Coach
	2018/2019
Examination Passed	Licensure Examination for Teachers
	2015