

*Original Research Article*

# Exploring an Effective Approach of Teaching Mathematics During Covid-19 Pandemic

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Abstract

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Many education institutions in Uganda and the world at large were closed in March, 2020 in order to slow down the spread of the Corona Virus. More than fifteen million students and teachers in Uganda were affected, all education activities such as teaching, and assessing of learners were prematurely stopped. Different approaches have been adopted to ensure continuity of learning during the lockdown and closure of schools. Most of these approaches are aiming at maintaining social distance and avoiding mass gathering during learning. The teaching of mathematics involves hands on problem solving, this means that meaningful learning of mathematics is through student teacher interactions. However, due the social distancing practice of slowing down the spread of Covid-19, the physical student-teacher interaction is impossible. The purpose of this study is to explore the Non-Student-Teacher Interaction (NSTI) ICT approaches that can be used during the teaching and learning of mathematics. An experimental approach was adopted during this study, a sample of forty-five mathematics students at Mountains of the Moon University was used and the results of the study indicated that video recording of lessons is an effective NSTI-ICT-approach of teaching mathematics.

**Keywords:** Covid-19, students-teacher interactions, teaching approaches, video recordings, zoom, printable materials.

## INTRODUCTION

### Covid-19 Pandemic

In march 2020, the world health organization declared a worldwide pandemic that started in China called Covid-19 that is coursed by Corona virus. It is believed to spread through the soft parts of our body that includes eyes, mouth and nose and it stays on surfaces and also moves in air from the infected person.

Many countries adopted a number of measures to control and stop the spread of this disease, the president of Uganda consequently suspended all public gatherings,

closed schools, markets, prayer places, and public and private transport.

The Ministry of Education started an online teaching to try to ensure continuity of learning, printed materials were sent to students in their villages, some lessons were conducted on radios and televisions, other schools continued teaching their children on line.

The need for ICT tools to ensure continuity of learning emerged, many platforms such as whatsapp, emails, face book, Moodle were adopted for teaching. However, the knowledge about which approach is effective for

delivering mathematics related content was missing. This gap is addressed in this study.

## Teaching of Mathematics

Quality mathematics instruction is key in teaching of mathematics. This includes use of visuals, making of connections, regular assessments and teaching for life. The best approach for teaching mathematics, therefore is one that provides a student the chance to understand, apply, comprehend and practices the learnt content.

The methods used to teach mathematics range from inductive to deductive. The use of ICT in teaching of mathematics is fundamental and should be emphasized.

Effective teaching of mathematics requires student-teacher interactions in solving mathematical problems. However, the ICT integration in mathematics can create a non-student teacher interaction that serves the same purpose. There exist many NSTI-ICT approaches such as video recordings, printable materials, zoom classes (video conferencing). All these approaches have been used to address the need for continuity of learning during Covid-19 lock down in Uganda. However, there is a need to explore the most effective approach among these; this study will address this concern.

## The NSTI -ICT approaches

There are various NSTI-ICT resources that can be used during the teaching and learning of mathematics. This study confined its self on three approaches. The video recording, the zoom class, and the printable materials.

### Video recordings

Video recordings are storage of video signal in a recording medium such as a magnetic tape, optical disc or computer memory. They are widely used in teaching and learning practices and according to Thorpe (2006), they help more students to achieve higher levels and tends to engage students. They can be replayed on and on for further understanding of the concepts.

A number of studies have been conducted on the use of video in teaching and learning. For example. according to Marshall (2002), videos recordings are relevant for practical lessons and are suitable for students to view the necessary steps and procedures of performing a task.

Video recordings of lessons involves creation of a vacuum classroom, preparation of lesson content and delivering the content as if it was a classroom. The instructor follows a step-by-step approach of delivery of lessons while a recording is taken (Hartell and Yuens, 2006).

According to Colestock and Sherin (2009), teachers

and students employ a variety of sense-making strategies while interpreting classroom videos. This helps in making good interpretation of the video and enhances understanding. Van and Sherin (2008), examined the changes in the teachers' thinking as they participate in a video club. Their findings indicated that video recording is a key tool for teaching and learning mathematics and the thinking of the students about the concept presented in the video changes over time as they watch the video.

The need to measure the knowledge level obtained by students when learning using the video approach still exist and this study explored this need. Also, a comparison between the use of video recordings and other NSTI-ICT approaches has been explored in this study.

### Zoom classes

Zoom provides an electronic platform for interaction between individual at a distance. It is a video conferencing approach. Unlike for video recordings, zoom does not involve first recording the content; however, the ongoing class can be recorded during the zoom instructions. In this study zoom classes means the delivery of lesson content to students at a distance using the zoom application. The teacher can see the learners in his class and the learners can see their colleagues and the teacher during the lesson and can ask questions directly to the teacher.

Zoom can help keep one's class going if the instructor or students have a situation that keeps them from meeting in person. Synchronous online class sessions, where everyone joins a Zoom meeting at a scheduled time, is one way to create engagement when students are remote.

### Online printable materials

In this study, printable materials refer to lecture notes and modules prepared in an interactive way and involving activities to engage the learners that are shared with students via different media. The printable material serves as the teacher and students read on their own.

### Main objective of the study

To explore the effective NSTI-ICT approach for teaching mathematics during Covid-19 Pandemic.

### Hypotheses

H1: There is no significant difference between the students' knowledge level in mathematics before and

after learning using both approaches of teaching.

H2: There is no significant difference between the mathematics knowledge obtained through learning using each of the three approaches.

## METHODS

The seventy-eight registered mathematics students at Mountains of the Moon University were given phone pre-test on sequences and series to ascertain their knowledge on the topic. The students' level of knowledge was measured using marks scored from the test while a phone test was preferred as it ensured that students provide on-spot responses to the test questions.

A sample of forty-five students who showed almost same level of knowledge were purposively selected from the group of 78 mathematics students that participated in the phone pre-test.

This sample was then randomly divided into three learning groups; V-group, H-group and Z-group. Each group was taught the topic content using a different NSTI-approach. Video for V-group, Handout/printed material (for self-teaching) for H-group and Zoom for Z-group. A phone post-test was then administered to the different learning groups to ascertain the difference in their knowledge on the same topic.

A questionnaire was also sent to students to provide their opinion on the respective NSTI approaches used. Data from the questionnaire was analyzed and compared with the test scores to provide a descriptive interpretation of the scores obtained by each learning group.

### Implementing the video recording teaching

In this approach of teaching, short videos were recorded and others picked from YouTube. The content of the videos from YouTube was checked to ensure that they suit the objectives of the lessons. The students were given the learning outcomes and a relevant video for each short lesson using whatsapp or emails. Students were required to watch the videos, take notes and practices the exercises.

### Implementing the zoom teaching

Zoom lesson were planned and students informed of the date and time of the lesson. Each lesson would take 10 to 15 minutes including students' questions. The requirements for these lessons are access rights for Zoom and internet.

### Implementing the printable material teaching

Printable materials inform of notes/handouts were pre-

prepared and sent to the students via whatsapp or email. Students were required to read and practice the exercises.

## RESULTS

### Students' Knowledge level in mathematics before and after learning

The knowledge of students in mathematics (sequences and series) was determined by administering a standardized phone test to the students and only those (forty-five) with almost same level of knowledge were selected to participate in the study. While the students' level of knowledge after learning was measured by administering another test.

This knowledge was measured in terms of marks scores from the test. The test consisted of ten standard questions obtained from classzone.com. Each question indicated one level; the students' level therefore ranged from level 1 to level 10.

The mean level of knowledge of the sampled students was found to be 3.24 with standard deviation of 0.72 and skewness of 0.4.

The descriptive statistics for students' knowledge level before and after learning for the different groups is indicated in the table 1 below.

The descriptive statistics indicate that the mean knowledge level before learning took place is 3.4, 3.1 and 3.1 for the V-group, H-group and Z-group respectively. While the mean knowledge after learning took places is 8.1, 5.9 and 4.9 for the V-group, H-group and Z-group respectively. The standard deviation before and after learning for each of the three approaches respectively is 0.65 as well as 0.90, 0.77 as well as 0.86 and 0.77 as well as 0.99. while the skewness before learning is -0.69, 0.26, and 0.26 for the three approaches respectively and after learning the skewness is 0.30, -0.53 and -0.38 for the three approaches respectively.

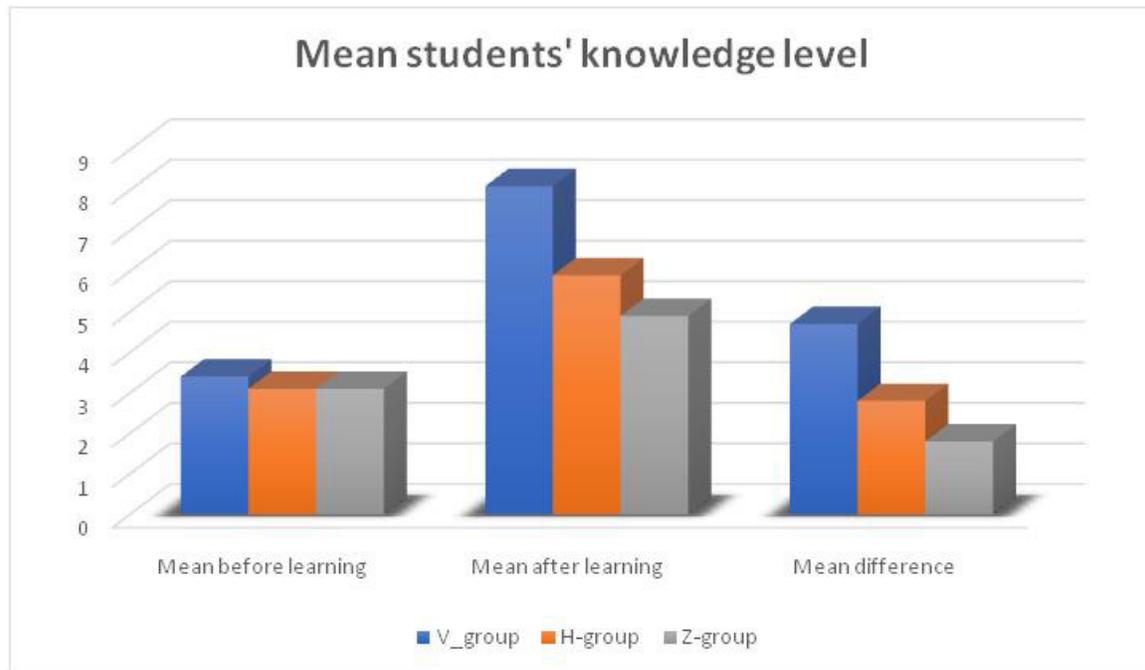
### Difference in knowledge obtained through learning using the different NSTI ICT approaches

The differences in the level of knowledge obtained after learning was measured using the differences in mean knowledge level before and after learning. The graph represents the mean and mean differences in knowledge obtained after learning.

The mean differences in students' knowledge level in mathematics indicate that there was a big difference in knowledge level for students who learned using the video recording approach with an index of 138.2; this is in agreement with Thorpe (2006). The mean difference in students' knowledge level for those who learned using the printable handouts showed an index of 90.3 and lastly those who learned using the zoom teaching showed an

**Table 1.** Students' Knowledge level in mathematics before and after learning

	V-GROUP		H-GROUP		Z-GROUP	
	Before	After	Before	After	Before	After
Mean	3.4	8.1	3.1	5.9	3.1	4.9
Standard deviation	0.65	0.90	0.77	0.86	0.77	0.99
Skewness	-0.69	0.30	-0.26	-0.53	-0.26	-0.38

**Figure 1.** Mean students' knowledge level in mathematics.

index of 58.1. These results literary mean that teaching mathematics using video recording is more effective than using either handouts or zoom teaching.

### Students opinions on the NSTI-ICT approach used

A questionnaire was administered to seek students' opinions on the NSTI-ICT approach used, the responses are discussed under the following themes.

#### Cost effectiveness

The handouts and the videos were reported to be cost effective since they only required students to have either a smart phone or a computer. The students who used the printable materials reported that it was easy for them to print the documents and even use them without using a phone or a computer. However, they reported that the method requires that the students have the ability to interpret the mathematical content on their own following the notes in the handouts. They added that it was not

easy for them to interpret some theorems. The Zoom teaching approach was not sighted as a cost-effective approach teaching by the users. The users reported that disruptions occurred during the classes due to internet failure and could miss some of the lesson content. This therefore means that the printable materials and the video approaches were rated as more cost effective compared to the zoom teaching approach. This is in support of the results obtained in the study by Van and Sherin (2008).

#### User friendly

The video teaching approach was reported to be use friendly, students reported that the video could be watched at any time and the instructor's verbal explanations was well followed. However, it was noted by some students that students' questions could not be attended to by the instructor. The printable materials were seen to also be user friendly to some users especially given the fact that the materials can be printed and used physically at any time. The zoom teaching was

rated user friendly by its users with emphasis on the fact that it is more less a normal classroom where learner-instructor interactions exist electronically. However, it was noted by all the users of this approach that it is expensive in terms of tools and internet.

### Level of students' interaction with the content

All students reported to have interacted with the content in all the three approaches, however the students who were taught using zoom meeting reported that the interaction was a usual classroom interaction that involved both the learners and the instructor. They added that the only challenge with zoom classes is the breakages due to internet breakdowns during the lesson. This indicates that given a stable internet connectivity, zoom classes would be effective for the teaching and learning of mathematics.

### Hypothesis testing

The results of the study indicate the following conclusions from the hypothesis tests done.

A Pearson correlation between the mean students' knowledge level before and after was obtained to be  $r = 0.95$ . This indicated a strong positive relationship between the mean before and after learning. It therefore shows that the knowledge before learning mathematics has a strong effect on the knowledge obtained after learning.

The difference between the mathematics knowledge obtained through learning using each of the three approaches was found to exist and it was found to be significant with  $p = 0.06$  and  $t = 3.644$ , at 0.05 level of significance. In this regard H1 is rejected since the test statistics is numerically greater than the  $p$  value.

The difference between the mathematics knowledge obtained across each of the three approaches (i.e between V-group and H-group, V-group and Z-group and H-group and Z-group) both was found to be significant since the statistics was numerically greater than the  $p$ -values in all cases; and hence H2 is also rejected.

### CONCLUSIONS

The use of video recording is an effective NSTI ICT approach for teaching and learning mathematics. It

allows students to view the lessons over and over until they master the content and it does not require internet facility unlike zoom classes. If zoom classes are used, they should be recorded for future references by the students. The Printable materials provide good knowledge of the concepts but lacks the instructor's explanations and visual step by step problem solving techniques.

### RECOMMENDATIONS

Mathematics instructor should make use of video recordings during teaching and learning of mathematics during the period of Covid-19 pandemic to ensure effective learning of mathematics without physical teacher-students interaction that has been discouraged due to Covid-19. Parents should ensure that they provide various platforms and equipment to their children to enable them continue learning without physical interactions with the teachers.

### ACKNOWLEDGEMENT

The students who participated in the study are highly appreciate and Mountains of the Moon University that provided an enabling environment for conducting the study is also acknowledged.

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