

The Use Of Computer Based Instruction To Improve The Learner's Mathematics Performance

Rose Ann Samonte Bagayan

roseann.bagayan@deped.gov.ph

Elementary Teacher, Lewin Elementary School, Lumban 4014, Philippines

Abstract

The main purpose of the study was to determine the significant effect in the use of Computer Based Instruction to the mathematical performance of the Grade Three learners of Lewin Elementary school, S.Y 2021 – 2022. Specifically, it sought to respond the following: (1) the respondents level of perception on the use of computer base-instruction in terms of; teachers pre-recorded video lessons, online tutorial videos, PowerPoint presentation; (2) the mean percentage score of the learner's mathematics performance in terms of pretest and posttest; (3) if there is a significant difference between the control and experimental group's mathematics performance in posttest; (4) if there is a significant effect the use of Computer Based Instruction to the mathematical performance of the Grade Three learners of Lewin Elementary School. Based on the data gathered, the learners perceived that the use of computer-based instruction was very effective. The level of controlled and experimental group's mathematics performance in pretest was below average while the posttest of the controlled group is average, and the experimental group is very good. The test of difference between the pre-test and post-test of the experimental group resulted to rejecting the null hypothesis which implies that there is a significant difference on the performance of students. Moreover, it showed how the use of computer-based instruction affect the experimental group mathematics performance in terms of teachers pre-recorded videos but does not significantly affect in terms of online tutorial videos and powerpoint presentations. These resulted to partially rejecting the null hypothesis. It can also be concluded that the use of computer-based instruction was significant effect on learners' mathematics performance. The researcher highly suggests that he use of Teacher's pre-recorded video lesson and online tutorial videos can help to reach out the learners amid COVID-19 pandemic. It must be included on their School Improvement Plan on the learner's development. Classroom teachers may also sustain the usage of the computer-based instruction in teaching mathematics. The teachers may devote more efforts to learn and apply new and different use of educational technology that can be useful to keep classroom well managed and conducive for teaching-learning.

Keywords: Teachers Pre-recorded Video Lessons, Online tutorial Videos, Powerpoint Presentation, Computer-bBsed Instruction, Mathematics Performance

1. Main text

Introduction

Educations is continuously developing as to technology. Teachers are indispensable to develop their teaching strategies. Computer-based instruction is a form of electronic learning that integrates the use of computer technologies in teaching together with other teaching materials.

There are so many research about to improve the mathematics skills of a student but until today there is no concrete solution to it but there are research study that can enhance a specific academic skills. The history of the computer goes back several decades however, there are five definable generations of computers. Each generation is defined by a significant technological development that changes fundamentally how computers operate – leading to more compact, less expensive, but more powerful, efficient and robust machines. This wonderful technology also used in teaching to improve the teaching and learning process. But the question is, It can really help the students to enhance their mathematics performance?

In today's present time, as the world hits by the COVID-19 pandemic, every single life existing has been change. The society, economy, business and even the education system. As these pandemic strikes, Our Education Committee

decided to promote different distance learning modalities that can provide a continuous learning for our students amid pandemic without physical contact with their teachers or classmates.

In this research paper, the researcher provides an opportunity to come up to a possible way to give quality education for elementary learners amid pandemics. The researcher come up to the idea of using computer-based instruction to the grade three pupils of Lewin Elementary school to improve their mathematics performance.

Background of the Study

Technology is an essential tool for learning Mathematics in the twenty-first century and all schools must ensure that all their students have access to technology. Effective teachers maximize the potential of technology to develop student's understanding, to stimulate their interest and increase their proficiency in Mathematics. When technology is used strategically it can provide access to Mathematics for the students. The Department of Education created the ICTU, a unit created under DepED Order 1, s. 2007, shall continue to provide technical support and services for ICT in all levels. It shall assist the Sub-Committees in formulating the technical standards and systems for curriculum and non-curriculum-based ICT programs. It is also encourage the classroom teacher to maximize the use of technology in their lesson and to integrate ICT in their teaching strategies.

A number of studies have suggested that the computer provides an effective vehicle for improving student's mathematics performance (Escanilla, 2019; Lashley, 2017; and Nwosu, 2020) but according to Gunn & Pitt (2015) computer-assisted learning packages are at least as effective in imparting information as traditional lectures and that students value the opportunity to reinforce their learning through interactive lecture notes and self-assessment quizzes.

In these present times, the Department of Education proposed that to continue the learning of our students with the use of different learning modalities such as modular, online or blended learning. In Lewin Elementary School, the distance learning modalities that been used in this time of pandemic is the modular distance learning. The teacher will provide all the printed materials that the students need to learn and they will study it with their parents or guardians. Sadly, some of the students were not able assist by their parents because both of them are working to survive in their daily basic needs and some are not illiterate to teach their children. In this scenario, the researcher come up with the blended learning strategy with the use of computer-based instruction. With this instruction, the teacher will provide pre-recorded videos of the lesson then the learners can watch it online or offline, powerpoint presentations and online tutorial videos that will be given weekly to each learner provided that it is saved in a OTG flash drive so that the learner can still watch it on their mobile phones.

The researcher decides to conduct this study since they were only few studies used primary students as their respondents and even though there are already existing study about computer-based instruction because in the past research, they always used the computer-based instruction in teaching junior high school, senior high school and tertiary students.

The purpose of the study is to determine the effect of computer-based instruction to the learner's performance in mathematics and to improve the mathematics performance of Grade Three (3) students in Lewin Elementary School S.Y. 2021 – 2022 with the use of computer-based instruction.

Theoretical Framework

The journey of computer starts from the beginning of the 20th century, and includes, inter alia, the famous Pavlovian Conditioning and Skinner's Operant Conditional Theory, continues through the mid 50s and the first time computers were used in learning environments, the influential Problem-Based Learning inspired by Howard Barrows in the 60s, David Merrill's Component Display Theory, the Cognitive Flexibility Theory in the late 1980s that aims to develop the learner's ability to comprehend multidimensional situations, the introduction of multimedia and CD-ROMs in educational environments in the 90s, to the development of WebQuest in 1995, and the launch of the Authentic Learning Model in the late 2000s by Marilyn Lombardi.

As cited by Benson (2016), Computer-based instruction originates from Skinner's programmed instruction. Presenting a stimulus, eliciting a response, and providing immediate feedback come with computer-simulated instructional strategies. The sophistication of computers adds more options and varies instruction, somewhat minimizing monotony and boredom. Further, computers allow for complex branching, for the recording of student responses, graphics and speech, drill and practice, problem solving, and tutorials. Cueing and shaping also guide the student to achievement. Computer-based training and computer-assisted training number among education-based models. Although more sophisticated, the instructional bases are primarily behaviorist. The demand for observable and measurable evidence that students have learned has resulted in the creation and development of performance objectives. Performance objectives describe what will be accomplished, the conditions under which they will be accomplished, and how the student will be measured. Computers, whether in the form of traditional personal computers, notebook computers, or tablet devices, are becoming more common in the classroom. Nearly every American student has access to computers and the Internet, and over half of all students use

it during the school day (Saine, 2012). This is already the case in a growing number of American schools where students are being assigned their own notebook computers or tablet devices for use in the classroom (Bean, O'Brian, & Fang, 2012; Saine, 2012).

Computer-based instruction, also commonly referred to as Computer Assisted Instruction, was introduced during the 1950s. The pioneers of the movement were a team of researchers at IBM, including Gordon Pask and O. M. Moore. However, it wasn't until the 1960s that the computer-based Instruction Theory began to take shape, thanks to federal funding for research and development for various industrial and educational labs throughout the United States. More specifically, the US government funded two companies - Control Data Corporation and Mitre Corporation -, for the development of two separate projects, PLATO (Programmed Logic for Automatic Teaching Operation) and TICCIT (Time- Shared Interactive Computer Controlled Information Television). (Cited by, Pappas 2014).

Statement of the Problem

The purpose of the study was to determine the effect of computer-based instruction to the learner's performance in mathematics. And to improve the mathematics performance of the learners through the use of computer-based instruction.

Specifically, it sought to answer the following questions:

1. What is the level of perception on the use of computer-based instruction in terms of:
 - 1.1 teachers pre-recorded video lessons;
 - 1.2 online tutorial videos; and
 - 1.3 powerpoint presentation?
2. What is the level of the Learner's mathematics performance of the control and experimental group in terms of:
 - 2.1 pretest; and
 - 2.2 posttest?
3. Is there a significant difference between the level of mathematics performance of the control and experimental group's mathematics performance in posttest?
4. Is there a significant effect in the use of Computer-based Instruction to the mathematical performance of the Grade Three learners at Lewin Elementary School S.Y. 2021-2022?

2. Research Methodology

This chapter presents the details of the investigation as basis for the researcher to carry out her investigative efforts in applying the appropriate research design, respondents of the study, research instrument, and data research procedure envisioned to acquire the needed data and statistical treatment of data.

Research Design

This experimental research was used in this study to determine the use of computer-based instruction and its effect to the learner's mathematics performance of Grade Three (3) pupils of Lewin Elementary School S.Y. 2021 - 2022.

According to Babbie as cited by Harland (2019) Experimental research is a study that strictly adheres to a scientific research design. It includes a hypothesis, a variable that can be manipulated by the researcher, and variables that can be measured, calculated and compared. Most importantly, experimental research is completed in a controlled environment. The researcher collects data and results will either support or reject the hypothesis. This method of research is referred to a hypothesis testing or a deductive research method. The researcher used pretest to find out the performance of the students without the use of computer-based instruction, secondly the researcher discussed the series of lessons using computer-based instruction and the respondents answered the posttest after the series of lesson with scrutiny the population of her research parameter, third, she made a careful record of what she observed, and the outcome.

The researcher utilized this kind of research to determine if there is a significant effect the use of computer-based instruction and to improve the mathematics performance of the grade three learners in Lewin elementary school Lumban, Laguna S.Y. 2021 – 2022.

Respondents of the Study

This research is focuses on the grade three (3) pupils of Lewin Elementary School so that the researcher decided to use all of the twenty-eight (28) grade three students of Lewin Elementary School in Lumban, Laguna S.Y. 2021 – 2022. The respondents will be divided into two groups alphabetically and classify as the controlled and experimental group of the study. It was purposely taken as a sample in this study since the researcher is the class adviser of the respondents.

Purposive sampling was employed in this study among (28) twenty-eight third graders in Lewin Elementary School all the population were purposely selected as the actual respondents during the day set for the gathering and retrieving of data from them.

As claimed by Saunders et. al. (2012), Purposive sampling (also known as judgment, selective or subjective sampling) is a sampling technique in which researcher relies on his or her own judgment when choosing members of population to participate in the study.

Research Procedure

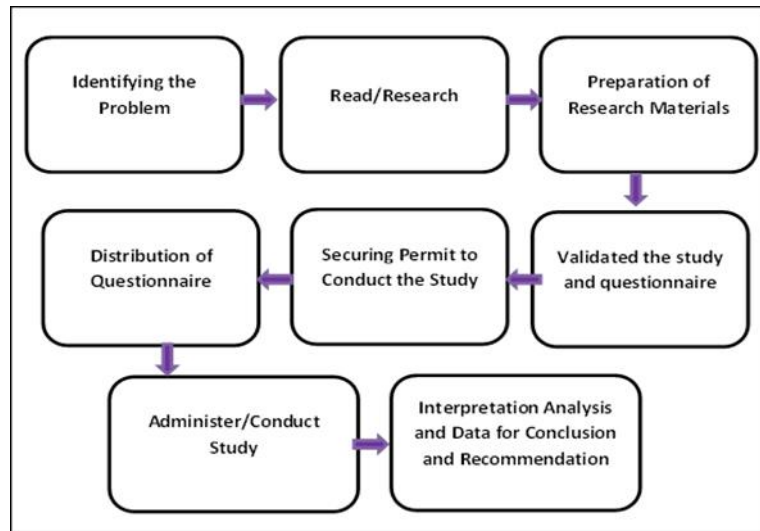


Figure 1: Research Procedure

The research study started by the presentation of the problem and defending the research title and after the approval, the researcher prepares all the necessary materials that will be used to attain the objectives of the study. The questionnaire checklist and pretest/posttest were validated by the panel members. The researcher also asked the school head of Lewin Elementary School to validate the self-made questionnaire. As there was assurance for validity and reliability of the major instrument coupled with the approval by the thesis adviser to conduct an actual study, letters addressed to the Schools Division Superintendent of Division of Laguna, District Supervisor of Lumban District and School Head of Lewin Elementary School in Brgy. Lewin Lumban, Laguna was prepared, requesting permission to distribute the one set of questionnaire to the third graders as actual respondents of this study.

The researcher gave the pretest to the controlled and experimental group. Then for the experimental group, the researcher gave each of the students a flash drive that contains the teachers pre-recorded videos, downloaded online tutorial videos and PowerPoint presentation that discusses the lesson on the following day. After the discussion inside the classroom, the researcher were administered the posttest to the experimental group. The perception of the experimental group based on the computer-based instruction was also gathered by the used of questionnaire checklist.

As approval was granted by the said school authorities, the distribution and retrieval of the one set of major instruments were done personally by the researcher in order to clarify questions which are find highly technical in nature by the actual respondents. The data were tallied and computed Mean, standard deviation, t-test and regression. The data were presented in tables/ graphs, analyzed and interpreted.

Research Instruments

One set of test questionnaire was issued to the respondents of this study before and after the series of lessons. The items in the said test questionnaires were based on the K-12 MELC on the time of the conducting of this study for objectivity, relevance and suitability to the problem areas investigated, as well as probability of favorable reception and return from the said respondents.

The tentative draft of the lesson plan and questionnaire were submitted to the thesis adviser for evaluation and corrections after an authority from Lewin Elementary School were consulted to improve further its organization and contents.

The improved drafts were tried out to twenty-five (25) dry-run subjects not included as actual respondents of this study using the Cronbach Alpha formula to ensure the validity and reliability of the test questionnaire. With the alpha coefficient of 0.93, it showed that the questionnaire for third graders was valid and reliable.

The researcher conducted an activity using the computer-based instruction. The respondents made the necessary output that the researcher needed. The researcher prepared the Teachers Pre-Recorded Video Lessons, Online Tutorial Videos, and PowerPoint Presentation then give it to the respondents using a flash drive. The respondents were asked to watch the given materials at home. And at school, on the following day, the activities were be given to the students based on the materials. After the class discussion to the experimental group, the posttest was administered. In the other hand, the controlled group will also be given the same posttest after they undergo the traditional classroom discussion.

The researcher made a questionnaire survey checklist with five (10) statements for each indicator, that was checked and validated by the research adviser, subject expert, and technical editor. The questionnaire was used to know the perception of the students on the use of computer-based instruction to the respondent's mathematics performance. The Likert Scale is used for the interpretation of the corresponding values of data gathered from the survey checklist.

Rating	Scale	Perception of the Attributes of the game-based Applications	Adjectival Rating	Scale	Performance Remarks
5	4.20-5.00	Strongly Agree	Very Useful	21-25	Very Good
4	3.40-4.19	Agree	Useful	16-20	Good
3	2.60-3.39	Neutral	Moderately Useful	11-15	Average
2	1.80-2.59	Disagree	Moderately Not Useful	6-10	Below Average
1	1.00-1.79	Strongly Disagree	Not Useful	0-5	Poor

Statistical Treatment of Data

The data obtained was statistically treated with the use of Mean, standard deviation, t-test and regression to determine the impact of computer-based instruction in improving the grade three pupils' mathematical skills.

The mean and standard deviation will be used to determine the mean level of the learner's perception on the use of computer-based instruction to improve their mathematics performance. The mean was calculated in order to verify the pretest and posttest mean score in Mathematics. The standard deviation was also used to describe and present the data in determining the degree of dispersion and estimate the variability in total population. The t-test was used to determine if the significant difference between the performance of the control and experimental group in pre-test and post-test. The regression was used to determine the significant effect of computer-based instruction to improve the mathematical skills of grade three pupils' in Lewin Elementary School. Electronic forms and spread sheets applications were used in tabulating and computing the statistics of study. It was presented to the statistician for, checking, computation, and validation of the results.

3. Result and Discussion

This chapter deals with the presentation, analysis and interpretation of data gathered to answer the sub problem relative to the main problem of this study. This part discusses the findings of the study based on the research questions.

Level of Perception on the Use of Computer-Based Instructions

The level of perception on the use of computer-based instruction was measured based on teachers' pre-recorded videos, online tutorial videos and powerpoint presentations.

Table 1. Level of Perception on the Use of Computer Based-Instructions in Terms of Teachers' Pre-Recorded Video Lessons

Teachers' Pre-Recorded Video Lessons	Mean	SD	Adjectival Rating
1. It was clear and visualized.	5.00	0.00	Very Useful
2. It was easy to watch and understand.	4.79	0.43	Very Useful
3. I enhanced my academic performance in mathematics because of it.	4.43	0.76	Very Useful

4. It can be played any gadget because teacher provides the OTG Flash drive.	4.71	0.47	Very Useful
5. It helps to be ready in the follow-up activities in the classroom.	5.00	0.00	Very Useful
6. I have already ideas on the topic to be discussed.	4.79	0.58	Very Useful
7. I motivate to do the follow-up activities at school	4.71	0.47	Very Useful
8. It helps me to study even without the physical presence of my teacher.	4.64	0.63	Very Useful
9. It is very helpful in this time of pandemic.	5.00	0.00	Very Useful
10. I always excited to watch my teacher pre-recorded videos of our next lessons.	5.00	0.00	Very Useful

Overall Mean = 4.81	Rating	Scale	Remarks	Adjectival Rating
Standard Deviation = 0.46	5	4.21-5.00	Strongly Agree	Very Useful (VU)
Verbal Interpretation = VU	4	3.41-4.20	Agree	Useful (U)
	3	2.61-3.40	Moderately Agree	Moderate Useful (MU)
	2	1.81-2.60	Disagree	Moderately Not Useful (MNU)
	1	1.00-1.80	Strongly Disagree	Not Useful (NU)

Table 1 presents the perception of the learners on the use of computer-based instruction in terms of teachers pre-recorded video lesson. The learners give the adjectival rating of *Very Useful* that the use of teachers' pre-recorded video lesson was found helpful, easy to visualize and the audio was clear with the mean and standard deviation of (M= 5.00, Sd= 0.00) respectively. The advance information about the topic was known by the learners on teachers' prerecorded video (M= 4.79, Sd= 0.58). The teachers' prerecorded video lesson motivates the learners to do follow up activities since it can play on tv and DVD (M= 4.71, Sd=0.47).

The overall mean and standard deviation (OM=4.81, Sd= 0.46) indicates that the level of perception of the learners on the use of teachers' pre-recorded video lesson was *Very Useful*. This indicates further the usefulness of the computer-based instruction such as teachers' pre-recorded video to continue the education and motivates the learner to attain the desired competencies for a specific learning area.

This was supported by the study of Marchand, Pearson, & Albion, 2014, they find out that in several decades, instructors and students in higher education have attempted to record lectures for clarification, easy access, and distant educational purposes. What first started out as audio recordings on cassettes and VHS videos has steadily progressed into digital lecture recordings with advances in technology. Student dependence on these mobile lectures has increased exponentially in recent years. It is also supported by Phanse & Chavan (2021) Pre-recorded teaching content is effective due to its flexibility, command over content flow like stop, play, rewind etc. But it depends on student desire to learn as it is self-regulatory method of learning. Student lack self-regulation get burdened with accumulated learning content resulting in low achievement.

Table 2. Level of Perception on the Use of Computer Based-Instructions in Terms of Online Tutorial Videos

Online Tutorial Videos	Mean	SD	Adjectival Rating
1. It is accessible anytime and anywhere.	4.36	0.74	Very Useful
2. I have access in watching the uploads online tutorial videos by my teacher.	4.43	0.51	Very Useful
3. I can easily learn on watching it.	4.50	0.76	Very Useful
4. It has clear discussion of the topic.	4.57	0.65	Very Useful
5. It has beautiful graphics and wonderful audio.	4.64	0.50	Very Useful
6. It helps me to understand the lesson.	4.07	0.83	Useful
7. I can answer the activities in module on my own after watching the appropriate online tutorial video for a specific lesson.	4.71	0.47	Very Useful
8. I enhanced my academic performance in mathematics because of it.	4.64	0.50	Very Useful
9. It is very helpful in this time of pandemic since we have only limited time on the face-to-face classes.	5.00	0.00	Very Useful
10. I always excited to watch different online tutorial videos of our lesson for the following day.	4.36	0.63	Very Useful

Overall Mean = 4.53	Rating	Scale	Remarks	Adjectival Rating
Standard Deviation = 0.63	5	4.21-5.00	Strongly Agree	Very Useful (VU)
Verbal Interpretation = VU	4	3.41-4.20	Agree	Useful (U)
	3	2.61-3.40	Moderately Agree	Moderate Useful (MU)
	2	1.81-2.60	Disagree	Moderately Not Useful (MNU)
	1	1.00-1.80	Strongly Disagree	Not Useful (NU)

Table 2 presents the perception of the learners on the use of computer-based instruction in terms of online tutorial videos. The learners *Strongly Agree* that the use of online tutorial videos was found accessible anytime and anywhere ($M=4.36$, $Sd=0.74$), have access in watching the uploads online tutorial videos by my teacher ($M=4.43$, $Sd=0.51$), easily to learn by watching it ($M=4.50$, $Sd=0.76$), has the clear discussion of the topic ($M=4.57$, $Sd=0.65$), has beautiful graphics and wonderful audio ($M=4.64$, $Sd=0.50$), after watching it the learners can answer their modules by their own ($M=4.71$, $Sd=0.47$), it can enhanced their academic performance ($M=4.64$, $Sd=0.50$), it was helpful in this time of pandemic ($M=5.00$, $Sd=0.00$), and they are all excited to watch and learn from it ($M=4.36$, $Sd=0.63$). Conversely, the learners Agree that the use of online tutorial videos was helps them to understand the lesson ($M=4.07$, $Sd=0.83$).

The overall mean and standard deviation ($OM=4.53$, $Sd=0.63$) indicates that the level of perception of the learners on the use of online-tutorial videos was *Very Useful*. This indicates further the usefulness of the computer-based instruction such as Online Tutorial Videos to continue the education and motivates the learner to attain the desired competencies for a specific learning area.

This result was also supported by Danielson, Preast, Bender, & Hassall (2014) Online availability of recorded lectures provides flexibility for those students who are juggling the competing demands of work, studies, and other commitments. Students do utilize the lecture recordings to review course content, revise class notes, clarify complex concepts, and work at their own pace. It is also beneficial to those students that missed the lesson for a period of time because they can rewind it. One cited challenge with video use in course teaching generally is that excessive use of unregulated opensource digital content can lead to less course structure which can in turn present problems for students in their learning (Jackman and Roberts, 2014). Establishing whether video can be used as an effective tool to develop knowledge and facilitate critical thinking skills within a higher education setting is identified as a research gap requiring greater exploration. Very little research is available evidencing knowledge development or critical thinking in the context of video-learning. Instead, current methodological approaches typically rely on short-term, post-experimental tests to measure differences in learning outcomes from using video or other multimedia resources. (Kirkwood and Price 2013).

Table 3. Level of Perception on the Use of Computer Based-Instructions in Terms of PowerPoint Presentation

PowerPoint Presentation	Mean	SD	Adjectival Rating
1. It is beautiful and pleasing to the eye of the viewer.	4.29	0.91	Very Useful
2. It is knowledgeable and easy to use.	4.21	0.89	Very Useful
3. It can catch my attention to listen in our discussion.	4.43	0.85	Very Useful
4. It helps me to understand the lesson.	3.93	0.83	Useful
5. It can help me to answer the activities on my module.	4.43	0.85	Useful
6. I can easily focus to the class discussion when my teacher uses it.	4.14	0.95	Very Useful
7. I enhanced my academic performance in mathematics because of it.	4.57	0.65	Very Useful
8. It helps me to study even without the physical presence of my teacher.	4.29	0.91	Very Useful
9. It is very helpful in this time of pandemic since we have only limited time on the face-to-face classes.	4.57	0.76	Very Useful
10. I always excited to listen to our discussion with the use of PowerPoint presentations.	4.36	0.93	Very Useful

	Rating	Scale	Remarks	Adjectival Rating
Overall Mean = 4.32	5	4.21-5.00	Strongly Agree	Very Useful (VU)
Standard Deviation = 0.85	4	3.41-4.20	Agree	Useful (U)
Verbal Interpretation = VU	3	2.61-3.40	Moderately Agree	Moderate Useful (MU)
	2	1.81-2.60	Disagree	Moderately Not Useful (MNU)
	1	1.00-1.80	Strongly Disagree	Not Useful (NU)

Table 3 presents the perception of the learners on the use of computer-based instruction in terms of PowerPoint presentations. The learners *Strongly Agree* that the use of PowerPoint presentations was found beautiful and pleasing to the eye of the viewer ($M=4.29$, $Sd=0.91$), knowledgeable and easy to use ($M=4.21$, $Sd=0.89$), It can easily catch the viewers attention ($M=4.43$, $Sd=0.85$), easily focus in the discussion ($M=4.14$, $Sd=0.95$), enhanced the academic performance ($M=4.57$, $Sd=0.65$), it can help the learner to study on their own ($M=4.29$, $Sd=0.91$). It was helpful in this time of pandemic ($M=4.57$, $Sd=0.76$), it was helpful in this time of pandemic ($M=5.00$, $Sd=0.00$), and they are all excited to watch and learn from it ($M=4.36$, $Sd=0.93$). Conversely, the learners Agree that the use of PowerPoint presentation was helps them to understand the lesson ($M=3.93$, $Sd=0.83$) and it can help them to answer the written activities on their module ($M=4.43$, $Sd=0.85$).

The overall mean and standard deviation ($OM=4.32$, $Sd=0.63$) indicates that the level of perception of the learners on the use of PowerPoint presentations was *Very Useful*. This indicates further the usefulness of the computer-based instruction such as PowerPoint presentations to continue the education and motivates the learner to attain the desired

competencies for a specific learning area.

According to Hossein Nouri, The College of New Jersey (2015) believes that PowerPoint presentations affected the keep of the information for a long time as well as the stimulation of short-term memory. He found in his research that the students learned by PowerPoint sector reported higher understandability and higher marks more than those who learned by blackboards. Ahmed (2012) also examined that the effectiveness of using videos and PowerPoint presentation on the students' achievement and the retention of information. The sample was 35 students from the first secondary school enrolled to the control group, while the experimental was 36 students from the first secondary class. The first group was taught traditionally such as blackboards and direct lectures. The second group was taught by using blended ways. The result showed that the students in the experimental section were positive and higher than the students in the control group.

Level of Learners' Performance in terms of Pretest and Posttest

The mathematics performance of the experimental group was measured based on their pretest and posttest scores.

Table 4. Controlled Group Mathematics Performance in Terms of Pretest and Post-test

Controlled Group				
Pre-test			Post-Test	
Score	Freq.	Percent	Freq.	Percent
16-20	0	0.00%	0	0.00%
13-16	0	0.00%	0	0.00%
9-12	1	7.14%	10	71.43%
5-8	7	50.00%	4	28.57%
0-4	6	42.86%	0	0.00%
Mean	4.64		9.71	
SD	2.98		1.68	
V.I.	Below Average		Average	

Table 4 presents the mathematics performance of the controlled group in terms of pretest and posttest. As shown in table, the controlled group's mean score in pre-test is 4.64 with the standard deviation of 2.98 and verbally interpreted as Below Average. It is also revealed that the controlled group mean score in post-test is 9.71 with the standard deviation of 1.68 and verbally interpreted as Average.

According to Rico, as cited by Millena (2015), stated that pre-test is a way which shows the preparedness or unpreparedness of the students in the examinations that they undertake within a certain course. Kock (2013) sustained further the foregoing viewpoints by claiming that posttest is an assessment to evaluate the academic performance of students after the orientation given on their behalf.

The mathematics performance of the experimental group was measured based on their pretest and posttest scores.

Table 5. Experimental Group Mathematics Performance in Terms of Pretest and Post-test

Experimental Group				
Pre-test			Post-Test	
Score	Freq.	Percent	Freq.	Percent
16-20	0	0.00%	12	85.71%
13-16	0	0.00%	2	14.29%
9-12	1	7.14%	0	0.00%
5-8	6	42.86%	0	0.00%
0-4	7	50.00%	0	0.00%
Mean	4.5		17.79	
SD	2.85		1.93	
V.I.	Below Average		Very Good	

Table 5 presents the mathematics performance of the experimental group in terms of pre-test and post-test. The experimental group's mean score in pre-test is 4.5 with the standard deviation of 2.85 and verbally interpreted as Below Average. It is also revealed that the controlled group mean score in post-test is 17.79 with the standard deviation of 1.93 and verbally interpreted as Very Good.

This result was supported by Airisian (2009) and Carpenter (2012). They emphasized that pre-test is an important component which is purposely given to determine how much the learner know about the topic. Posttest measure what the students has acquired from the module or if they have mastered the objectives. Based on the result of the experimental group, it is shows that after the use of computed-based instruction, their mathematics performance in terms of posttest was improved.

Significant Difference between the Control and Experimental Groups' level of Mathematics Performance in Pretest and Posttest

The significant difference in the controlled and experimental groups mathematics performance based on their pretest and posttest.

Table 6. Significant Difference in the Learners Mathematics Performance in Pretest and Posttest

	<u>Controlled Group</u>	<u>Experimental Group</u>	<i>Mean Difference</i>	<i>t</i>	<i>p-value</i>	<i>Analysis</i>
	<i>Mean</i>	<i>Mean</i>				
<i>Pre-test</i>	4.64	4.50	0.14	0.17	0.87	Not Significant
<i>Post-test</i>	9.71	17.79	8.08	-21.81	0.00	Significant

Table 6 revealed the significance difference in the learner's mathematics performance of the controlled and experimental group in terms of pretest and posttest. The pretest result of the two group of learners has no significant difference as indicated in the ($p= 0.87$). The p value is higher than (0.05) level of significance which supported the result of the analysis. This means that majority of the learners has the same level of pre- existing knowledge about the content of the topic. On the other hand, the result of the post test of the two group of learners has significant difference. The controlled group attain the *Average* performance while the Experimental group attain the *Very Good* performance. The ($p= 0.00$) is lower than the (0.05) level of significance. This means that the Use of Computer Based-Instructions help the students to improve their performance.

Kelly (2017) contented that the teachers need to know the students' knowledge before the lesson begins. Pretest is one way to make this determination to assess the students' proficiency that will be taught in the lesson. Therefore, before teaching, teachers should carefully review the results, the data from the pre-test. Pre-test helps measure students learning over a period of time and marks the level of understanding before the instruction. Meanwhile, posttest measures student learning. The comparison of these two tests can provide the teacher an opportunity to track the students' development.

Significant Effect on the use of Computer-Based Instruction to the Mathematical Performance of the Learners

The significant effect on the use of computer-based instruction in terms of teacher pre-recorded video lessons, online tutorial videos and powerpoint presentation to the mathematical performance of the learners.

Table 7. Significant Effect on the Use of Computer-Based Instruction on the Learners Performance in the Posttest

<u>Computer-Based Instruction</u>		<i>t</i>	<i>p-value</i>	<i>Analysis</i>
Teacher Pre-Recorded Video Lessons	Performance (posttest)	-3.390	.007	Significant
Online Tutorial Videos		1.734	.014	Significant
PowerPoint Presentation		1.366	.202	Not Significant

The table 7 presented the effect on the use of computer-based instruction in terms of teachers' prerecorded video lesson, online tutorials video, and power point presentation on the learners' performance in the post- test.

As showed in the table, it's manifested that the use of computer-based instruction in terms of power point presentation have *no significant* impact on students' performance. Specifically, power point presentation gained ($p= .202$), which were all higher than (0.05) level of significance which supported the result of the analysis. This explains more that the learner's evaluation on the computer-based instruction such as online tutorial and power point presentation has no impact on the result of their posttest. This was supported by Jackman and Roberts (2014) that the online tutorial video use in course teaching generally is that excessive use of unregulated opensource digital content can lead to less course structure

which can in turn present problems for students in their learning. It was also investigated by Kazu and Demirkol (2014) show that there was no significance difference found between the two groups at the end of pre-test but the averages of the final test grades, the experiment group has been found more successful than the 33-control group, female students have turned out to be more successful than the male students.

On the other hand, the use of computer-based instruction in terms of online tutorial videos and teacher pre-recorded video lesson has a significant effect on students' mathematics performance with the p-value of 0.014 and 0.007 respectively which was lower than the 0.05 level of significance. This was supported by the findings of Brame (2015) Pre-recorded videos are more effective when they're short, can have its pace controlled by the student and maintain students' attention through objectives – such as a worksheet or problem to be solved. It was also found out that most institutions have their major lecture halls that equipped with tools for real-time lectures recordings. Drouin (2014)

4. Summary of Findings

This chapter discusses the summary, conclusions, and recommendations of the study based on the results of the analysis of data gathered.

Summary

The purpose of the study was to determine the impact of computer-based instruction to the learner's performance in mathematics. And to improve the mathematics performance of the learners through computer-based instruction. It utilized twenty-eight (28) grade three students of Lewin Elementary School in Lumban, Laguna S.Y. 2021 – 2022. The respondents will be divided into two groups alphabetically and classify as the controlled and experimental group of the study. It was purposely taken as a sample in this study since the researcher is the class adviser of the respondents.

The main instrument used in this research study was a pretest/posttest prepared and modified by the researcher. A researcher-made questionnaire in the form of checklist was also prepared by the researcher to collect the needed data for the students. The pretest/posttest and questionnaire were modified and validated for suggestions and enhancements before it was distributed to the respondents.

The researcher gave the pretest to the controlled and experimental group. Then for the experimental group, the researcher gave each of the students a flash drive that contains the teachers pre-recorded videos, downloaded online tutorial videos and PowerPoint presentation that discusses the lesson on the following day. After the discussion inside the classroom, the respondents were administered the posttest to the controlled and experimental group. The perception of the experimental group based on the computer-based instruction was also gathered by the used of questionnaire checklist. As there was assurance for validity and reliability of the major instrument coupled with the approval by the thesis adviser to conduct an actual study.

The responses from the respondents were recorded, tallied, computed, and analyzed. The statistical treatments used in computing the data were mean, standard deviation, and t-test.

From the instruments that yielded the data gathered by the researcher summarized the following findings.

The level of perception of the learners on the use of teachers' pre-recorded video lesson was *Very Useful*. The level of perception of the learners on the use of online-tutorial videos was *Very Useful*. The level of perception of the learners on the use of PowerPoint presentations was *Very Useful*. This indicates further the usefulness of the computer-based instruction such as Teacher's Pre-recorded videos, online tutorial videos and use of PowerPoint presentations to continue the education and motivates the learner to attain the desired competencies for a specific learning area.

The controlled group's mathematics performance in terms of pretest described as *Below Average*, and their posttest described as *Average*. While the experimental group's mathematics performance in terms of pretest is described as *Below Average* and their posttest described as *Very Good*.

The pre-test result of the two group of learners has no significant difference as indicated in the p-value. The p value is higher than the level of significance which supported the result of the analysis. This means that majority of the learners has the same level of pre-existing knowledge about the content of the topic. On the other hand, the result of the post test of the two group of learners has significant difference. The controlled group attain the *Average* performance while the Experimental group attain the *Very Good* performance. The p-value is lower than the level of significance. This means that the Use of Computer Based-Instructions help the students to improve their performance.

It's manifested that the use of computer-based instruction in terms of power point presentation have no significant effect on the learner's mathematics performance. Specifically, power point presentation gained the p-value that was higher than the level of significance which supported the result of the analysis. This explains more that the learner's evaluation on the computer-based instruction such as power point presentation has no impact on the result of their posttest.

Moreover, the use of computer-based instruction in terms of online tutorial videos and teacher pre-recorded video lesson has a significant effect on students' mathematics performance Specifically their p-value is lower that the level of significance which supported the result of the analysis. This implies that the use of computer-based instruction in terms of

online tutorial videos and teachers pre-recorded video lesson is effectively helping the learners to improve their mathematics performance.

Conclusions

In the light of the summary of findings of this study, the following conclusions were drawn.

The use Computer-based instruction in terms of Teacher's pre-recorded video lessons, online tutorial videos and use of PowerPoint presentation were perceived by the respondents as very effective and indicates further the usefulness of the computer-based instruction to continue the education and motivates the learner to attain the desired competencies in mathematics. The mean scores of the pretest and posttest results after using the computer-based instruction was significant which resulted to reject the first null hypothesis of the study and there is a significant effect in the use computer-based instruction particularly in online tutorial video and teacher's pre-recorded video lesson on the performance of Grade three (3) learners of Lewin Elementary School in Lumban, Laguna. Therefore, the second null hypothesis of the study is hereby rejected.

Recommendations

Based on the findings and conclusions drawn, the following were recommended:

1. To School Administration

The use of Teacher's pre-recorded video lesson can help to reach out the learners amid COVID-19 pandemic. It must be included on their School Improvement Plan on the learner's development.

2. To Classroom Teachers

In this time of pandemic or even there in no pandemic, they can use this as additional teaching strategies. By the means of giving prior the lesson discussion by the means of their pre-recorded videos, they will lessen the time of lesson discussion inside the classroom. The teaching and learning process will be more interactive because the students have already had knowledge on the lesson to be discussed.

They may sustain the usage of the computer-based instruction particularly with the use of teacher's pre-recorded videos in teaching mathematics. Using these literacy strategies, it can help students to enhance their learning in problem solving. The teachers may devote more efforts to learn and apply new and different use of educational technology that can be useful to keep classroom well managed and conducive for teaching-learning.

The teachers may strengthen the innovative teaching strategies to further enhance the mathematics performance of the students.

3. To Other Researchers

To ensure better mathematics performance, other researchers is encourage to conduct parallel studies to find out other materials to improve the mathematics skills of elementary students.

Further studies should be conducted making a closer look on other unknown variables that might contribute to the new normal education particularly in finding the new teaching strategies in the distance learning.

References

- Abadier, John Marson (March 2012). The Use of Electronic and Non-Electronic Instructional Materials as Enhancement performance: A Comparative Study.
- Ahmed. A. M. M. (2011) { in Arabic} The Impact of Using Blended Learning in Teaching Chemistry on the Achievement and the Attitude toward it and Maintain the Learning Impact on the Secondary Students. The Journal of the Scientific Education, Egypt, 14 (3): 173.
- Airasian, S. (2019). The Effect of computer assisted instruction on sixth grade students academic achievements in the teaching of flowery plants in science course at primary education. Unpublished Master's Thesis University of Gazi, Ankara, Turkey.
- Appersona, Jennifer M, Eric L. Laws and James A. Scepansky; The impact of presentation graphics on students' experience in the classroom; Computers & Education; Volume 47, Issue 1, August 2006, Pages 116-126
- Arrman Kyaw Feb 26, 2021. Study: Pre-Recorded Videos Prove More Effective for Student Learning Than In-Person Instruction
- Bahnson, J., & Olejnikova, L. (n.d.). Are Recorded Lectures Better than Live Lectures for Teaching Students Legal Research. LAW LIBRARY JOURNAL, 109, 18
- Baker, J. P., Goodboy, A. K., Bowman, N. D., & Wright, A. A. (2018). Does teaching with PowerPoint increase students' learning? A meta-analysis. *Computers & Education*, 126, 376–387.
- Benson, Steven (2016); Operant Conditioning and its Application to Instructional Design: Article Review; Published: June 12, 2016;

- Bean, T., O'Brian, D., & Fang, Z. (2012). Past and future directions in content area literacies. *Journal of Adolescent & Adult Literacy*, 56(4), 275-278.
- Brame, C.J. (2015). Effective educational videos.
- Brogan, D. & Kutner, M. (2012) Comparative Analyses of Pretest-Posttest Research Designs, *The American Statistician*, 34:4, 229-232, DOI: 10.1080/00031305.1980.10483034.
- Burt, F. (2021). Computer assisted instruction in mathematics can improve students' test scores: A study. Retrieved from ERIC database (ED443688)
- Carpenter, Vanessa C. (2012). Attitude and Perception of Students towards the Use of English as Language of Learning for Science and Mathematics.
- Cavanagh, M. (2012). Students' experiences of active engagement through cooperative learning activities in lectures. *Active Learning in Higher Education*, 12(1), 23-33.
- Chen, C.-M. and Wu, C.-H. (2015), 'Effects of different video lecture types on sustained attention, emotion, cognitive load, and learning performance', *Computers & Education* 80, 108-121.
- Chris Burt | February 18, 2021 Study: Pre-recorded videos can boost student learning.
- Cooper, D. and Higgins, S. (2015), 'The effectiveness of online instructional videos in the acquisition and demonstration of cognitive, affective, and psychomotor rehabilitation skills', *British Journal of Educational Technology* 46(4), 768-779.
- Colak, M. (2014). To what extent do social network sites affect students' academic lives?
- Danielson, J., Preast, V., Bender, H., & Hassall, L. (2014). Is the effectiveness of lecture capture related to teaching approach or content type? *Computers & Education*, 72, 121-131.
- Dorothy Kropf, - 1 Purdue University: Computer Based Instruction: Categories, Characteristics and Applications in Education-2 E-Learning Industry: Instructional Design Models and Theories: Computer-Based Instruction Theory
- Drouin, M.A. (2014). If you record it, some won't come: Using lecture capture in introductory psychology. *Teaching of Psychology*, 41
- Escanilla, Kister Quin (2019). The Effect Of Computer Assisted Instruction To Mathematics Achievement Of Grade V Students.
- Fortes, M. A., Fredeluces, R. R., Garcia, R. M. (April 2019). Effect of Modular Instruction in the Performance of BSED I-A Students of LSPC, Sta. Cruz Campus, Santa Cruz, Laguna, A.Y. 2017-2018.
- Gamabri, I. (2015). Effectiveness of PowerPoint presentation on students' cognitive achievement in Technical Drawing, 3(4), 4.
- Giannakos, M. N., Jaccheri, L. and Krogstie, J. (2016), 'Exploring the relationship between video lecture usage patterns and students' attitudes', *British Journal of Educational Technology* 47(6), 1259-1275.
- Gorissen, P., Van Bruggen, J., & Jochems, W. (2012). Students and recorded lectures: Survey on current use and demands for higher education. *Research in Learning Technology*, 20, 297-311.
- Gunn, Allan and Pitt, Sarah (2015); The effectiveness of computer-based teaching packages in supporting student learning of parasitology. Pages 1-14 | Received 28 Mar 2003, Accepted 29 Apr 2003, Published online: 14 Dec 2015
- Hadgu, R.M., Huynh, H., & Gopalan, C. (2016). The use of lecture capture and student performance in physiology. *Journal of Curriculum & Teaching*, 5, 11-18.
- Hake, N. (2017). Does Replacing Face-to-face Lectures with Pre-recorded Video Lectures Affect Learning Outcomes?: Proceedings of the 11th International Conference on Computer Supported Education, 454-457.
- Harland, Darci J. (September 2019); esources.pollfish.com was first indexed by Google in September 2019.
- Hill, A., Arford, T., Lubitow, A., & Smollin, L. M. (2012). "I'm ambivalent about it": The dilemmas of PowerPoint. *Teaching Sociology*, 40(3), 242-256.
- Hopper, K. B., & Waugh, J. B. (2014). PowerPoint: An overused technology deserving of criticism, but indispensable. *Educational Technology*, 54(5), 29-34.
- Hortal, Kristela Janine A. (2016) Instructional Material In Strengthening Differentiated Instruction In Teaching Mathematics.
- Lozano, Rose Ann L. (2018) Enhancing Mathematics Skills Through Intervening Scaffolding Instruction.
- Hortal, R. (2012). The effects of computer use on the acquisition of multiplication facts by a student with learning disabilities. *Journal of Learning Disabilities*, 20, 336-341.
- Hosseini, Nouri. (2015) The College of New Jersey. How to use powerpoint presentations. 21(3). 55-61
- Jackman, W. M. and Roberts, P. (2014), 'Students' perspectives on YouTube video usage as an e-resource in the university classroom', *Journal of Educational Technology Systems* 42(3), 273-296.
- Johnson, H. (2013). Effects of computer supported education on the success of students on teaching of Newton's Laws of Motion, *World Applied Sciences Journal*, 3 (1), 51-56
- Jordan, Camille (2019). Cooperative Learning: Its effects on the performance of the selected Grade 6 pupils in Palasan Elementary School, Santa Cruz, Laguna, School Year 2018-2019.

- Jordan, L. A., & Papp, R. (2014). PowerPoint®: It's not "yes" or "no": It's "when" and "how". *Research in Higher Education Journal*, 22, 1–11.
- Kay, R. H. (2012). 'Exploring the use of video podcasts in education: A comprehensive review of the literature', *Computers in Human Behavior* 28(3), 820–831.
- Kazu, I. Y. and Demirkol, M. (2014) Blended learning: Let's get beyond e- Learning. *Turkish Online Journal of Educational Technology – TOJET*, 13(1):78-87.
- Kensey H., (2013). The impact of computer-assisted and laboratory-based teaching methods in the teaching of chemical equilibrium on students' achievements, recall level and attitudes toward chemistry. Unpublished: Doctoral Dissertation University of Marmara, İstanbul, Turkey.
- Kelly, C. Y. (2017). A comparison of computer-assisted instruction and the traditional method of teaching basic statistics. *Journal of Statistics Education*, 16 (1), Retrieved from
- Kernbach, Sebastian; (PDF) *Slip-Sliding-Away: A Review of the Literature on the Constraining Qualities of PowerPoint*. Available from: Institute for Media and Communications Management, University of St. Gallen, Blumenbergplatz 9, 9000 St. Gallen, Switzerland.
- Kirkwood, A. and Price, L. (2013), 'Examining some assumptions and limitations of research on the effects of emerging technologies for teaching and learning in higher education', *British Journal of Educational Technology* 44(4), 536–543.
- Kock, Y. (2013). An evaluation of the effectiveness of computer assisted learning strategy and expository method of teaching biology: a case study of lumen Christi international high school, Uromi, Nigeria. *Journal of Social Science*, 16 (3), 215-220.
- Koney, C. (2013). The effect of the computer assisted teaching and 7e model of the constructivist learning methods on the achievementss and attitudes of high school students. *The Turkish Online Journal of Educational Technology (TOJET)*, 5 (4), Article 11
- Lari, S., F. (2014). The impact of using PowerPoint Presentations on Student's Learning and Motivation in Secondary Schools. *Social and behavior sciences. Europass Teacher Academy| Flipped classroom*; 2020
- Lashley, Lindon (2017). The Effects of Computer-Aided Instruction in Mathematics on the Performance of Grade 4 Pupils. July 2017 Learn from Blogs. Graph. Learn and Grow. Published: July 2022
- Lindo, Lashley (2017) The effect of computer-aided instruction in Mathematics on the performance of Grade 4 Pupils. *AGE Open* July-September 2017: 1–12 ©
- López, M.P and Rodríguez, L. E. (2013) *Educational Technology Research and Development*. Psychology and Behavioral Sciences Collection. 61 (4): 625-638.
- Magtanong, Alyssa Nikka L. (March 2012). Acceptability of Module in Pluralizing Countable Nouns as Alternative Instructional Materials in High School's English.
- Marchland, J.P., Pearson, M.L., & Albon, S.P. (2014). Students and recorded lectures: Survey current use and demands for higher education. *Research & Learning Technology*, 20, 297-311.
- Maynor, L.M., Barrickman, A.L., Stamatakis, M.K., & Elliott, D.P. (2014). Student and faculty perceptions of lecture recording in a Doctor of Pharmacy curriculum. *American Journal of Pharmaceutical Education*, 77(8), 1-7.
- Merriam, N. (2012). The effect of computer-assisted physics instruction on the achievements of the student and the attitude of the student toward the computer. Unpublished Master's Thesis University of Ankara, Ankara, Turkey.
- Millena, R.. (2015) Teaching Literacy Strategies in Math. The College at Brockport: State University of New York Digital Commons @Brockport. Unpublished Master's thesis
- Morillo, Jayson R. (2013). Effects of Games on Learning Preposition in English of Freshmen in Laboratory High School of Laguna State Polytechnic University- Santa Cruz campus.
- Motagi, A. (2018). Promoting student engagement, (1) Programs, Techniques and Opportunities Press.
- Moulton, S. T., Türkay, S., & Kosslyn, S. M. (2017). Does a presentation's medium affect its message? PowerPoint, Prezi, and oral presentations. *PloS One*, 12(7), e0178774
- Nillet, S. (2017). Online Learning: A Panacea in the Time of COVID-19 Crisis. *Journal of Educational Technology Systems*, 49(1), 5–22.
- Nwosu, Obiora, Prof. (2020). Effect of computer aided instruction on students' interest in selected topics in electronic libraries course in federal tertiary institutions in Anambra State, Nigeria. *Library and Information Perspectives and Research*, 2(1), 71-81, January 2020; ISSN: 2672-5886
- Ozalan, E.N & Maden, Z.L (2013). The use of PowerPoint presentations in the department of foreign language education of middle east technical university. *Middle East & African Journal of Educational Research*. Issue z. PowerPoint at 25: Conversation with Robert Gaskins. (2012). (On-Line)
- Pappas, Christopher (2014); *Instructional Design Models and Theories: Inquiry-based Learning Model*; June 18, 2014; eLaerning Industry;
- Phanse, M., Chavan, T., (2021) Computerassisted instruction with exceptional children. *Journal of Special Education*, 19, 497-509.

- Planning and Changing, v38 n3-4 p181-190 2007 Department of Educational Administration and Foundations. College of Education, Illinois State University, Campus Box 5900, Normal, IL
- Ramlogan, S., Raman, V. and Sweet, J. (2014), 'A comparison of two forms of teaching instruction: video vs. live lecture for education in clinical periodontology', *European Journal of Dental Education* 18(1), 31–38.
- Rasi, P. and Poikela, S. (2016), 'A review of video triggers and video production in higher education and continuing education pbl settings', *Interdisciplinary Journal of Problem-Based Learning* 10(1).
- Rim Mekonnen Hadgu, Sophia Hoang-Vy Huynh & Chaya Gopalan (2016) The Use of Pre-recorded Lectures on Student Performance in Physiology. Department of Applied Health & Nursing, Southern Illinois University Edwardsville, Illinois, USA. January 23, 2016. Vol. 5, No. 1; 2016.
- Saunders, M., Lewis, P. & Thornhill, A. (2012) "Research Methods for Business Students" 6th edition, Pearson Education Limited
- Saine, P. (2012). iPod, iPads, and the SMARTBoard: Transforming literacy instruction and student learning. *New England Reading Association Journal*, 47(2), 74-79.
- Shah, S., Cox, A.G., & Zdanowicz, M.M. (2013). Student perceptions of the use of pre-recorded lecture modules and class exercises in a molecular biology course. *Currents in Pharmacy Teaching & Learning*, 5(6), 651-658.
- Sonan S. Panse and Chetan U. Chavan. COMPARATIVE STUDY ON EFFECTIVENESS OF USING PRE- RECORDED TEACHING CONTENT AND ONLINE LIVE LECTURES AS MEDIUM OF INSTRUCTION IN TEACHER EDUCATION. January-March 2021. Vol.11, Issue 41. Pages No. 68-72. An international Bilingual Peer Reviewed Refereed Research Journal.
- Taslibeyaz, E., Aydemir, M. and Karaman, S. (2017), 'An analysis of research trends in articles on video usage in medical education', *Education and Information Technologies* 22(3), 873–881.
- Tienken, Christopher H.; Wilson, Michael J. The Impact of Computer Assisted Instruction on Seventh-Grade Students' Mathematics Achievement
- Tienker C.H; and Maher J.A. (2015). Progressive comparison of the effects of computer-assisted instruction on the academic achievement of secondary students. *Journal of Research on Computing in Education*, 33(4), 325-337.
- Vasbieva, D. G., Klimova, I. I., Agibalova, E. L., Karzhanova, N. V., & Bírová, J. (2016). Enhancement of Students' Vocabulary Learning Through a Blended Learning Approach. *International Electronic Journal of Mathematics Education*, 11(5), 1195-1203.
- Yousef, A. M. F., Chatti, M. A. and Schroeder, U. (2014), Video-Based Learning: A Critical Analysis of The Research Published in 2003– 2013 and Future Visions, in 'The Sixth International Conference on Mobile, Hybrid, and On-line Learning : eLmL 2014; Barcelona, Spain, from March 23, 2014 to March 27, 2014', IARIA, Barcelona, pp. 112– 119.
- Yumul, Robert G. (2018) Electronic Intervention Materials in Teaching Mathematics.