SELF-MADE VIDEO TUTORIALS IN MATHEMATICS 8

Jessica Mae Maranan Adofina

Laguna State Polytechnic University-Sta Cruz Campus
Email: *jessicamae.adofina22@gmail.com*

Abstract

Changing face-to-face classroom settings into online classrooms and distance learning is part of the "New Normal" in the current circumstances. Math would be more complicated and difficult for students to learn. The researcher tries to create ways to teach and learn mathematics by creating traditional materials. The researcher's goal is to create online tutorial videos that demonstrate various tactics, strategies, and shortcuts for studying Mathematics as remedial activities for students who are having difficulty with the subject. Students can access and utilize the content at their own pace and at their most convenient time by using self-made math video tutorials. The study used quasi-experimental research design. The skills included in the video tutorials were identified using the MELC. The self-made video tutorials underwent validations from four (4) mathematics experts and four (4) ICT experts. The study has forty-five (45) student-respondents under online distance learning. The results revealed that the level of acceptability of self-made video tutorials in terms of Components as to content, objectives, relevance and interactivity were perfectly acceptable. This also revealed that the level of acceptability of self-made video tutorials in terms of Characteristics as to communication skills, quality of voice, clearness of audio and voice quality were also perfectly acceptable as the statements were strongly agreed. The level of students' performance in terms of their Diagnostic Test were Fairly Satisfactory, while their Summative Test revealed that they were under Very Satisfactory. There is a significant difference between diagnostic and summative test as the gained score went higher after the utilization of self-made video tutorials. The level of acceptability of self-made video tutorials in terms of Components has no significant effect with the students' academic performance. The level of acceptability of self-made video tutorials in terms of Characteristics has also no significant effect with the students' academic performance.

Keywords: Video Tutorials, Online Learning, Self-made Video Tutorials, and Performance

1. INTRODUCTION

Today's technological growth reflects the reality of our society, particularly in the educational domains. This technological advancement enhances and accelerates the completion of daily chores (Maldonado, et. al., 2018).

Mathematics is a distinct topic that is an important part of the school curriculum. It serves as a catalyst for the advancement of all other sciences. We use Mathematics in all aspect of our lives, whether we realize it or not. However, the vast majority of students around the world despise Mathematics since it appears to be extremely tough. In the subject of social sciences, mathematics is seen as an essential tool for deciphering the immediate environment and representing diverse social, scientific, and technical events that occur in today's world (Williamson, 2018).

In order to meet students' learning needs, changing face-to-face classroom settings into online classrooms and distance learning is part of the "New Normal" in the current circumstances. Math would be more complicated and difficult for students to learn. Both teachers and students have used electronic devices and the internet to communicate, educate, and learn. Through the internet's ease of access to information and communication, a new teaching and learning technique known as video-based training has arisen and continues to evolve. Learners were at peace in their learning because they could pick when and where to access and view classes and lectures, and they could study and learn at their own pace without being conscious of being left behind.

The researcher tries to create ways to teach and learn mathematics by creating traditional materials. The researcher's goal is to create online tutorial videos that demonstrate various tactics, strategies, and shortcuts for studying Mathematics as remedial activities for students who are having difficulty with the subject. Students can access and utilize the content at their own pace and at their most convenient time by using self-made math video tutorials.

Background of the Study

As the Philippines continues to grapple with the coronavirus outbreak, a passionate debate rages about when and how schools should reopen. It suggests that online and modular distance learning – an alternative to regular face-to-face classes

ostensibly designed to avoid the risk of getting the fatal virus – may really be dangerous. One way is through the use of technology and the internet, where YouTube has become pervasive in society.

Teacher-made videos can be a great way to support all students, especially the 1 in 5 students who learn and think differently. When the teacher make their own videos, they can tailor the instruction to the needs of their students. They can also bring a personal connection to the online learning environment.

Instructional films were self-contained, self-contained units of education that students could view over and over again in order to achieve the Most Essential Learning Competency. It is self-made in that it includes examples created by the researcher and a flow of conversation that students can easily grasp about how a particular lesson or solution will be explored. Self-pacing describes classroom education using instructional films, in which students proceed through learning activities at their own pace.

Self-made video tutorials are one type of instructional material that can be used in the teaching and learning process. Pulong Sta Cruz National High School Grade 8 students used this resource as one of their interventions to guarantee continuity of learning even in asynchronous sessions. In order to obtain the goal competencies, students must complete a sequence of learning activities. Lessons are subdivided according to the Most Essential Learning Competency (MELC) provided by the DepEd. The Mathematics 8 provides triangle congruence, triangle congruence postulate namely SAS, ASA, and SSS Congruence Postulate, and solving corresponding parts of congruent triangles. The researcher believes that if they master this level, it is easy for them to understand more complex topic in the preceding level.

With these ideas in mind, the researcher is encouraged to conduct a study at Pulong Sta Cruz National High School on using self-made video lessons in Mathematics 8 and evaluating their efficacy in terms of academic performance.

Statement of the Problem

The purpose of this study is to determine the effectiveness of self-made video tutorials in Mathematics 8.

Specifically, the study sought answer to the following questions;

1. What is the level of acceptability of self-made video tutorial in terms of components as to:
   - 1.1 content;
   - 1.2 objective;
   - 1.3 relevance; and
   - 1.4 interactivity?
2. What is the level of acceptability of self-made video tutorials in terms of characteristics as to;
   - 2.1. communication skills;
   - 2.2. quality of voice;
   - 2.3. clearness of audio; and
   - 2.4. visual quality?
3. What is the level of students' performance in Mathematics 8 in terms of:
   - 3.1. Diagnostic test; and
   - 3.2. Summative test?
4. Is there a significant difference between Students' Performance in Mathematics 8 in terms of the diagnostic and summative tests?
5. Is there a significant effect between the Self-Made Video Tutorials in Mathematics 8 in terms of its components and characteristics to the students' performance in Mathematics 8?

2. METHODOLOGY

2.1 Research Design

The Research Design used Quasi-Experimental research design to determine the extent of utilization of self-made math 8 video tutorials.

Because it is defined by what it lacks, quasi-experimental research is a unique research methodology. It is comparable to experimental research in that an independent variable is manipulated. Because there is no control group, no random selection, no random assignment, and/or no active manipulation, it varies from experimental research (Abraham & MacDonald 2011). A pre-structured questionnaire can be effectively designed utilizing quasi-experimental research. Moreover, Choueiry (2021) elucidated that the outcomes of the pre-intervention and post-intervention measurements are compared to evaluate the effect of the independent variable on the dependent variable.

This research design is appropriate for this topic since the researchers will gather data using a pre- and post-test. In a pretest-posttest design, the dependent variable is measured twice: once before and after the treatment is implemented. If there is a substantial difference between the two, the obtained data will be compared.

In this research, a homogeneous group sharing similar characteristics, namely; Grade-8 students enrolled using the online mode of studying implemented in Pulong Sta Cruz National High School.

2.2 Population and Sampling Technique

The Purposive Sampling Technique was used in this study; it is a technique in which respondents are picked based on the researcher's judgment and on respondents' attributes. Because there is no face-to-face interaction due to the pandemic, only those who will complete diagnostic and summative tests, as well as the survey questionnaire, are chosen.

Purposive sampling, according to Vijayamohan (2022), is the process of picking samples from a larger sample size depending on the survey taker's or researcher's assessment. In other words, a purposive sample is chosen to meet the needs of the test, survey, or research for which it will be utilized.

The researcher chose Grade 8 Junior High School students of Pulong Sta Cruz National High School comprising 45 students for the School Year 2021-2022. All of these students are opted Online Distance Learning as their modality.

2.3 Research Instrument

The proponent utilized the ***Numerical Rating*** and the Equivalent to rate the respondents' perception from 1 to 5, with 5 as the highest rating. The levels (or scale) used to differentiate between Perfectly Acceptable, Acceptable, Neutral, Unacceptable and Totally Unacceptable. Each level is accompanied by a criterion, or set of criteria, that specifies what is needed to reach that level of quality.

Scale	Range	Description	Verbal Interpretation
5	4.21-5.00	Strongly Agree	Perfectly Acceptable
4	3.41-4.19	Agree	Acceptable
3	2.61-3.39	Neutral	Neutral
2	1.81-2.59	Disagree	Unacceptable
1	1.00-1.80	Strongly Disagree	Totally Unacceptable

2.4 Statistical Treatment of Data

Statistical treatment of data of the present study is shown in the table below.

Statement of the Problem	**Statistical Tool**
To determine the level of acceptability of self-made video tutorial in terms of components.	Mean and Standard Deviation
To determine the level of acceptability of self-made video tutorial in terms of components.	Mean and Standard Deviation
To determine the level of students' performance in Mathematics 8.	Frequency, Relative Frequency, Verbal Interpretation, Mean and Standard Deviation
To identify whether there is a significant difference between the level of students' performance in Mathematics 8 in terms of diagnostic and summative tests.	T-test
To ascertain whether there is a significant effect between the self-made video tutorials in Mathematics 8 in terms of its components and characteristics to the students' performance in Mathematics 8.	Regression Analysis

3. RESULTS AND DISCUSSION

This chapter presents the statistical analysis of data with the corresponding interpretation, and analysis of the results.

Level of Self-made Video Tutorials in Mathematics 8 in terms of its Components

The respondents assessed the level of acceptability of self-made video tutorials in Mathematics 8 in terms of its Components as to content, objectives, relevance and interactivity which was revealed in the following tables, which shows the average mean, standard deviation, and verbal interpretation.

Table 1. Level of Acceptability of Self-Made Video Tutorials in Mathematics 8 in terms of its Components as to Content.

STATEMENT	**Mean**	**SD**	**Remarks**
As a student, the content…			

1. demonstrated the topic/lesson properly and precisely.	4.29	0.79	Strongly Agree
2. presented a review of past lesson/s.	4.22	0.74	Strongly Agree
3. has a short and clear explanation in the video.	4.31	0.73	Strongly Agree
4. was useful supplementary material for reinforcement and application of new learning.	4.36	0.71	Strongly Agree
5. includes an overview of the task.	4.29	0.66	Strongly Agree
Grand Mean	**4.29**		**Strongly Agree**
Interpretation	**Perfectly Acceptable**		

Legend:

Scale	Range	Remarks	Interpretation
5	4.21 – 5.00	Strongly Agree	Perfectly Acceptable
4	3.41 – 4.20	Agree	Acceptable
3	2.61 – 3.40	Neutral	Neutral
2	1.81 – 2.60	Disagree	Unacceptable
1	1.00 – 1.80	Strongly Disagree	Totally Unacceptable

The above data reveal that self-made video tutorials in Mathematics 8 in terms of its component as to content is perfectly acceptable, denoted by the grand mean of (M=4.29). This further implies that respondents strongly agree that self-made tutorial video consisted of a proper and precise lesson, a review of past lessons, short and clear explanation, supplementary materials, and an overview of the tasks.

The respondents strongly agree that the content was useful supplementary material for reinforcement and application of new learning, which gained the highest mean of (M=4.36, SD=0.71). However, they also strongly agree that it presented a review of past lesson/s as it bears the least mean of (M=4.22, SD=0.79). This insinuates that the content of the self-made video tutorials is supplemental to academic subject.

The result is supported by the study of Kay (2012), that videos can include academic content as well as material that is supplemental to academic subject, such as news or clips. Video lectures, video tutorials, brief knowledge snippets, and "how-to" example-based video-modelling can all be utilized to enhance both practical and conceptual instruction.

Table 2. Level of Acceptability of Self-Made Video Tutorials in Mathematics 8 in terms of its Components as to Objectives.

STATEMENT	Mean	SD	Remarks
As a student, the objectives of the lesson…			
1. set a clear presentation.	4.40	0.69	Strongly Agree
2. were obtained in the presentation.	4.33	0.67	Strongly Agree
3. provided systematic explanations.	4.42	0.66	Strongly Agree
4. were aligned to the skills and competencies.	4.36	0.68	Strongly Agree
5. enhanced students' critical thinking skills.	4.36	0.68	Strongly Agree
Grand Mean	**4.37**		**Strongly Agree**
Interpretation	**Perfectly Acceptable**		

Legend:

Scale	Range	Remarks	Interpretation
5	4.21 – 5.00	Strongly Agree	Perfectly Acceptable
4	3.41 – 4.20	Agree	Acceptable
3	2.61 – 3.40	Neutral	Neutral
2	1.81 – 2.60	Disagree	Unacceptable
1	1.00 – 1.80	Strongly Disagree	Totally Unacceptable

The above data reveal that self-made video tutorials in Mathematics 8 in terms of its component as to objectives is perfectly acceptable, denoted by the grand mean of (M=4.37). This further implies that respondents strongly agree that self-made tutorial video has a well-defined and articulated learning objectives are important.

The respondents strongly agree that the objective of the lesson provided systematic explanations, which gained the highest mean of (M=4.42, SD=0.66). However, they also strongly agree that objectives of the lesson were obtained in the presentation as it bears the least mean of (M=4.33, SD=0.69). This insinuates that the objectives of the self-made video tutorials are the foundation of lesson planning.

This is parallel to the study of Cavero (2016), he emphasizes that learning objectives are the heart of every lessons. They give a purpose to learning. They are the foundations for lesson planning. The objectives are the backbone of any lesson. Thus, it is essential that lessons, even if delivered through face-to-face, online, or modular classes, can preview viewers on the skills and competencies they are about to possess as they finish them.

Table 3. Level of Acceptability of Self-Made Video Tutorials in Mathematics 8 in terms of its Components as to Relevance.

STATEMENT	Mean	SD	Remarks
As a student, the video tutorial…			
1. made learning independent from time and space.	4.40	0.62	Strongly Agree
2. provided relevant discussion on the subject matter.	4.42	0.69	Strongly Agree
3. reinforced concepts necessary for mastery.	4.18	0.83	Agree
4. provided long-term learning.	4.27	0.75	Strongly Agree
5. achieved better retention of students' learning.	4.38	0.68	Strongly Agree
Grand Mean	**4.33**		**Strongly Agree**
Interpretation	**Perfectly Acceptable**		

Legend:

Scale	Range	Remarks	Interpretation
5	4.21 – 5.00	Strongly Agree	Perfectly Acceptable
4	3.41 – 4.20	Agree	Acceptable
3	2.61 – 3.40	Neutral	Neutral
2	1.81 – 2.60	Disagree	Unacceptable
1	1.00 – 1.80	Strongly Disagree	Totally Unacceptable

The above data reveal that self-made video tutorial in Mathematics 8 in terms of its components as to Relevance is perfectly acceptable as denoted by the grand mean of (M=4.33). This implies that respondents strongly agree that the video tutorial provides independent learning time and space.

The respondents strongly agree that the video tutorials provided relevant discussion on the subject matter, which gain the highest mean of (M=4.42, SD=0.69). However, they agree that video tutorial reinforced concepts necessary for mastery as it bears the least mean of (M=4.18, SD=0.83). This insinuates that the objectives of the self-made video tutorials provide relevant discussion, encourage life-long learning and better retention.

In addition, it is consistent with the assertions of Kim et al. (2014) that any innovations, whether in a module or video format, must have specific ideas that are acceptable, relevant, and appropriate for the students' levels in order to achieve validity. Relevance is a priority when choosing a self-made tutorial video to watch.

Table 4. Level of Acceptability of Self-Made Video Tutorials in Mathematics 8 in terms of its Components as to Interactivity.

STATEMENT	Mean	SD	Remarks
As a student, the video tutorial…			
1. can be watched as many times for the mastery in learning	4.36	0.80	Strongly Agree
2. set view close-up illustrations of examples.	4.40	0.65	Strongly Agree
3. assists tasks instructions in clear and simple manner.	4.40	0.65	Strongly Agree
4. provides easy access may it be online or offline.	4.47	0.69	Strongly Agree
5. strengthens demonstration with practice.	4.42	0.69	Strongly Agree
Grand Mean	**4.41**		**Strongly Agree**
Interpretation	**Perfectly Acceptable**		

Legend:

Scale	Range	Remarks	Interpretation
5	4.21 – 5.00	Strongly Agree	Perfectly Acceptable
4	3.41 – 4.20	Agree	Acceptable
3	2.61 – 3.40	Neutral	Neutral
2	1.81 – 2.60	Disagree	Unacceptable

1	1.00 – 1.80	Strongly Disagree	Totally Unacceptable

The above data reveal that the self-made video tutorials in Mathematics 8 in terms of its components as to Interactivity is perfectly acceptable, denoted by the grand mean of (M=4.41). This implies that respondents strongly agree that it can be watched as many times for the mastery of learning.

The respondents strongly agree that the video tutorial provides easy access may it be online and simple manner, which gained the highest mean of (M=4.47, SD=0.69). However, they strongly agree that it can be watched as many times form the mastery in learning as it bears the least mean of (M=4.36, SD=0.80). These results indicate that higher incidents of rewatching video tutorials were because of the interactive nature of the video.

This is parallel to the study of Van der Meij and Van der Meij (2013), states that learners have the ability to alter video playback through user control. Learners can start, pause, stop, restart, and turn backward or ahead in this video instruction that we are studying. Learners can tailor their viewing to their attentional processes using the control.

Level of Self-Made Video Tutorials in Mathematics 8 in terms of its Characteristics

The respondents assessed the level of acceptability of self-made video tutorials in Mathematics 8 in terms of its Components as to content, objectives, relevance and interactivity which was revealed in the following tables, which shows the average mean, standard deviation, and verbal interpretation.

Table 5. Level of Acceptability of Self-Made Video Tutorials in Mathematics 8 in terms of its Characteristics as to Communication Skills.

STATEMENT	Mean	SD	Remarks
The speaker's…			
1. pronunciation and enunciation are clear and intelligible.	4.29	0.73	Strongly Agree
2. explanation demonstrated full understanding.	4.38	0.68	Strongly Agree
3. usage of grammar is simple and understandable.	4.40	0.62	Strongly Agree
4. fluency in teaching shows confidence	4.40	0.69	Strongly Agree
5. character as being friendly and respectful manifested in the video.	4.33	0.71	Strongly Agree
Grand Mean	**4.36**		**Strongly Agree**
Interpretation	**Perfectly Acceptable**		

Legend:

Scale	Range	Remarks	Interpretation
5	4.21 – 5.00	Strongly Agree	Perfectly Acceptable
4	3.41 – 4.20	Agree	Acceptable
3	2.61 – 3.40	Neutral	Neutral
2	1.81 – 2.60	Disagree	Unacceptable
1	1.00 – 1.80	Strongly Disagree	Totally Unacceptable

The above data reveal that the self-made video tutorials in Mathematics 8 in terms of its characteristics as to Communication Skill is perfectly acceptable, denoted by the grand mean of (M=4.36). This implies that respondents strongly agree that viewers' top priority in choosing videos is whether they would understand the speaker or not.

The respondents strongly agree that the video speaker's usage of grammar is simple and understandable, and fluency in teaching shoes confidence, which both gained the highest mean of (M=4.40) and (SD=062, SD=0.69). However, they also strongly agree that the speaker's pronunciation and enunciation are clear and intelligible as it bears the least mean of (M=4.29, SD=0.73). These results indicate that tutorial videos were easy-to-understand and with a proper and intelligent sounding delivery.

According to Korytářová, (2019), English is widely used as a lingua franca in education; because online tutorials are utilized internationally, their creators should anticipate a diverse audience, including a sizable proportion of non-native speakers.

Table 6. Level of Acceptability of Self-Made Video Tutorials in Mathematics 8 in terms of its Characteristics as to Quality of Voice.

STATEMENT	Mean	SD	Remarks
The speaker use…			

1. the right rate of speech.	4.29	0.69	Strongly Agree
2. the proper height or depth in the tone of voice	4.29	0.79	Strongly Agree
3. her energy in increasing and sustaining manner.	4.36	0.61	Strongly Agree
4. speech that is clear and simple.	4.38	0.68	Strongly Agree
5. precise volume.	4.33	0.67	Strongly Agree
Grand Mean	**4.33**		**Strongly Agree**
Interpretation	**Perfectly Acceptable**		

Legend:

Scale	Range	Remarks	Interpretation
5	4.21 – 5.00	Strongly Agree	Perfectly Acceptable
4	3.41 – 4.20	Agree	Acceptable
3	2.61 – 3.40	Neutral	Neutral
2	1.81 – 2.60	Disagree	Unacceptable
1	1.00 – 1.80	Strongly Disagree	Totally Unacceptable

The above data reveal that the self-made video tutorials in Mathematics 8 in terms of its characteristics as to Quality of Voice is perfectly acceptable, denoted by the grand mean of (M=4.33). This implies that respondents strongly agree that the speaker's use her energy in increasing and sustaining manner.

The respondents strongly agree that the speaker use speech that is clear and simple, which gained the highest mean of (M=4.38, SD=0.68). However, they also strongly agree that the speaker use the right rate of speech and the proper height or depth in the tone of voice as both bears the least mean of (M=4.29) and (SD=0.69, SD=0.79). These results indicate that the speaker uphold proper speech rate that attract viewers.

According to Chiou et al., (2020) suggest that trust is an important aspect of how virtual humans are perceived in a learning context and that social cues such as voice quality will likely influence people's trust in virtual humans and other types of pedagogical agents, based on prior research outside of learning contexts.

Table 7. Level of Acceptability of Self-Made Video Tutorials in Mathematics 8 in terms of its Characteristics as to Clearness of Audio.

STATEMENT	Mean	SD	Remarks
1. The volume is good for voice.	4.31	0.70	Strongly Agree
2. There is no background or other distracting noise.	4.24	0.77	Strongly Agree
3. Audio level of the video was consistent throughout the video with no significant high or low incidents.	4.31	0.70	Strongly Agree
4. There are no technical glitches.	4.38	0.68	Strongly Agree
5. Sound effects are just enough.	4.22	0.74	Strongly Agree
Grand Mean	**4.29**		**Strongly Agree**
Interpretation	**Perfectly Acceptable**		

Legend:

Scale	Range	Remarks	Interpretation
5	4.21 – 5.00	Strongly Agree	Perfectly Acceptable
4	3.41 – 4.20	Agree	Acceptable
3	2.61 – 3.40	Neutral	Neutral
2	1.81 – 2.60	Disagree	Unacceptable
1	1.00 – 1.80	Strongly Disagree	Totally Unacceptable

The above data reveal that the self-made video tutorials in Mathematics 8 in terms of its characteristics as to Clearness of Audio is perfectly acceptable, denoted by the grand mean of (M=4.29). This implies that respondents strongly agree that video tutorials can easily understand by the students since the words and language used is properly presented and grammatically correct.

The respondents strongly agree that the there are no technical glitches in the video tutorials, which gained the highest mean of (M=4.38, SD=0.68). However, they also strongly agree that the sound effects are just enough as it bears the least mean of (M=4.22, SD=0.74). These results indicate that the respondents highly accepted the audio quality used in the video tutorial.

To support the result, Basu Roy & McMahon, (2012) producing good-quality self-made video tutorials require appropriate equipment and skills. Regarding the Quality of Voice and Communication skills, issues in technical glitches, background noise, consistency of volume, voice volume, and sound effects must be addressed as it affects the total quality of the video material. Viewers prefer to watch without any technical issues. In addition, high-quality educational video products need resources and equipment, and filming and editing can be time-consuming.

Table 8. Level of Acceptability of Self-Made Video Tutorials in Mathematics 8 in terms of its Characteristics as to Visual Quality.

STATEMENT	Mean	SD	Remarks
The speaker use…			
1. the speaker is fully visible with clear attention paid to proper lighting	4.36	0.77	Strongly Agree
2. video is recorded, editing and delivered in the highest HD resolution	4.36	0.80	Strongly Agree
3. captioned video text available and includes only minor errors in capitalization, punctuation, spelling, speaker identification, spacing and timing	4.31	0.82	Strongly Agree
4. figures/Drawings/Illustrations are organized and presented in a logical, easy to follow sequence	4.42	0.78	Strongly Agree
5. animation is smooth and sound effects makes the animation interesting.	4.31	0.82	Strongly Agree
Grand Mean	**4.35**		**Strongly Agree**
Interpretation	**Perfectly Acceptable**		

Legend:

Scale	Range	Remarks	Interpretation
5	4.21 – 5.00	Strongly Agree	Perfectly Acceptable
4	3.41 – 4.20	Agree	Acceptable
3	2.61 – 3.40	Neutral	Neutral
2	1.81 – 2.60	Disagree	Unacceptable
1	1.00 – 1.80	Strongly Disagree	Totally Unacceptable

The above data reveal that the self-made video tutorials in Mathematics 8 in terms of its characteristics as to Visual Quality is perfectly acceptable, denoted by the grand mean of (M=4.35). This implies that respondents strongly agree that the speaker is fully visible with clear attention paid to proper lighting.

The respondents strongly agree that the speaker use figures/drawings/illustrations which are organized and presented in a logical, easy to follow sequence, which gained the highest mean of (M=4.42, SD=0.78). However, they also strongly agree that the captioned video text available and includes only minor errors in capitalization, punctuation, spelling, speaker identification, spacing and timing, and animation is smooth and sound effects makes the animation interesting as they both bears the least mean of (M=4.31, SD=0.82). These results indicate that watching videos that instructor or teachers perform a task enhance students knowledge that helps them with their activities.

This is parallel to the study of Hoogerheide et al., (2014) where evidence suggests that watching video-modeling when an instructor performs a task can enhance students' confidence in believing they can accomplish the same activity, and that most learners prefer video with the teacher's picture present, which can have a positive influence.

Level of Student's Performance in Mathematics 8

The researcher assessed the level of the Student's Performance in Mathematics 8 in terms of Diagnostic and Summative Test as revealed in the following table, which shows the frequency, relative frequency, mean, standard deviation and verbal interpretation.

Table 9. Level of the Student's Performance in Mathematics 8 in terms of Diagnostic Test.

Scores	Frequency	Relative Frequency	Remarks
41-50	0	0%	Outstanding

31-40	0	0%	Very Satisfactory
21-30	9	20%	Satisfactory
11-20	34	75.56%	Fairly Satisfactory
10 and below	2	4.44%	Needs Improvement
Total	**45**	**100 %**	
Mean	**16.56**		**Fairly Satisfactory**
SD	**4.84**		

It can be gleaned from the table that most of the scores of the respondents obtained by the score 11-20 got a mean score of 16.56 and a standard deviation of 4.84 with a remark of Fairly Satisfactory. This means that the students, before utilizing self-made video tutorials already have a Fairly Satisfactory remark with some of the topics. The students at this stage acquire a minimum level of knowledge and core understanding about the selected topics in Mathematics 8.

This was supported by the study of Reiss & Obersteiner (2019), that most of the students included in the study obtained fairly satisfactory scores from the diagnostic test. There are occasional satisfactory scores; however, there are students who need improvement. This implies low-level math skills and competencies. This is mainly observed since the shutting down of schools and flexible learning modality was implemented. In the mathematics classroom, the main aims are to improve students' mathematical abilities and encourage their development. It also necessitates diagnostic tests in order to properly analyze students' replies to specific problems and to recognize their difficulties in learning, comprehending, and applying mathematics.

Table 10. Level of the Student's Performance in Mathematics 8 in terms of Summative Test.

Scores	Frequency	Relative Frequency	Remarks
41-50	10	22.22%	Outstanding
31-40	14	31.11%	Very Satisfactory
21-30	21	46.67%	Satisfactory
11-20	0	0%	Fairly satisfactory
10 and below	0	0%	Needs Improvement
Total	**45**	**100 %**	
Mean	**33.69**		**Very Satisfactory**
SD	**6.83**		

It can be gleaned from the table that most of the scores of the respondents obtained by the score 21-30 got a mean score of 33.69 and a standard deviation of 6.83 with a remark of Very Satisfactory. This means that the students, after utilizing self-made video tutorials already have a Very Satisfactory remark with some of the topics. The students at this stage acquire a mastery level of knowledge and core understanding about the selected topics in Mathematics 8.

The results showed success in the implementation of the self-made video tutorials. Most of the scores have improved at a remarkable rate. This also implies that the self-made video tutorials helped the students in learning math skills and competencies. Summative evaluations are often administered during a designated "test time" with minimal interruptions and student engagement. According to Zheng et al, (2019), this "test time" is separate from instructional time. Indeed, interpreting summative tests assumes no learning occurs during the exam, and the atmosphere is typically constructed to support that idea.

Table 11. Significant difference between the Students' Performance in Mathematics 8 in terms of Diagnostic and Summative Test.

Groups	Mean	Mean Difference	Df	Computed T-Value	P-Value	Critical T-Value	Analysis
Diagnostic	15.56	17.13	44	15.520	0.000	2.02	Significant
Summative	33.69						

**significant at a .05 level of significance*

The test of the difference between the diagnostic and summative tests of students' mathematics in Mathematics 8

shows a computed value of (t-value= 15.520; p< .05) interpreted as Significant.

Based on the data, it is shown that there is a significant difference between the students' performance in Mathematics 8 in diagnostic and summative tests in utilizing the Self-Made Video Tutorials in Mathematics 8. It shows that the null hypothesis "There is no significant difference between the students' performance in Mathematics 8 in terms of Diagnostic and Summative Test" is rejected.

The finding is similar to the study of Wijiya et al. (2021). They found that the introduction of video-based learning can increase students scores. In addition, they promote that video-based learning should be used in schools to help students in learning difficult mathematical concepts for ease of learning and serves as supplementary material in learning.

Test on the Significant Effect between the Self-Made Video Tutorials in terms of its Components and Characteristics and the Students' Performance in Mathematics 8.

Shows the Students' Performance in Mathematics 8 in terms of Summative Test upon utilizing the Self-Made Video Tutorials. The data were statistically treated using regression analysis. The following shows components. Computed t-value, p-value, and its analysis**.**

Table 12. Test of Significant Effect between the Self-Made Video Tutorials in terms of its Components and the Students' Performance in Mathematics 8.

Components		Computed t-value	p-value	Analysis
Content	Students' Performance	0.435	0.666	Not Significant
Objective		0.325	0.747	Not Significant
Relevance		-0.574	0.569	Not Significant
Interactivity		0.221	0.826	Not Significant
$\alpha = 0.05$				

Based on the data, it is shown that there is no significant effect between the Self-Made Video Tutorials in terms of its Components and the Students' Performance in Mathematics 8. It shows that the null hypothesis "There is no significant effect between the Self-Made Video Tutorials in terms of its Components and the Students' Performance in Mathematics 8" is being accepted.

Though the result of the test is not significant, the study of der Meij & Dunkel (2020) supports the use of video-based learning and calls for the improvement of the existing self-made video tutorials through adding complementary review video and arranging for practice with external feedback. By doing so, the utilization of video tutorials was expected to improve the performance of the students holistically.

The components of the video tutorials were already established. Due to the range of aims and the resulting variability in the design of learning films, it becomes prudent to further increase the adaptability of the criterion catalog. Parallel to this, a set of uniform standards would need to be created, which would serve as a benchmark for all educational videos, allowing for some quality comparison. (Ratnayake et al, 2019)

Table 13. Test of Significant Effect between the Self-Made Video Tutorials in terms of its Characteristics and the Students' Performance in Mathematics 8.

Components		Computed t-value	p-value	Analysis
Communication Skills	Students' Performance	6.412	0.652	0.518
Quality of Voice		6.369	-0.257	0.799
Clearness of Audio		4.025	-0.003	0.998
Visual Quality		3.331	0.319	0.751
$\alpha = 0.05$				

Based on the data, it is shown that there is no significant effect between the Self-Made Video Tutorials in terms of its Characteristics and the Students' Performance in Mathematics 8. It shows that the null hypothesis "There is no significant effect between the Self-Made Video Tutorials in terms of its Characteristics and the Students' Performance in Mathematics 8" is being accepted.

The results contradict the study of Nagy (2018) which shows that the better characteristics of video materials have significant effect towards learning performance and learning satisfaction. Since learning satisfaction is not within the scope this study, it is a must to be recommended to future researchers that will conduct similar study.

This is parallel to the study of Kokoc et al (2020), that the influence of different video lecture genres on visual attention and learning, as well as how learners' attention levels affect cognitive performance when watching video lectures, is unknown. Learners might be presented with a video that uses the most efficient video style for their attention span. Furthermore, research into creating customized video lectures might assist address the issue of whether delivering the same sort of video lecture to everyone produces the same results.

4. CONCLUSION AND RECOMMENDATION

Based on the finding of the study, the following conclusions were drawn: (1) The hypothesis stating that there is no significant difference between the students' performance in Mathematics 8 in terms of diagnostic and summative tests of the respondents resulted that it is rejected. (2) The hypothesis stating that there is no significant effect between the Self-Made Video Tutorials in terms of its components and characteristics and the level of students' performance is accepted.

Based on the findings and conclusions, the following recommendations are given consideration.

1. Through the finding of this study, students and parents may spend their time gathering different instructional materials such as video tutorials especially from YouTube that may best help them in learning mathematics especially in this new normal education where the students learn independently. The self-made video tutorials as instructional and intervention materials may help the students to support their independent learning so that there will be no gap during the learning process.
2. The findings of the study would create an opportunity to provide the best tools that support their learning process during new normal education. The self-made video tutorials should be also aligned to the Most Essential Learning Competencies (MELCs) from DepEd so that students may be able to acquire the expected knowledge, skills, and values expected of them.
3. Since the study found out that there is an improvement in the Mathematics performance of the students, the teacher may use the self-made video tutorials that can be paired in their selected learning competency targets. Teachers may add another activities on camera that can fit in to the skills and knowledge of the students.
4. Addressing and mitigating the impacts of sudden shift in delivery of Basic Education this material can reduce the reliance of learners in printed modules. As addition learners can also maximize the use of online, DepEd TV, ETulay & Radio Based Instruction.
5. The future researchers may use this research as their reference and may conduct a further study focusing on other subject specializations.

References

Abraham, I. and MacDonald, K. (2011). Encyclopedia of Nursing Research: Quasi-Experimental Research. Springer Publishing Company. Available at:http;??0searcg.credoreference.com.brum.beds.ac.uk/content/entry/spennurres/quasi_experimental_research/0.

Abuda, B. F. Q. (2019). Mastery level of students using strateic intervention material (SIM) in teaching mathematics: a quasi-experimental study. Instabright Egazette, 1-1.

Acedo, E., & Robles, A. C. M. O. (2019). Development and Validation of Educational Video Tutorials for 21st Century Secondary Learners. Asian Journal of Multidisciplinary Studies, 2(2), 42–49. https://asianjournal.org/online/index.php/ajms/article/view/186/70

Asselin, M., Dobson, T., Meyers, E.M., Teixiera, C., & Ham, L. (2011). Learning from YouTube: an analysis of information literacy in user discourse. In Proceedings of the 2011 iConference (pp. 640-642). ACM.

Baltazar, Errol.Validation and Effectiveness of Multimedia Instructional Materials in Teaching Math in San Isidro Elementary School. 2015

Basu Roy, R. & McMahon, G. (2012). High Fidelity and Fund: But Fallow ground for learning? https://doi.org/10.1111/medu.12044

Boateng,R., Boateng,SL.,Awuah,RB., Ansong,E., & Anderson,AB., (2016). Videos in learning in higher education: assessing perceptions and attitudes of students at the University of Ghana. Retrieved From: https://slejournal.springeropen.com/articles/10.1186/s40561-016-0031-5

Buzzetto-More, N. (2015). Student Attitudes towards the Integration of YouTube in Online, Hybrid, And Web-Assisted Courses: An Examination of the Impact of Course Modality on Perception. MERLOT Journal of Online Learning and Teaching, 11(1), 55-73

Cahyanto, M.A.S., et al (2019) J. Phys.: Conf. Ser. 1397 012019 Analysis of Students' Misconception Based on the Use of Learning Objectives in Classification of Materials and Their Properties

Carmichael, M.,Reid,AK.,Karpicke,JD.(2018), Assessing the Impact of Educational Video on Student Engagement, Critical Thinking and Learning: The Current State of Play. Retrieved From: https://us.sagepub.com/sites/default/files/hevideolearning.pdf

Cavero-Delgado, Ana J., 2016, Effects of the Use of Computers, Integrated to an Instructional Module on Functions of the Attitudes towards Mathematics and the Achievement in Functions in Precalculus of College Students, (Dissertation Abstract International Vol. 67 No. 6 December (2084-A)).

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.

Chintalapati, N., & Daruri, V.S.K. (2017). Examining the use of YouTube as a Learning Resource in Higher Education: Scale development and validation of TAM model. Telematics and Informatics, 34(6), 853-860

Chiou, E. K., Schroeder, N. L., & Craig, S. D. (2020). How we trust, perceive, and learn from virtual humans: The influence of voice quality. Computers & Education, 146, 103756. https://doi.org/10.1016/j.compedu.2019.103756

Debnath C. & Janet C. 2017. How to Write Well-Defined Learning Objectives https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5944406/

Distasio, S. (2016). Top 3 advantages of video-based training. Retrieved from http://www.epathlearning.com/uncategorized/the-top-3-advantages/ on February 04

Dominic, M., Caroline, A., Jane, S., Alan, S.G., Gavin's., Camilla, C. (2012). Pacing Strategy in Schoolchildren Differs with Age and Cognitive Development. Medicine & Science in Sports & Exercise, 44(2), p 362-369

Doolittles, P.E., Bryant, L.H. and Chittum, J.R. (2015), Effects of degree of segmentation and learner disposition on multimedia learning. British Journal of Educational Technology 46(6), 1333-1343

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.

Giannakos, M., Jaccheri, L. & Krogstie, J. (2014). Looking at MOOCs rapid growth through the lens of video-based learning research. International Journal of Emerging Technologies in Learning, 9.

Ginns, P., Martin, A.J. & Marsh, H.W. (2013). Designing Instructional Text in a Conversational Style: A Meta-analysis. Educ Psychol Rev 25, 445–472 (2013). https://doi.org/10.1007/s10648-013-9228-0

Guerrero, A., Diaz, I., Reche, P., and Garcia, S. (2020), E-Learning in the Teaching of Mathematics: An Educational Experience in Adult High School. MDPI. Doi:10.3390/math8050840 (www.mdpi.com/journal/mathematics).

Guo, P.J., Kim, J., & Rubin, R. (2014). How video production affects student engagement: An empirical study of MOOC videos. In Proceedings of the First ACM conference on Learning @ Scale Conference (pp. 41-50). ACM.

Heron,ML. & Cho,MH (2015).Self-regulated learning: the role of motivation, emotion, and use of learning strategies in students' learning experiences in a self-paced online mathematics course.

Holly, 2018. Pre and Post Tests. Are they beneficial in the classroom? https://www.teachstarter.com/au/blog/pre-and-post-tests-are-they-beneficial-in-the-classroom/

Hoogerheide, V. & Loyens, S. (2014). Effects of Creating Video-Based Modeling Examples on Learning and Transfer. Learning and Instruction 33(33):108-109

Hopkins, L., Hampton, B.S., Abbott, J.F., Buery-Joyner, S.D., Craig, L.B., Dalrymple, J.L.,…&Wolf,A., (2018). To the point; medical education, teachnology, and the millennial learner. American journal of obstetrics and gunecology, 218(2), 188-192

Iftikhar,M., Riaz, S., & Yousaf, Z., (2019). Impact of YouTube Tutorials in Skill Development among University Students of Lahore. Retrieved From: https://files.eric.ed.gov/fulltext/EJ1266671.pdf

iSpring Support Team. (2015). Key advantages of video lectures. Retrieved from http://www.ispringsolutions.com/articles/key-advantages-of-video-lectures.html on February 02.

Kaczorowski TL, Hashey AI, Di Cesare DM. (2018). An Exploration of Multimedia Supports for Diverse Learners During Core Math Instruction. Journal of Special Education Technology. 2019;34(1):41-54. doi:10.1177/0162643418781298

Kahrmann,CR., (2016). Efficacy of Math Video Tutorials on Student Perception and Achievement. Retrieved From: https://digitalcommons.kennesaw.edu/cgi/viewcontent.cgi?article=1010&context=teachleaddoc_etd

Kay,R.H (2012), Evaluating the use of problem-based video podcasts to teach mathematics in higher education, Computers & Education 59(2), 619-627.

Kelly, J. (2015). Four benefits of video based learning today. Retrieved from http://technofaq.org/posts/2015/02/four-benefits-of-video-based-learning-today/ on January 13.

Kim, J., Guo, P.J., Seaton, D.T., Mitros, P., Gajos, K.Z., & Miller, R.C., (2014). Understanding in-video dropouts and interaction peaks online lecture videos. In Proceedings of the First ACM conference on Learning @ scale conference (pp. 31-40).ACM.

Kokoç, M., IIgaz, H., & Altun, A. (2020). Effects of sustained attention and video lecture types on learning performances. Educational Technology Research and Development, 68(6), 3015–3039. https://doi.org/10.1007/s11423-020-09829-7

Korytářová, S. (2019). Communicative strategies in online video tutorials. Ostrava Journal of English Philology, 11(1).

Kuehn P. R., 2021. Function and Importance of pre and post-test https://owlcation.com/academia/PrePost-Test-A-Diagnostic-Tool-For-More-Effective-Teaching-of-EFL-Students.

Lee, BN., (2019). The Effectiveness of Video Clips to Enhance Students' Achievement and Motivation on History Learning and Facilitation. Retrieved From: https://www.researchgate.net/publication/334668088_The_Effectiveness_of_Video_Clips_to_Enhance_Students'_Achievement_and_Motivation_on_History_Learning_and_Facilitation

Madariaga, L., Nussbaum, M., Gutiérrez, I., Barahona, C., & Meneses, A. (2021). Assessment of user experience in video-based learning environments: From design guidelines to final product. Computers & Education, 167, 104176. https://doi.org/10.1016/j.compedu.2021.104176

Maldonado-Mahauad, J., Perez-Sanagustin, M., Kizilcec, R.F., Morales, N., & Munoz-Gama, J. (2018). Mining theory-based patterns from big data: Identifying self-regulated learning strategies in Massive Open Online Courses. Computer in Human Behavior, Vol. 80, No. 1, pp. 179-196.

Mayer, R. E. (2014). Cognitive theory of multimedia learning. In R. E. Mayer (Ed.), *The Cambridge handbook of multimedia learning* (pp. 43–71). Cambridge University Press. https://doi.org/10.1017/CBO9781139547369.005

McDonald, K., & Smith, C. M. (2013). The Flipped Classroom for Professional Development: Part I. Benefits and Strategies. The Journal of Continuing Education in Nursing, 44(10), 437–438. https://doi.org/10.3928/00220124-20130925-19

Moghavvemi, S., Sulaiman, A., Jaafar, N.I., & Kasem, N. (2018). Social media as a complementary learning tool for teaching and learning: The case of youtube. The International Journal of Management Education, 16(1), 37-42.

Nagy, J. T. (2018). Evaluation of Online Video Usage and Learning Satisfaction: An Extension of the Technology Acceptance Model. The International Review of Research in Open and Distributed Learning, 19(1). https://doi.org/10.19173/irrodl.v19i1.2886

Nardo, M.T.B. (2017). Modular Instruction Enhances Learner Autonomy. American Journal of Educational Research, 2017, Vol. 5, No. 10, 1024-1034. DOI: 10.12691/education 5-10-3

National Council of Teachers of Mathematics (2020). Professional standards for school Mathematics. Retrieved from https://www.nctm.org/uploadedFiles/Standards_and_Positions/PSSM_ExecutiveSummary

Noriel, Rachelle C. (2014) The Effect of Using Tangram on the Peformance of Selected Grade 7 Students of Suba National High School. Majayjay, Laguna. Unpubished Thesis. Laguna State Polytechnic University, Sta. Cruz Campus, Sta. Cruz Laguna.

Pi, Z. and Hong, J. (2016), 'Learning process and learning outcomes of video podcasts including the instructor and ppt slides: a Chinese case', Innovations in Education and Teaching International 53(2), 135–144.

Prieto, N., Naval, V., Carey, T. (2017). Practical Research for Senior High School. Lorimar Publishing Inc, Quezon City, Metro Manila.

Purwanti, I. T., Suryawati, E., & Eliwarti. (2022). Video lectures in online EFL flipped-classroom: Effectiveness, students' evaluation and experiences. European Journal of Educational Research, 11(2), 885-898. https://doi.org/10.12973/eu-jer.11.2.885

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).

Ratnayake, I., Bruder, R., & Klein, T. (2019, July). Integrating video tutorials in mathematics teaching: quality criteria to choose good videos. In 43rd Annual Meeting of the International Group for the Psychology of Mathematics Education VOLUME 4 Oral Communications and Poster.

Reiss, K., Obersteiner, A. (2019). Competence Models as a Basis for Defining, Understanding, and Diagnosing Students' Mathematical Competences. In: Fritz, A., Haase, V., Räsänen, P. (eds) International Handbook of Mathematical Learning Difficulties. Springer, Cham. https://doi.org/10.1007/978-3-319-97148-3_4

Rettie, C. 2016. Accreditation — Standard 2 Curriculum — Learning Objectives https://www.nppostgradtraining.com/2016/07/19/accreditation-standard-2-curriculum-learning-objectives/

Robles, A.C.M. and Acedo, E. (2019). Development and Validation of Educational Video Tutorials for 21st Century Secondary Learners. Asian Journal of Multidisciplinary Studies. Vol. 2, No.2

Roy, R. B, & McMahon, G. T. (2012). Video-based cases disrupt deep critical thinking in problem-based learning. Medical Education, 46(4), 426–435. https://doi.org/10.1111/j.1365-2923.2011.04197.x

Sanders, S. 2019. A Brief Guide to SELECTING AND Using Pre-Post Assessment https://www.google.com/url?sa=t&source=web&rct=j&url=https://files.eric.ed.gov/fulltext/ED604574.pdf&ved=2ahUKEwjS0Z6P8_rwAhXIc94KHYeHAO0QFjAQegQIChAC&usg=AOvVaw36MUj-sBfttvfQA1lU7G2W&cshid=1622703957807

Shlikov, O., Diamond, S. K., Bents, L., & Ramos, E. (2020). USE OF TUTORIAL VIDEO IN THE EDUCATIONAL PROCESS. 2020 p., 16.

Sorden, S. (2012). A Cognitive Approach to Instructional Design for Multimedia Learning. Informing Science Journal. Northern Arizona University, Flagstaff, AZ, USA

Stanic, T. (2014). Why you should add video to your teaching. Retrieved from https://blog.edynco.com/ instructional-design/why-you-should-add-video-to-yourteaching/ on January 02.

Swarts, J. (2012). New modes of help: Best practices for instructional video. Technical Communication, 59(3), 195-206.

Tamim, R.M. (2013). Teacher's Use of YouTube in the United Arab Emirates: An Exploratory Study. Computers in the Schools, 30, 329-345. Doi:10.1080/07380569.2013.844641

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

Teng,J., (2015), The Effectiveness of Video Tutorial and Preview on Self Efficacy, Task Performance and Learning. Retrieved From: https://essay.utwente.nl/69309/1/Teng%20J.%20-%20S1559206%20-%20masterscriptie.pdf

Ten Hove, P. & Van der Meij, H. (2015). Like It or Not. What Characterizes YouTube's More Popular Instructional Videos? Technical Communication, 62(1), 48-62.

Van der Meij, H., & Dunkel, P. (2020). Effects of a review video and practice in video-based statistics training. Computers & Education, 143, 103665.

Van der Meij, H., & Van der Meij, J. (2013). Eight guidelines for the design of instructional videos for software training. Technical Communication, 60(3), 205-228.
https://doi.org/10.1016/j.compedu.2019.103665

Vijayamohan, P. (2022), Purposive Sampling 101: Definition, Types and Examples. Retrieved From: https://surveysparrow.com/blog/purposive-sampling/

Vural, O. F. (2013). The Impact of a Question-Embedded Video-Based Learning Tool on E-Learning. Educational Sciences: Theory and Practice, 13(2), 1315–1323. https://eric.ed.gov/?id=EJ1017292

Wijaya, T. T., Li, L., Hermita, N., Putra, Z. H., & Alim, J. A. (2021). Helping junior high school student to learn fibonacci sequence with video-based learning. Int. J. Interact. Mob. Technol., 15(11), 183-191.

Williamson, T. (2018). Alternative logics and applied mathematics. Philos. Issues 2018, 28, 399-424. [Google Scholar} [Cross Ref]

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.

Zhang, D., et. al (2019) Instructional Video in E-learning: Assessing the impact of interactive video on learning effectiveness, Research Gate.

Zheng, G., Fancsali, S. E., Ritter, S., & Berman, S. R. (2019). Using Instruction-Embedded Formative Assessment to Predict State Summative Test Scores and Achievement Levels in Mathematics. Journal of Learning Analytics, 6(2), 153–174. https://doi.org/10.18608/jla.2019.62.11