Contemporary Mathematics and Science Education
2023, 4(1), ep23008
ISSN 2634-4076 (Online)
https://www.conmaths.com/

Research Article

OPEN ACCESS

Video lessons as mathematics supplementary learning materials for struggling students in online distance learning

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Citation: Insorio, A. O., Villanueva, Z. T., & General III, D. E. (2023). Video lessons as mathematics supplementary learning materials for struggling students in online distance learning. *Contemporary Mathematics and Science Education*, 4(1), ep23008. https://doi.org/10.30935/conmaths/12818

ABSTRACT

Online distance learning as a new normal learning modality gives new hope for the students to continue learning through the provision of the internet and devices. However, many students struggled with mathematics lessons because of the limited synchronous interaction time. Practical action research was conducted to address the said problem on grade 10 students utilizing teacher-made video lessons via Google Classroom as mathematics supplementary learning materials for struggling students. Participants were 50 strugglers with low grades from the first and second grading periods selected purposively. Test materials, survey questionnaire, and interview guide were the instruments used in data collection validated by two head teachers and one master teacher in mathematics education and pilot tested on non-participants. The result shows that the students performed better in the post-test examination after consuming teacher-made video lessons. Students understood the mathematics lessons better, and the performance tasks became manageable. However, they suggested having longer video lessons with more illustrative examples and explanations using the local language. Also, they requested to upload the video lesson early so that they could do advanced study.

Keywords: learning material, online distance learning, struggling students, video lesson

Received: 23 Aug. 2022 ◆ Accepted: 21 Nov. 2022

INTRODUCTION

Online distance learning is one of the modalities implemented in the Philippines to continue education despite the challenges delivered by the unceasing spread of mutated COVID-19. In this modality, the teacher served as a facilitator of learning using different technologies on the internet, which allows synchronous and asynchronous instructions (DepEd Order No. 012, s. 2020, 2020). However, the students have limited screen time a day to avoid too much exposure to the radiation caused by devices used in online learning, as suggested by the American Academy of Pediatrics and World Health Organization (DM-CI-2020-00162, 2020). So, the synchronous session is limited to one hour per subject area per week to cater to the nine subject areas and three hours for asynchronous activities. Nevertheless, this does not ensure the development of the target competencies because the one-week lessons are taught for one hour only, especially in mathematics which requires much explanation, illustrative examples, activities, and assistance from the teacher.

Online learning is the best solution to deliver education in the current situation since it is not affected by time and space. The interaction between teachers and students can be done anytime and anywhere (Syarifudin, 2020). It improves the teacher's and student's interaction efficiently and makes the creation of learning materials easier (Yunitasari & Hanifah, 2020). Teachers and students use computers, laptops, or mobile phones to access learning materials and tasks (Isnaini & Azhar, 2021). However, when it comes to choosing devices to search for appropriate teaching materials must be based on students' technological characteristics (Adhe, 2018).

On the other hand, Pacita Complex National High School is one of the public schools in San Pedro City, Laguna, Philippines implementing online distance learning since the school year 2020-2021. Under this modality, the students attend a synchronous session once a week for one hour in mathematics subjects and asynchronous sessions for three hours. Despite the hard work of mathematics teachers to teach the intended competencies during the synchronous session, some students are struggling in dealing with mathematics lessons. A one-hour discussion seems insufficient to fully grasp the competencies, even if they have asynchronous sessions. They need more explanation of mathematics concepts, principles, and procedures than doing activities independently. For the last school year, grade 10 students struggled in online distance learning, particularly in mathematics lessons based on

the result of the summative tests and performance tasks. This problem continues today. So, mathematics teachers must find ways of helping students to cope with the challenges.

Learning mathematics in this new normal is very challenging, especially in addressing the needs of struggling students with a limited time of synchronous sessions. Teachers must devise and carry–out a plan to augment the limited real-time sessions and facilitate effective learning. Students experience low-quality learning in online distance learning due to challenges (Barrot et al., 2021). These challenges hinder the learning of the students like poor internet connection, limited teacher and student interaction, less teacher assistance, and demotivation of the students to do self-paced learning caused by distraction at home. However, helping the students cope with their mathematics learning challenges will benefit them and the school system. If the students learn well despite the limited time in the synchronous session, their academic performance will increase, leading to better school performance. It means every student must develop his or her mathematical competencies despite the constraints brought by the present situation.

The mathematics teacher's prime duty is to ensure that every student develops the most essential learning competencies (MELCs) in every session to secure the learning continuity up to the next level and cultivate the habits of mind, passion, and love for learning the subject. It is the teacher's responsibility to design learning activities and materials appropriate to the student's understanding. They have to address the immediate concerns, particularly the struggling students who are left behind and losing their interest in learning subject matter.

Struggling students seldom voice out their difficulties which leads to the teacher not paying attention to them until the students are unable to cope with mathematics lessons (Ovadiya, 2021). The student with learning difficulties experienced mistakes in learning mathematics. They need repeated explanations from the teacher to grasp the mathematical concepts and procedures, which is more difficult for the teacher to repeat the explanation many times individually (Tan et al., 2020). So, video lessons are appropriate for struggling students in which they can watch the teacher teaching the mathematics lesson repeatedly or within their control. The students can use videos to review the learning materials given by the teachers (Turmudi et al., 2013). Hence, fewer studies have been conducted regarding mathematics video interventions in secondary schools (Bouck & Cosby, 2019).

LITERATURE REVIEW

Students preferred watching videos rather than reading learning materials (Jungić et al., 2015; Sahin et al., 2015). Research on learning through instructional video is rapidly increasing due to the rapid growth in online distance education (Poquet et al., 2018). However, instructional videos must have exercises or learning tasks to engage the viewers (De Koning et al., 2018; Fiorella & Mayer, 2018; Poquet et al., 2018). Teachers may incorporate quizzes and self-assessment questions to reinforce learning in the instructional video (Hansch et al., 2015; Hollands & Tirthali, 2014).

Students have positive attitudes toward using videos for learning that produce better study habits and learning outcomes (Kay, 2012). Kinnari-Korpela (2015) used short video lectures composed of Powerpoint slides with audio and video examples produced by iPad to enhance mathematics learning. She found that using short video lectures motivated the students to learn mathematics. The students used the video to internalize and understand the mathematics content better since step-by-step solutions and explanations were provided within the video. Utilizing a short video is proper to deliver a mathematics lesson.

Bullo (2021) integrated video lessons in science class amidst the global pandemic. He found that science video lessons were more effective in learning competencies than using the modular approach in the new normal setting. Video lessons helped the students better comprehend the lesson even with less teacher assistance. Hence, videos for students over 12 years old are compelling e-learning materials for motivation or knowledge acquisition (Lipomi, 2020). Using video effectively helped students with learning difficulties comprehend basic concepts, perceive mathematical ideas, master problem-solving methods, and acquire learning achievement within students' concentration (Huang et al., 2020).

Tan et al. (2020) revealed that learning via video engaged students with learning difficulties in mathematics compared with the traditional approach. Hence, utilizing technology in education assists students in understanding mathematical concepts better (CunHua et al., 2019; Huang et al., 2016) and improves student academic achievement (Wijaya et al., 2020; Zhang et al., 2020). Learning using videos improves the students' mathematics learning outcomes (Rahmadani & Nurlaelah, 2019). These justify the use of videos in delivering mathematics lessons.

Baer and Vargas (2021) claimed that utilizing video lessons in teaching students in mathematics is effective in improving academic performance. The teacher should prepare and utilize video lessons to encourage the students to learn more. It means it is the teacher's responsibility to produce his/her video lessons rather than download them from the available online resources. However, fewer studies have been conducted on video effectiveness as a learning tool for online learning and how people learn from watching it (Hansch et al., 2015; Ou et al., 2019). Bokhove and Drijvers (2012) claimed that a digital intervention like a video lesson positively affects the mathematical competencies acquisition of secondary students. The statements above justify need to conduct a study regarding effectiveness of video lessons.

Helping struggling students can be done by providing teacher-made video lessons for asynchronous sessions as supplementary learning materials. Students become guided to learn more mathematics lessons through teacher-made video lessons (Amstelveen, 2018). Also, the teacher's presence in the video inspires the students to consume the video lessons. Videos made by the teacher play a vital role in students' learning via online platforms (Ou et al., 2019). Teacher-made videos motivate the students to watch them since there are related to school subjects.

The above literature supports the premise that video lessons help students cope with learning challenges. However, the use of video in mathematics education is still rare because the utilization of videos is not consistently and regularly used (Kinnari-Korpela, 2015). So, it is time to use video in delivering mathematics lessons, especially in online distance learning, wherein teacher-student interaction is limited. Hence, most of the video lessons in the past are for science, technology, engineering, and mathematics students (Wagner et al., 2020), not for regular basic education students at the secondary level. However, utilizing videos for mathematics learning is necessary for the current situation (Brezovnik & Lipovec, 2021). Also, there is a great need for research to introduce video lessons in the new normal that engages the students in learning (Bullo, 2021).

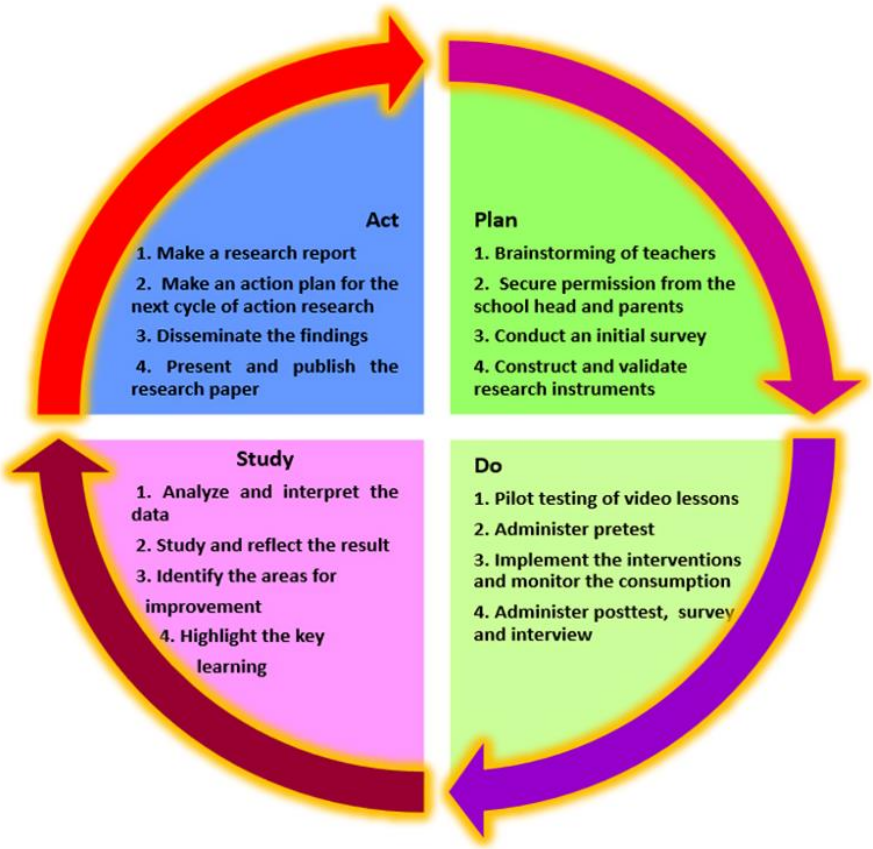

Figure 1. Conceptual paradigm (Source: Authors' own elaboration)

THEORETICAL AND CONCEPTUAL FRAMEWORK

This study believes in the premise of the Mayer's (2014) cognitive theory of multimedia learning posits that learning takes place deeply from words and pictures together using videos with text, pictures, and sounds. Learning becomes deeper since the visual and auditory materials help the students process the information and learn. In a video lesson, relevant words from the presented graphics are organized coherently and then integrated with the student's prior knowledge. It means the teacher must carefully select the words and pictures to be included in the video lesson utilizing the students' local context, considering the students' level of understanding.

Figure 1 presents the study flow under the plan-do-study-act model derived from the work of Edward Deming and Walter Shewhart (Taylor et al., 2014). The plan stage starts with the brainstorming of the mathematics teachers about the challenges faced by the students under online distance learning and possible interventions considering the result of the first grading assessment. Afterward, they secured a school head's permission to conduct action research addressing the main problem. One-hour discussion synchronously was not enough to teach the one-week competencies. Hence, permission from the parents was secured through informed consent and assent forms. Then, an introductory survey was conducted to elicit the students' responses regarding their challenges and technological capabilities for profiling. After one month, test materials for the pre- and post-test, an open-ended survey questionnaire, and interview guide questions were constructed and then validated by three experts in mathematics education. For the do stage, the video lesson interventions were pilot-tested for two weeks to non-participants to ensure their feasibility. Also, test materials were pilot-tested to establish internal consistency.

A pre-test was carried out on the participants via Google Form during the synchronous session, and the students had only one chance to answer for 30 minutes. The result was set aside for future comparison. Then, two months of implementation of video lessons were employed by posting video lessons on Google Classroom with additional asynchronous activities. The teacher notified students of the uploaded video lesson in the Google Classroom via the stream section or Messenger group. After the implementation, the post-test was administered via Google Forms to assess the learning outcomes. Hence, a survey was administered after one week, and the interview was conducted two weeks after the examination to gather qualitative data supporting quantitative findings.

Data were tested statistically and thematically for the study stage to produce valid interpretations. The researchers studied the findings carefully and reflected on the processes to identify the loopholes and gaps in the study. Things to improve were identified and highlighted the key learning for improvement in the next action research cycle. In the act stage, a research report was done, and an action plan was crafted considering the plans and improvements for future research. Finally, results were disseminated through fora meetings, professional conference presentations, and international journal publications.

Research Questions

This study addressed the effectiveness of mathematics teacher-made video lessons for struggling students under the online learning modality. Specifically, it explored to respond the following questions:

1. How are the pre- and post-test results described statistically?

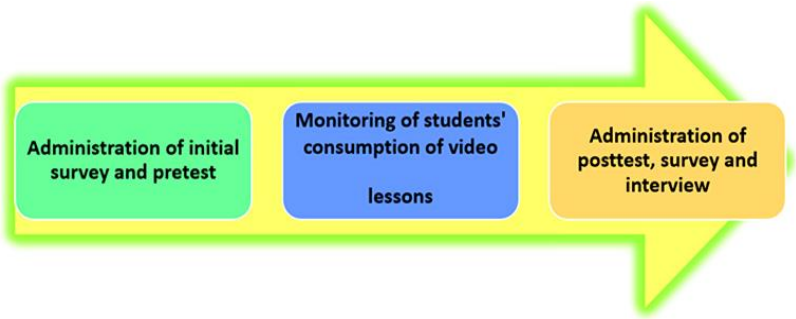

Figure 2. Flow chart of data gathering procedure (Source: Authors' own elaboration)

2. Are the mean scores of the pre- and post-test examinations results statistically different?
3. How helpful are the teacher-made video lessons via Google Classroom in understanding the mathematics lesson better?
4. What are the students' suggestions to improve the teacher-made video lessons posted on Google Classroom?

METHODOLOGY

Research Design

The study utilized a practical action design concerning the use of teacher-made video lessons for online learning modality in grade 10 Mathematics. The practical action research design was the most suited for this study since the main objective was to solve the students' learning difficulties by providing teacher-made video lessons as interventions. Practical action research aims to address a specific problem by upgrading practices using accessible materials suited to the people who perceived the problems (Fraenkel & Wallen, 2010). This research design addresses the present issue, concern, and problem experienced in the locality of the practitioner by utilizing the most appropriate intervention, strategy, or systematic change.

Participants of the Study

The participants were struggling students from four sections of grade 10 at Pacita Complex National High School for the school year 2021-2022 who failed to master the learning competencies in the first grading period. The number of participants was 50 students to ensure that statistical power of 97% using the G*power version 3.1.9.4. These students struggled in mathematics due to less interaction time between the teacher and the students in synchronous sessions. So, the purposive sampling method was employed in participant selection. The struggling students were the ones who got low scores on summative tests and performance tasks for the first and second grading periods as a manifestation of low academic performance.

Hence, voluntary participation was considered in the study through the provision of a letter for the participants, informed consent, and assent forms to ensure that the participants were willing to be part of the study. The purpose of participation, the right to withdraw anytime, and anonymity rights were stated in the said letter.

Research Instrument

The researchers prepared three research instruments: multiple-choice test materials, open-ended survey questionnaire, and interview guide questions. They were validated by a master teacher and two head teachers in the mathematics department regarding clarity, content, design, format, and usefulness to establish the content and face validity. The validators' suggestions were strictly followed, like simplification of questions, grammar, and proper use of punctuation marks. Then, the instruments were revised. Hence, inter-rater agreement was conducted via the Kendall coefficient of concordance with a .96 computed value which means the raters highly agreed on the validity of the instruments. The 30-item test material for the pre-test and other parallel post-test materials were utilized to measure the prior knowledge and learning outcome as a result of teacher-made video lesson consumption. First, the test materials were pilot-tested as part of pre-implementation to 30 non-participants to compute the reliability index using Kuder-Richardson Formula 20 since there were easy, average, and challenging questions. Also, quantitative data were derived from the test result (Nugroho et al., 2019). It had reliability indices of .80 and .81, respectively, which means the instruments were highly reliable.

Item analysis was done to establish the quality of test materials (Sharma, 2021). In the final version of pre-test material, there were five difficult items with a 0.20-0.39 difficulty index, nine average difficult items with a 0.40-0.59 difficulty index, and 16 easy items with a 0.60-0.79 difficulty index. For the discrimination index, nine good items were found between 0.30-0.39, while 21 exceptional items were more than 0.40. Hence, there were eight items with 66.66% and twenty-two with 100% for distractor efficiency. On the other hand, the post-test material has five difficult items found between 0.20-0.39 difficulty index, eight average difficult items with 0.40-0.59 difficulty index, and 17 easy items with 0.60-0.79 difficulty index. However, eight good items were found between 0.30-0.39 discrimination index, while twenty-two exceptional items were more than 0.40. Similarly, it has seven items with 66.66% and twenty-three with 100% for distractor efficiency.

Moreover, a five-item open-ended survey questionnaire was used to collect qualitative data regarding how helpful the teacher-made video lessons via Google Classroom were in understanding the mathematics lesson better and suggestions for improvement. Hence, semi-structured interviews were conducted with some participants to verify the responses to the survey.

Data Gathering

Figure 2 shows the methods of data collection done in the study. After the grant of permission by the school head, an introductory survey was administered to identify the students' challenges in online learning and technological capabilities like internet connections and device ownership as bases for crafting interventions suited to the student's needs and capacity. The initial survey responses were kept and analyzed quantitatively to describe the challenges experienced by the students during synchronous and asynchronous sessions. Also,

students' technological capabilities were considered in planning the interventions.

From the introductory survey results, the researchers single out the most appropriate intervention considering the students' interest, available resources, MELCs, the module's content, technological capabilities of the students, and the nature of learners. The researchers crafted a proper mechanism for implementing the video lesson interventions. Video lessons were posted in Google Classroom, together with follow-up activities. At the pre-implementation stage, the informed consent and assent forms were sent to the students online as part of the protocol because the participants are minors between the ages of 16 to 18 years old. Students' participation was done voluntarily. Hence, a 30-item pre-test was administered via Google Form for one synchronous session for 30 minutes to ensure the students were the ones who answered the test materials. Hence, if the student experiences an internet connection problem, he/she may ask for consideration from the teacher to take the examination later.

The study utilized teacher-made video lessons as interventions for struggling students in grade 10 mathematics. The said video lessons were made by the mathematics teacher explaining the lesson in the Filipino and English languages as additional learning materials during asynchronous sessions. These video lessons last six to ten minutes and were posted in Google Classroom with additional activities via Google Forms after watching the said videos. Video lessons were made not too long to cover the one-week competencies because it will lose the student's attention (Ou et al., 2019). Hence, the student must have a screen break time every twenty minutes to take away from the screen as recommended by American Optometric Association (DM-CI-2020-00162, 2020). Also, the teacher's face is included in the video lesson to have a teacher's presence. The student must see the teacher talking in the video to encourage student engagement. The video length must be short and has a medium-rate speech recording (Guo et al., 2014).

In the video lesson, the teacher discussed the learning objective, a short review, the content of the lesson, and illustrative examples. Students learned at their own pace while watching the video lessons. When the students miss a synchronous session, they can watch the video lessons to keep updated with the lesson. Making a video is the best medium to show illustrative examples demonstrated by the screen via animation, visuals, and recording with audio (Ou et al., 2019). The mathematics teacher explained the video lessons using the local language, which produced necessary learning improvement (Muniyandy et al., 2015). So, the teacher utilized the Filipino and English languages to explain the content of the video lessons.

Two months of implementation under the third grading period were considered. The mathematics teacher monitored the video lesson consumption to safeguard that the students watched the video lessons by providing activities and journal writing every week as evidence of what the students learned and unlearned. After watching the video lessons, instruction on the activities was given during asynchronous sessions via Google Classroom. The answers to the activities were automatically collected via Google Classroom by attaching files. Every Tuesday, video lessons were posted in the Google Classroom to give ample time for the students to watch, and asynchronous activities were posted via the Google Classroom every Friday. The video lesson for Tuesday contains supplementary materials related to the target competencies for the week, elaborating more on the mathematics lessons with illustrative examples. On Friday, the student was instructed to answer the fifteen-item seatwork activities as formative assessment via Google docs with the solutions to check if the students consumed and understood the video lessons. The teacher monitored the outputs by giving feedback and returning them to the students, so they immediately knew if their answers were correct.

The post-test was administered via Google Form during synchronous sessions to assess the effect of video lessons on the learning outcomes. Data were kept confidential for comparison with the pre-test scores. Hence, open-ended surveys were done to gather qualitative data regarding how video lessons assisted the students to develop mathematics competencies and collect students' suggestions to improve the video lessons. Also, random semi-structured interviews were conducted to clarify and verify the students' responses to the open-ended survey.

The first researcher was an outsider responsible for data analysis and research report, while the second researcher was the teacher who implemented the interventions. The teacher bracketed her ideas on how the students will respond and removed biases over the data collection. The third researcher was the one who administered the initial survey and interview to avoid influencing students' responses. Hence, member checking was also done by the third researcher.

Ethical Considerations

Ethical considerations must be in harmony with any research as part of the writing protocol (Blair, 2016; Creswell, 2009). These ethical issues must get the attention of the researchers regarding the rights of human subjects, data collection, analysis and interpretation, respect to research locality, and dissemination of findings (Roberts, 2010). A letter of permission to the school head and participants, informed consent, and assent forms were assured before the implementation as part of the protocol. Data were treated confidentially, and participants' identities were not disclosed to avoid untoward incidents. Pseudonyms were used to replace the name of the participants from selection up to dissemination of findings. Data were stored digitally on the researchers' laptop computers for two years; after that, all data was erased. Hence, the study was appropriately disseminated through faculty meetings, conference presentations, journal publications, and fora so that other teachers may benchmark to other learning areas.

Data Analysis

Statistical package for the social sciences version 23 was applied to describe the scores from the pre- and post-test using mean and standard deviation, Shapiro-Wilk tests for normality tests of data, and homogeneity of variances using Levene's test. Hence, paired sample t-test for significant differences before and after the interventions and Cohen's d was applied to compute the effect size in response to the first two research questions.

For qualitative data, codes were placed in the responses on open-ended questionnaires and interview transcripts after reading and reading again through manual coding. The data were placed in MS Excel spreadsheets and the researchers worked together to segment each response. The small responses were coded and compared or contrasted with other data sets. Then codes were categorized to form a group of ideas. Each category was sorted and regrouped to form broad concepts called themes. Hence, thematic analysis was utilized to formulate categories into themes derived from codes (Guest et al., 2011). Thematic analysis is a method of qualitative data reduction to identify patterns of experience to describe the data as themes (Given,

Table 1. Normality & homogeneity of variance test of pre- & post-test scores

Test	Shapiro-Wilk test		Levene's test	
	Statistic	p-value	Statistic	p-value
Pre-test	.972	.292	.080	.778
Post-test	.962	.108	1.632	.207

Table 2. Descriptive statistics, paired sample t-test for significant difference and effect size using Cohen's d

Scores	Minimum score	Maximum score	Mean	Standard deviation	df	t-value	p-value	Cohen's d
Pre-test	3	19	10.12	3.751				
Post-test	6	28	18.88	5.491	-49	-11.966	.000	5.034

2008). Member checking was done to establish the accuracy and completeness of qualitative data by returning the responses and data analysis to the participants. The participants were asked if the collected data represented their experiences and suggestions to improve the video lessons.

Table 1 shows the normality and homogeneity of variance tests as the pre-requisites before using any inferential statistics. It can be gleaned from the table above that the data were normally distributed. The p-values using the Shapiro-Wilk test exceeded the alpha level (α>.05). Also, Levene's test shows that the variances were homogeneous since the p-values exceeded the alpha level (α>.05), which means the parametric test of difference particularly t-test was the most appropriate test for the significant difference between pre- and post-test scores. Parametric tests required data normality and homogeneity of variances before they were used in hypothesis testing (Tabachnick & Fidell, 2013).

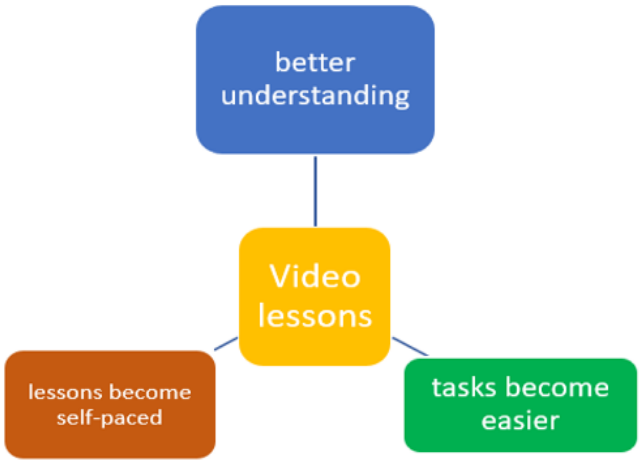

Figure 3. Effects of teacher-made video lessons via Google Classroom in understanding the mathematics lesson (Source: Authors' own elaboration)

RESULTS

Table 2 describes the quantitative data using mean and standard deviation. Based on the table, the pre-test scores ranged from 3 to 19 with a 10.12 mean, while the post-test scores ranged from 6 to 28 with an 18.88 mean. The test scores have standard deviations of 3.751 and 5.491, respectively. Prelude to the data normality test, the mean as the most common measure of central tendency and standard deviation as the most relevant measure of variability must be established as data description (Lydersen, 2020).

As shown in **Table 2**, the t-value of -11.966 (p=.000) shows a significant difference between the pre- and post-test scores. The student performed better in the post-test examination since the t-value was negative. It implies that the video lessons as supplementary learning materials effectively guided the struggling students in learning mathematics. The increment in the mean score signifies the improvement in the student's academic performance, supporting Baer and Vargas (2021) study. The teacher-made video lessons equipped struggling students to cope with the challenges of online learning with limited synchronous time.

On the other hand, the effect size using Cohen's d (5.034) signifies the practical significance of the video lessons. Lovakov and Agadullina (2021) claimed that effect size is needed for any research to understand the practical meaning of empirically computed differences. Cohen's d shows the significant effect of video lessons on academic performance. It implies that video lessons have a positive effect on the academic performance of students in mathematics. Struggling students have improved learning after watching video lessons since their teacher explained the video content, similar to Muniyandy et al.'s (2015) findings. The students' mathematical learning outcomes improved through video lessons, similar to the findings of Rahmadani and Nurlaelah (2019).

Figure 3 depicts the effect of teacher-made video lessons on struggling students. The mathematics lessons became understandable to the struggling students since they could repeatedly watch the video lessons from Google Classroom. They could follow the step-by-step solutions to a mathematical problem after watching the video since they had control to repeat, fast-forward, or pause the video lessons in any part. Hence, performance tasks given by the teacher became easier to perform after acquiring competencies. However, some students can do self-paced learning by watching the video and going back to any part of the video while answering the assigned activities. Also, they can answer the learning activities on their own. It signifies that watching teacher-made video lessons equipped struggling students the with necessary competencies. The secondary students preferred to watch the video lessons because they acquired mathematics competencies similar to the findings of Bokhove and Drijvers (2012).

The words of the participants support the findings above.

> "The video lessons were explained properly, understandable, and not complicated" (Participant 5).

> "It is helpful because of the step-by-step procedure, and I can rewatch it" (Participant 9).

Figure 4 depicts the students' suggestions for video lesson improvement posted on Google Classroom. Struggling students suggested having more illustrative examples with explanations to understand the lesson better. They also suggested using the local

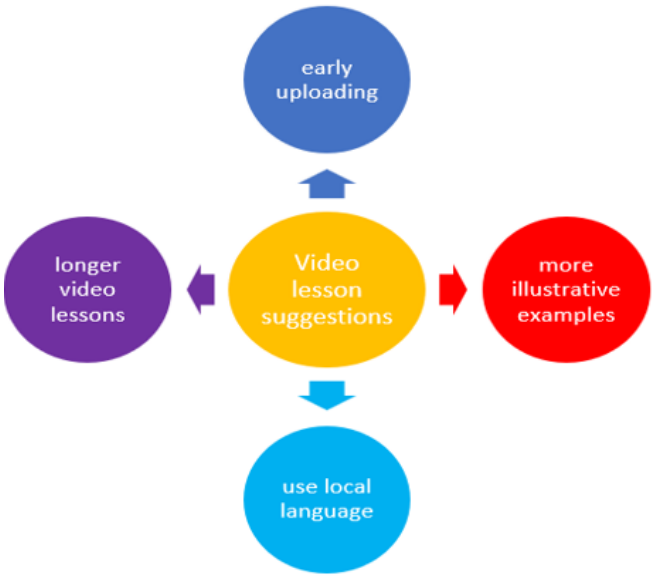

Figure 4. Students' suggestions for teacher-made video lesson improvement (Source: Authors' own elaboration)

language (Filipino) to explain the content of the video so that they can quickly grasp the explanation and better comprehend the mathematical solutions. Hence, they requested longer videos, up to 30 minutes of span, so that many examples were covered and to upload the video lessons before the synchronous session to have an advanced study.

The words of the participants supported the findings above.

> "I think the only thing I can suggest is to make more examples because some of the tasks that are given to us are not related to the video lesson, but overall, the video lesson is helpful" (Participant 2).

> "My only suggestion is for teachers to upload the video lessons in advance" (Participant 10).

DISCUSSIONS

Helping struggling students cope with the difficulties in learning mathematics lessons is an excellent task for mathematics teachers. Teachers must find ways to help the students learn mathematics, especially in online distance learning, where less student-teacher interaction is observed. Hence, with the advanced technological assistance offered today by various online resources, mathematics teachers must make their video lessons rather than take them from online resources like YouTube or online websites. The teacher-made video lessons have been proven more effective than those available online. Video lessons improve the academic performance of the students (Baer & Vargas, 2021) since students prefer to watch the video rather than read text (Jungić et al., 2015; Sahin et al., 2015). So, it is better to have teacher-made video lessons than to make printed instructional materials. The teacher-made video lessons improve academic learning in mathematics (Amstelveen, 2018), which can be placed via an online platform (Ou et al., 2019). So, mathematics teachers must do video lessons including activities or tasks to be answered by the students to motivate them to consume the video and upload it immediately via an accessible learning management system.

Students prefer to consume video lessons because they have positive attitudes toward them, and the consumption produces learning outcomes (Kay, 2012). Hence, they control when and where they will watch the video lessons. Also, they can pause, fast-forward, or repeat watching if they are confused or misunderstood the lesson. They can repeat watching the video to hear the teacher's explanations again to grasp the mathematical ideas and concepts fully (Tan et al., 2020). They understand the mathematics lesson better because detailed explanations are provided (Kinnari-Korpela, 2015), as shown in the result of pre- and post-test examinations attested statistically using paired sample t-test. Through video lessons, students can comprehend the lesson with less assistance from the teacher (Bullo, 2021). They had a better understanding of the mathematics lessons, performance tasks become manageable, and self-paced learning happens. Hence, through video lessons, struggling students understand the basic concepts, acquire mastery of problem-solving methods, and concentrate on mathematical ideas (Huang et al., 2020).

In the lens of multimedia learning theory, learning becomes better using video lessons, especially if text and attractive figures are combined with the teacher's voice and animation, which help the students build the target competencies. The teacher-made video lessons serve as means of helping struggling students build autonomy in learning. Learning through watching video lessons engage the students in learning mathematics (Tan et al., 2020). So, the mathematics teacher should make video lessons appropriate to the student's level of understanding that catches the attention and demands a consumption need. Teachers need to select the content and activities carefully to be included. Hence, constant feedback from the students is a must to determine the appropriateness of the content.

Despite the positive effect of video lessons in increasing students' motivation and academic performance, the researchers professed that changes could be made in the next cycle of action research. These changes are there should be brief text explaining the purpose and video content, adding more relevant examples, details, exercises, and explanations, and a review of the lesson which highlights the fundamental concepts of the lesson. Also, students' immediate feedback from the previously watched video lessons must be considered in the next video lesson improvement. On the other hand, students must receive immediate feedback from the teacher regarding their academic performance after submitting outputs. Hence, the teacher may use a conversational manner of lesson delivery rather than formal language for better student engagement. Similarly, connecting the video lesson content to the assigned activities or performance tasks makes the consumption of the video lesson exciting and meaningful in the students' eyes.

CONCLUSIONS AND RECOMMENDATIONS

The study has shown that teacher-made video lessons improved the mathematics academic performance of the students. The significant difference between the pre- and post-test mean scores signified the effectiveness of video lessons as supplementary learning materials for struggling students. The effect size justified the magnitude of the effect of the said intervention, which means that the increment in score was due to the video lesson consumption. Also, the post-test mean score was significantly higher than the pre-test mean score. It means that the struggling students understood the mathematics lesson better, complied

with the required performance tasks, and learned the lesson autonomously through the consumption of the video lesson posted on Google Classroom. However, students suggested having advanced uploading of the video lessons with more illustrative examples and explanations, plus the use of local language in explaining the content.

The study was restricted to four sections for two months of implementation since this was action research in nature. The study did not include the challenges that the struggling students experienced during the consumption of video lessons. So, it is suggested to have various studies from different schools about the perceptions and experiences of struggling students while watching teacher-made video lessons. Hence, as the study improves, a more extended implementation period, consistent communications, and a regular survey may be done in the next action research cycle.

Author contributions: AOI: data analysis and research report; **ZTV:** implementation and administration of test materials; & **DEG:** administration of survey, interview, and member checking. All authors approve final version of the article.

Funding: The authors received no financial support for the research and/or authorship of this article.

Acknowledgements: The authors would like to thank to all people who contributed a lot to the completion of this endeavor. The school head of Pacita Complex National High School-Sonia J. Alvero for your all-out support, head teacher of mathematics department Erwin S. Corpuz for your encouragement to pursue this activity, master teacher 2 Irma Estella Marie L. Esteban for giving suggestions for improvement, and head teacher VI of San Pedro Relocation Center National High School-Main Campus Marites M. Urcia for validating the research instruments. To all grade 10 students who participated voluntarily, you were the reason why this action research was carried out. Above all, to Almighty God and Lord Jesus as the source of Divine wisdom, courage, and prosperity. May the researchers be served as stewards of peace, wisdom, transformation, and faith.

Ethics declaration: A letter of permission to the school head and participants, informed consent, and assent forms were assured before the implementation as part of the protocol.

Declaration of interest: Authors declare no competing interest.

Data availability: Data generated or analyzed during this study are available from the authors on request.

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