Teacher-Made Videos as Learning Tool in Elementary Statistics during the Pandemic: A Developmental Research

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***Abstract*—The COVID-19 pandemic has affected education institutions around the world which has forced them to abruptly shift to online learning to address educational challenges with limited resources. Hence, this developmental research aimed to develop teacher-made videos as a learning tool for online learning in elementary statistics. This was utilized as an asynchronous lecture material during the pandemic and its acceptability was evaluated using the ADDIE Model. However, this paper focused only on the development and evaluation phase. It included 104 freshmen university students and five experts as participants of the study. Mean, standard deviation, frequency count, correlation analysis, and test of difference were used as data analysis tools. The developed videos consist of the following elements: title, learning objectives, overview, content discussion, assessment, and answer key. The teacher-made videos were highly acceptable in terms of learning objectives, content, organization and presentation, format and design, learning activities, and assessment as evaluated by the students and experts. In addition, when the participants were grouped according to sex and specialization, their overall acceptability mean did not exhibit significant differences. It was also found that the evaluation factors in the acceptability questionnaire all have a strong, positive correlation with the overall acceptability mean. Thus, technology-enhanced instructional materials like videos and other learning media are helpful learning resources in maximizing learning outcomes amid the pandemic.**

***Index Terms*—ADDIE model, developmental research, online learning, statistics education, videos.**

I. Introduction

The COVID-19 pandemic has affected not just the public health but also all other human endeavors including the education system. It has transformed instruction in all levels of education from the usual face-to-face interaction to other modalities like online learning, distance learning, blended learning, etc. This was also true to state colleges and universities resulting in class suspensions [1]. This forced the teachers and students to migrate educational activities online [2], [3] following the policy of most governments to restrict population interaction [4] to prevent virus transmission [5]-[7]. This online learning modality was implemented to ensure learning continuity, hone skills, and improve technology literacy [8]. Wentling *et al*. defined online learning as knowledge acquisition facilitated primarily by electronic means [9]. This type of learning involves online delivery of content allowing students to participate in courses from anywhere at any time [10], [11] using any platform [3].

However, online learning calls for innovative efforts from educators to make sure students still receive quality education despite the limitations of the pandemic. With this, a series of measures were adopted to face the educational challenges in times of pandemic [12], [13]. This included rethinking and recalibrating more effective methodologies and developing more student-friendly and interactive digital environments [14], [15]. Despite the efforts of the teachers to continually make learning effective even during a pandemic, advantages and challenges with this abrupt transition have been found from both students' and teachers' perspectives [16], [17], specifically for mathematics instruction [18], [19]. Many teachers were still unsatisfied because of their preference to face-to-face learning [19]. Constraints on online learning delivery of content to students have been raised [20].

In terms of statistics, this pandemic has proven that statistical literacy is an important skill that should be possessed by everyone. Experts have utilized statistical skills such as interpreting and analyzing data in assisting their respective governments in developing strategies to flatten the curve of infected people [21]. The goal of statistics education is to produce statistically literate adults who appropriately use statistical thinking [22]. Furthermore, statistically literate individuals can decipher potential outcomes based on essential data [23]. However, the lack of statistical literacy among people has impacted the public's understanding of information related to the COVID-19 pandemic [24]. This study emphasized that lack of mathematical understanding about statistics influenced the increase in COVID-19 infection and mortality rates.

Meanwhile, statistics courses are commonly present in the curricula of university academic programs (i.e. undergraduate and post-graduate) [25]. In the Philippines, statistical concepts are part of the general education course Mathematics in the Modern World (MMW) in Higher Education Institutions (HEI's). This can be specifically found in Section 2 Part 1 on Data Management [26], [27]. However, learners' level of achievement in Probability and Statistics was deficient and they considered this course a complicated area of mathematics [28]. To add, many students experience failure in learning statistics due to factors like anxiety, motivation, and difficulty in quantitative understanding [29]. Cherney [30] found out that actively engaging students with technology was a successful tool in increasing students' involvement in a statistics class. In terms of technology use in statistics education, videos were helpful in learning the content and provided important resources when students needed additional tools to master the material [29]. Students showed positive attitudes toward the video tutorials and recommended them for other classes [31].

Moreover, there is growing literature on the use of technology in higher education [32]-[34], education in

Manuscript received June 16, 2022; revised August 8, 2022; accepted August 15, 2022.

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doi: 10.18178/ijiet.2023.13.1.1774

general [35], [36], and in mathematics education [37]-[39]. In learning mathematics, the use of appropriate learning media helps improve students' mathematical thinking abilities [40]. In line with this, videos as technological tools in education have also gained attention from previous research. Videos and their benefits in education have been discussed in many studies [41]-[44]. Video lessons were helpful to struggling students in mastering course materials. It was also reported that videos increased student-teacher interaction [41]. Video lessons helped increase the motivation of at-risk students to persist [42]. Ichinose and Clinkenbeard [43] also revealed that students taking college algebra in video-based classes performed better on examinations. Based on their experiences, students appreciated the concepts of mathematics in nature when teachers hybridized these topics with videos [44].

The demand for the integration of technology like videos in education was even heightened by the pressures and challenges of the pandemic [45], [46], and the rapid shift to e-learning [47]. Teachers have had to innovate and use new learning methodologies for which they were not prepared; for example, incorporating technology as one of the main tools to deliver knowledge mainly through videos and online classes [48]. One way to face the challenge is to integrate technology into the classroom and make teachers become innovative learning facilitators [36], [49], [50]. However, several factors need to be improved: materials presented in e-learning, interaction with lecturers, the appropriateness of assessment, and benefits of e-learning [51]. Educational institutions need to provide teachers training opportunities on how to improve online learning, make good materials, and make learning media more interactive [3]. Moreover, learners learn best when teachers vary their instructional delivery and employ as many interventions as possible providing learners many opportunities to grasp the lesson in the most interactive and engaging multimedia instruction [52].

In addition, one of the general provisions of the CHED Memorandum Order No. 20. S. of 2013 or the "General Education Curriculum: Holistic Understandings, Intellectual and Civic Competencies," was the development of up-to-date and appropriate course syllabi, readings, materials, and resources for the new general education courses like MMW which includes elementary statistics concepts [26].

Videos in education have been examined in terms of its various effects, influences, aspects, and elements. For example, Rauf and Fauziah (2021) evaluated the students' responses to the use of mathematics learning videos and found that the students believed that the videos they used were categorized as "good" in terms of relative advantage, compatibility, complexity, trialability, and observability [53]. Similarly, Nabayra (2022) reports that teacher-created videos may significantly aide learners in monitoring their own progress and promote flexibility in delivering mathematics instruction [54]. This implies that there are factors to be considered in developing instructional media materials (i.e. videos) in order to maximize the usability and effectivity of the materials.

There are also researches that highlight the effect of using videos in education. Karmila *et al.* (2020) revealed that interactive learning videos contributed to the improvement of students' conceptual understanding, learning motivation and learning outcomes [55]. A paper by Insorio and Macandog (2021) examined the influence of teacher-made videos in mathematics lessons through examining students' scores in summative tests before and after using the videos. It was found that the video lessons made by the teacher helped the students obtain understanding of the mathematics lessons and encouraged enjoyment among the students because they visually see their teacher on screen [56].

Although instructional materials and technology-based education have been widely studied, there limited literature and research that explore the use of teacher-made videos in specific settings such as in an Elementary Statistics undergraduate course. This paper could potentially provide precise and detailed information about how videos made by teachers be designed and developed to increase its acceptability for use in the classroom. It also hopes to bring about new ideas and techniques in designing curriculum and lessons considering the changes caused by the pandemic.

Overall, this study explores the development and evaluation of teacher-made videos in terms of acceptability for online learning in elementary statistics during the pandemic.

II. Methodology

A. Research Design

This study employed a developmental research design. Developmental research is a systematic study of designing, developing, and evaluating instructional programs, processes, and products [57]. Specifically, this study falls under the Type 1 developmental research which, according to [58], focuses on a certain instructional product, program, process, or tool. This study utilized Type 1 developmental research design because it aimed to develop teacher-made videos as learning tool for online learning in elementary statistics situated during the pandemic and evaluated its acceptability by experts and students. Moreover, this study utilized the ADDIE(Analysis-Design-Development-Implementation-Evaluation) model of [59] in the development of the videos. This paper, however, focused only on the development and evaluation of the teacher-made videos.

B. Participants of the Study

This study was conducted in a State University in the Western Visayas region in the Philippines. Moreover, the participants of the study were 104 first year university students taking Secondary Education program specializing in different fields other than mathematics. The participants were selected through cluster sampling. These three groups of students were taking Mathematics in the Modern World (MMW), a general education course in the Higher Education curriculum in the Philippines. This course covers Data Management (elementary statistics concepts) in Section II Part 1 of the course [26].

Along with the five experts (Statistics, Instructional Material Development, ICT, Curriculum, and Research), the 104 freshmen university students evaluated the acceptability of the videos developed through Google Form.

C. Instrumentation, Data Collection, and Analysis

The evaluation questionnaire for the developed videos in elementary statistics for online learning was a 30-item Likert-type checklist. This instrument was used to determine the acceptability of the teacher-made videos in terms of learning objectives, content, organization and presentation, format and design, learning activities, and assessment in which every category has five (5) statements. The instrument was accomplished by both the experts and the students. The evaluation questionnaire was reviewed by three experts to ensure its validity. It was also found reliable with a Cronbach's alpha coefficient of 0.89. According to [60], the instrument is reliable if Cronbach's alpha value is greater than 0.6.

To score the responses of the respondents, the following five-point scale was used: 5 - Strongly Agree (SA), 4 - Agree (A), 3 - Moderately Agree (MA), 2 - Disagree (D), and 1 - Strongly Disagree (SD). The acceptability of the videos based on the indicators used the following scale: 4.51-5.0 (Highly Acceptable), 3.51-4.50 (Acceptable), 2.51-3.50 (Moderately Acceptable), 1.51-2.50 (Fairly Acceptable), 1.0-1.50 (Not Acceptable).

In the Development stage, the researcher developed the teacher-made videos as learning tool on elementary statistics for online learning. The videos were developed based on the outline and format constructed in the Design stage. The average length of the videos was 30-40 minutes per video. In addition, the videos were created using the TechSmith Camtasia as a screen casting tool. The developed teacher-made videos were then tried out and used in the classes of the 104 freshmen university students during the second semester of the Academic Year 2020-2021 on March 2021. After the tryout, the students and five experts accomplished the evaluation questionnaire as an assessment of the acceptability of the developed videos.

Moreover, the mean, frequency count, and standard deviation were employed to determine the acceptability of the developed videos as evaluated by the students and experts. Cronbach's alpha was used to determine the reliability of the acceptability questionnaire.

The relationship among evaluation factors in the acceptability questionnaire was determined using correlational analysis to further identify how each evaluation factor relates to the overall acceptability mean. The independent samples t-test was used to determine if there is a significant difference between the overall acceptability means of the participants, when grouped according to sex. Lastly, ANOVA was used to determine if there are significant differences between participants' overall acceptability mean when grouped according to their specialization (i.e. social studies, science, and English).

III. Results

A. The Main Elements of the Developed Teacher-Made Videos as Learning Tool for Online Learning in Elementary Statistics

The main purpose of this study is to develop teacher-made videos as a learning tool for online learning in elementary statistics, a component of the course Mathematics in the Modern World in the Higher Education curriculum in the Philippines. The developed videos have the following uniform elements:

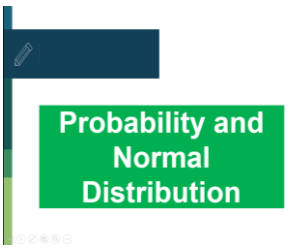

Fig. 1a. Title

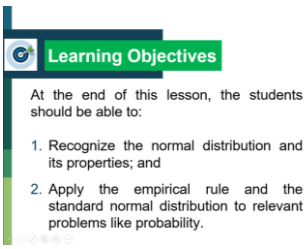

Fig. 1b. Learning objectives

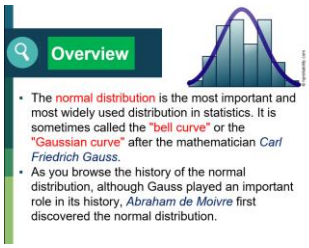

Fig. 1c. Overview

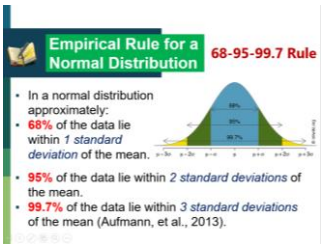

Fig. 1d. Content discussion

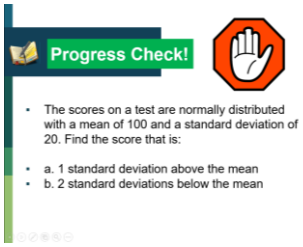

Fig. 1e. Assessment

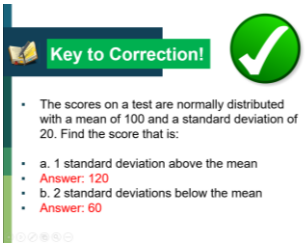

Fig. 1f. Answer key

Title. This is a brief but comprehensive statement of the entire theme in a specific video (see Fig. 1a). It presents the topic covered in the video.

Learning Objectives. These are specific statements that enumerates the students' learning targets for each video (see Fig. 1b).

Overview. This is a bird's eye view of the topic covered by a specific video (see Fig. 1c). It is needed to prepare the minds of the students and to stimulate their interest.

Content Discussion. This part is the lecture proper (see Fig. 1d) where every lesson is presented clearly, comprehensively, and with specific examples. It hopes to enrich students' understanding of the topic because of the extensive content included in each lesson.

Assessment. This feature of the video (see Fig. 1e) displays question items that allow students to check their progress as they go through the video. It may be a practice exercise, a drill, or a thought-provoking question that would solicit thinking to better understand the topic discussed.

Answer Key. This feature in the video (see Fig. 1f) will provide the students immediate answers to the questions that are posted in the progress check section (assessment). This part of a certain video follows immediately after the progress check.

The main elements and format of the developed videos in this study is in accordance with the "cognitive theory of multimedia learning" [61], [62]. This is an important

framework for effective video design. Students are interested in learning that is presented in various formats such as videos, audios, and other technologies designed to raise interest and allow student responses immediately [63]. It also resonates with the findings that the quality of the material is an essential determinant because of its positive impact to student satisfaction [64].

B. Acceptability of the Teacher-Made Videos in Terms of Learning Objectives

As seen in Table I, the learning objectives of the videos have an overall rating of "highly acceptable" (M = 4.83, SD = 0.04). In particular, the students have rated "The objectives suit the topics being tackled in the video" as the highest with a mean of 4.93 and SD of 0.25. In addition, for the experts, all indicators of the learning objectives attained a comparable rating (M = 4.80, SD = 0.45). The overall rating of the students was "highly acceptable" (M = 4.86, SD = 0.22). For the experts, the same overall rating of "highly acceptable" was found out (M = 4.80, SD = 0.45).

TABLE I: ACCEPTABILITY OF THE TEACHER-MADE VIDEOS IN TERMS OF LEARNING OBJECTIVES

	Students		Experts				
	Mean	SD	Mean	SD	Grand Mean	SD	Description
1. The videos are accompanied by a list of specific objectives.	4.90	0.30	4.80	0.45	4.84	0.05	HA
2. The objectives suit the topics being tackled in the video.	4.93	0.25	4.80	0.45	4.86	0.09	HA
3. The objectives are realistic and simple.	4.85	0.39	4.80	0.45	4.82	0.04	HA
4. The objectives fit to the level and needs of the students.	4.74	0.44	4.80	0.45	4.78	0.03	HA
5. The objectives are attainable through the content, illustrative examples and learning activities.	4.88	0.33	4.80	0.45	4.83	0.04	HA
Overall Rating	4.86	0.22	4.80	0.45	4.83	0.04	HA

Legend: 4.51-5.0 (Highly Acceptable-HA), 3.51-4.50 (Acceptable-A), 2.51-3.50 (Moderately Acceptable-MA), 1.51-2.50 (Fairly Acceptable-FA), 1.0-1.50 (Not Acceptable-NA)

More specifically, it can be implied that the learning objectives of each teacher-made video are presented, the objectives listed in the videos are relevant to the topics covered, these objectives are realistic and concise, and that they are matched with the learners' needs. In addition, the learning objectives presented in the videos are practical with the aid of the content, examples and learning activities embedded within every teacher-made video.

Furthermore, stating the objectives in a simple, realistic, specific, and attainable manner is important for an asynchronous lecture material like videos. The results conform to the findings in the study of Laroza [65] in which clearly stated objectives guide the students in attaining full understanding of the concepts to be discussed, making it accessible and achievable. This is in line with another research stating that technology (e.g. videos) open more opportunities for gaining optimum learning objectives [39].

C. Acceptability of the Teacher-Made Videos in Terms of Content

The content of the video has an overall rating of "highly acceptable" (M = 4.77, SD = 0.08) as reflected in table II. In terms of the grand mean, the highest rating was attributed to "The contents of the videos are aligned to the learning objectives" (M = 4.86, SD = 0.08). In particular, the overall rating of the students was "highly acceptable" (M = 4.84, SD = 0.22). Similarly, the experts generated the same overall rating of "highly acceptable" (M = 4.72, SD = 0.52).

TABLE II: ACCEPTABILITY OF THE TEACHER-MADE VIDEOS IN TERMS OF CONTENT

	Students		Experts				
	Mean	SD	Mean	SD	Grand Mean	SD	Description
1. The contents of the videos are aligned to the learning objectives.	4.92	0.27	4.80	0.45	4.86	0.08	HA
2. Contents include illustrative examples that will aid students' understanding of the topic.	4.75	0.46	4.80	0.45	4.77	0.04	HA
3. Drills and practice exercises are also present that would help students check their progress in the videos.	4.91	0.28	4.80	0.45	4.85	0.07	HA
4. The content is extensive with rich variety of supporting information that elaborates students' knowledge of the topic.	4.74	0.44	4.40	0.89	4.57	0.24	HA
5. The contents of the videos are aligned to the course description of the subject.	4.87	0.34	4.80	0.45	4.82	0.04	HA
Overall Rating	4.84	0.22	4.72	0.52	4.77	0.08	HA

Legend: 4.51-5.0 (Highly Acceptable-HA), 3.51-4.50 (Acceptable-A), 2.51-3.50 (Moderately Acceptable-MA), 1.51-2.50 (Fairly Acceptable-FA), 1.0-1.50 (Not Acceptable-NA)

The teacher-made videos, in particular, have demonstrated relevance of topics covered to objectives, effectual examples for learning, appropriate drills and exercises, set with ample information to elaborate concepts, and established connection of topics to the course description of the subject area.

The results agree to the findings in the study of [29] where students found the video contents helpful in learning and possess important resources when students need additional tools for mastery. Also, it agrees with the students' perceptions on instructional materials: easy content and

in-line with students' expectations [3]. Additionally, students' satisfaction is influenced by the e-learning content in an e-learning or online learning platform [66], [67].

D. Acceptability of the Teacher-Made Videos in Terms of Organization and Presentation

Table III shows that the organization and presentation of the videos has an overall rating of "highly acceptable" (M = 4.71, SD = 0.16). In particular, the students have evaluated "The sequence of the topics is properly and logically organized" and "The videos are presented clearly and concisely to enhance readability" as the highest with a mean of 4.91 and SD of 0.28. The overall rating of the students was "highly acceptable" (M = 4.84, SD = 0.20) and a comparable overall rating of "highly acceptable" was obtained from the experts (M = 4.60, SD = 0.79).

These results particularly reveals that the teacher-made videos examined in this paper have content arranged in proper and logical manner, interaction-promoting features, organized content for ease of thinking and understanding process, enhanced readability of video visuals, and accurate matching of materials to students' level of understanding.

Furthermore, the respondents believed that interaction feature must be present in a video lecture to stimulate interest. Similarly, Wang [68] reports that the content and organization of videos should be adjusted to accommodate only key theorems and questions without overlapping materials. This also considered the most appropriate platform for presenting the material to facilitate optimal learning [69].

TABLE III: ACCEPTABILITY OF THE TEACHER-MADE VIDEOS IN TERMS OF ORGANIZATION AND PRESENTATION

	Students		Experts				
	M	SD	M	SD	Grand Mean	SD	Description
1. The sequence of the topics is properly and logically organized.	4.91	0.28	4.60	0.55	4.76	0.23	HA
2. The presentation provides option for interaction to stimulate learners' attention and interest.	4.77	0.42	4.60	0.89	4.67	0.10	HA
3. The organization and presentation of the videos is comprehensive enough that facilitates students' construction of knowledge.	4.76	0.43	4.60	0.89	4.67	0.10	HA
4. The videos are presented clearly and concisely to enhance readability.	4.91	0.28	4.60	0.89	4.75	0.21	HA
5. The videos as anchor materials are well-presented and organized that suits the students' level of understanding.	4.86	0.35	4.60	0.89	4.72	0.17	HA
Overall Rating	4.84	0.20	4.60	0.79	4.71	0.16	HA

Legend: 4.51-5.0 (Highly Acceptable-HA), 3.51-4.50 (Acceptable-A), 2.51-3.50 (Moderately Acceptable-MA), 1.51-2.50 (Fairly Acceptable-FA), 1.0-1.50 (Not Acceptable-NA)

E. Acceptability of the Teacher-Made Videos in Terms of Format and Design

The format and design of the videos has an overall rating of "highly acceptable" (M = 4.66, SD = 0.15). As portrayed in Table IV, the students have evaluated "Appropriate pictures, graphics and illustrations are utilized for better understanding of the topic" as the highest with a mean of 4.83 and SD of 0.40. The overall rating of the students was "highly acceptable" (M = 4.79, SD = 0.29) and an analogous overall rating of "highly acceptable" was obtained from the experts (M = 4.56, SD = 0.77).

The result asserts that the videos suit its end users well because the format and design of the videos is consistent and unified. Furthermore, the appropriate pictures, graphics, and illustrations utilized made it visually appealing and interesting. This result concurs that the use of graphics/visuals in videos creates a marginal difference in student's learning performance; attention, interest, and engagement levels; and eventual learning [70]. Meanwhile, the quality of learning resources, such as the improper design of learning materials, was a potential threat that might affect students' learning [71]. Hence, format and design must be considered in designing effective media materials for learning like videos.

TABLE IV: ACCEPTABILITY OF THE TEACHER-MADE VIDEOS IN TERMS OF FORMAT AND DESIGN

	Students		Experts				
	M	SD	M	SD	Grand Mean	SD	Description
1. The format of the video is consistent that follows a unified structure.	4.82	0.39	4.60	0.55	4.69	0.13	HA
2. Appropriate pictures, graphics and illustrations are utilized for better understanding of the topic.	4.83	0.40	4.60	0.89	4.70	0.14	HA
3. Format is visually appealing and interesting.	4.71	0.48	4.60	0.89	4.65	0.06	HA
4. The video is appropriate for instruction in terms of clear narration and smooth transition.	4.79	0.41	4.40	0.89	4.60	0.29	HA
5. The over-all design suits its end user.	4.79	0.41	4.60	0.89	4.68	0.12	HA
Overall Rating	4.79	0.29	4.56	0.77	4.66	0.15	HA

Legend: 4.51-5.0 (Highly Acceptable-HA), 3.51-4.50 (Acceptable-A), 2.51-3.50 (Moderately Acceptable-MA), 1.51-2.50 (Fairly Acceptable-FA), 1.0-1.50 (Not Acceptable-NA)

F. Acceptability of the Teacher-Made Videos in Terms of Learning Activities

Table V depicts that the learning activities of the videos have an overall rating of "highly acceptable" (M = 4.77, SD = 0.07). In terms of the grand mean, the highest rating was accounted from "Activities are suited to the level of the students" (M = 4.84, SD = 0.06). In general, the overall rating of the students was "highly acceptable" (M = 4.83, SD = 0.25) and a resembling overall rating of "highly acceptable" was obtained from the experts (M = 4.72, SD = 0.63).

The result indicates that there are sufficient, workable, and varied learning activities in the videos. In addition, the learning activities were suited to the learners' level, and are relevant to the objectives and the topic covered. Indeed, online learning can provide more benefits for students if it comes with quality information and learning activities [72], [73]. Video-based learning makes teaching and learning activities more effective and efficient, improves students' abilities, and creates a different atmosphere from the traditional classroom methods [74].

G. Acceptability of the Teacher-Made Videos in Terms of Assessment

The assessment part of the videos has an overall rating of "highly acceptable" (M = 4.78, SD = 0.13) as shown in Table VI. The grand mean was attributed from the same statement with the highest rating as evaluated by the students (M = 4.86, SD = 0.08). In general, the overall rating of the students was "highly acceptable" (M = 4.88, SD = 0.24) and a similar overall rating of "highly acceptable" was found from the perspective of the experts (M = 4.68, SD = 0.72).

TABLE V: ACCEPTABILITY OF THE TEACHER-MADE VIDEOS IN TERMS OF LEARNING ACTIVITIES

	Students		Experts				
	M	SD	M	SD	Grand Mean	SD	Description
1. Learning activities are relevant to the objectives and the topics in the videos.	4.88	0.33	4.80	0.45	4.82	0.03	HA
2. Learning activities are sufficient to realize the objectives.	4.75	0.44	4.80	0.45	4.79	0.02	HA
3. Activities are suited to the level of the students.	4.88	0.35	4.80	0.45	4.84	0.06	HA
4. Learning activities are workable and feasible.	4.83	0.38	4.60	0.89	4.71	0.15	HA
5. Varied learning activities are incorporated in the videos.	4.80	0.40	4.60	0.89	4.70	0.14	HA
Overall Rating	4.83	0.25	4.72	0.63	4.77	0.07	HA

Legend: 4.51-5.0 (Highly Acceptable-HA), 3.51-4.50 (Acceptable-A), 2.51-3.50 (Moderately Acceptable-MA), 1.51-2.50 (Fairly Acceptable-FA), 1.0-1.50 (Not Acceptable-NA)

TABLE VI: ACCEPTABILITY OF THE TEACHER-MADE VIDEOS IN TERMS OF ASSESSMENT

	Students		Experts				
	M	SD	M	SD	Grand Mean	SD	Description
1. Assessment tasks are workable.	4.89	0.31	4.80	0.45	4.86	0.08	HA
2. Assessment activities are suited to the level and needs of the students.	4.87	0.34	4.60	0.89	4.72	0.16	HA
3. Assessment tasks are aligned to the learning objectives.	4.90	0.30	4.80	0.45	4.84	0.05	HA
4. Assessment tasks are adequate that cover the topics discussed in the videos.	4.88	0.32	4.60	0.89	4.73	0.18	HA
5. Assessment exercises are integrated across the videos.	4.87	0.34	4.60	0.89	4.74	0.20	HA
Overall Rating	4.88	0.24	4.68	0.72	4.78	0.13	HA

Legend: 4.51-5.0 (Highly Acceptable-HA), 3.51-4.50 (Acceptable-A), 2.51-3.50 (Moderately Acceptable-MA), 1.51-2.50 (Fairly Acceptable-FA), 1.0-1.50 (Not Acceptable-NA)

The result implies that the assessment of the videos is workable, suited to the level of the students, aligned to the learning objectives, adequate and integrated across the videos. Based on the findings of this study, assessment is a significant part of a video lecture material, and it is supported by what Woolfitt [75] asserted that videos should incorporate active elements (such as quizzes or assessments). Hence, assessment must be considered in the development of any learning media [51]. Teacher-created videos are indeed helpful for the students to reflect on their learning progress through self-assessment [54], [76], [77]. Since statistical concepts are one of the least mastered topics of freshmen students in statistics [78], the use of videos was proven effective and acceptable [79] like other digital tools [80], [81] in improving performance in mathematics.

H. Differences between Groups Based on Participants' Sex

This paper also presents an analysis of the data gathered to determine if there is a significant difference between the mean scores of the participants when it comes to the evaluation factors in the acceptability questionnaire. Results showed that there is no statistically significant difference between the means of the female participants and the male participants for all the evaluation factors. As shown in Table VII, there is no significant difference between the means of the female participants and the male participants in terms of the learning objectives (t=1.280, p=0.205), content, (t=0.877, p=0.384), organization and presentation (t=0.008, p=0.994), format and design (t=-0.360, p=0.720), learning activities (t=0.660, p=0.511), and assessment (t=-0.401, p=0.690).

TABLE VII: DIFFERENCES BETWEEN GROUPS BASED ON PARTICIPANTS' SEX

	Mean difference	t	p-value
Learning objectives	0.06077	1.280	0.205
Content	0.04402	0.877	0.384
Organization and presentation	0.00032	0.008	0.994
Format and design	-0.02121	-0.360	0.720
Learning activities	0.03413	0.660	0.511
Assessment	-0.01898	-0.401	0.690

The average ratings of the females were higher compared to that of the males in terms of learning objectives, content, organization, and presentation and learning activities. The male participants have higher average ratings in format and design and assessment compared to the female participants.

This result indicates that there is evident homogeneity in the acceptability of the teacher-made videos even when the participants were grouped according to sex.

I. Difference in the Overall Mean of Acceptability Among Groups Based on Participants' Specializations

This paper also tested if there is a significant difference between the overall mean of acceptability of the participants when grouped according to their specializations. Table VIII shows that there is no significant difference (F=0.003, p=0.997) between social studies majors, science majors and

English majors in terms of the overall mean of acceptability of the teacher-made videos.

TABLE VIII: DIFFERENCE IN THE OVERALL MEAN OF ACCEPTABILITY AMONG GROUPS BASED ON PARTICIPANTS' SPECIALIZATIONS

	F	p-value
Between groups	0.003	0.997

This result imply that the teacher-made videos are similarly acceptable to all groups (social studies, science and English), and the rating of the participants categorized by their respective specializations do not necessarily affect the level of acceptability assessed by the participants.

J. Relationship between the Over-All Mean of Acceptability and the Respective Evaluation Factors

Table IX presents the Pearson-r correlation data analysis result where the relationship between the overall mean of acceptability and the respective evaluation factors are tested. Results show that all the evaluation factors (i.e. learning objectives, content, organization and presentation, format and design, learning activities and assessment) are significantly related to the overall mean of acceptability of the teacher-made videos. In addition, all the evaluation factors (i.e. learning objectives, content, organization and presentation, format and design, learning activities and assessment) and the overall mean of acceptability are characterized by highly significant strong positive correlations. This indicates that the evaluation factors used in the questionnaire were all predictive of the overall acceptability of the teacher-made videos.

TABLE IX: RELATIONSHIP BETWEEN THE OVER-ALL MEAN OF ACCEPTABILITY AND THE RESPECTIVE EVALUATION FACTORS

		r	p-value	Interpretation
Over-all mean of acceptability	Learning objectives	0.632	< 0.001	Strong positive correlation; significant
	Content	0.747	< 0.001	Strong positive correlation; significant
	Organization and Presentation	0.779	< 0.001	Strong positive correlation; significant
	Format and Design	0.759	< 0.001	Strong positive correlation; significant
	Learning Activities	0.760	< 0.001	Strong positive correlation; significant
	Assessment	0.773	< 0.001	Strong positive correlation; significant

IV. CONCLUSION AND RECOMMENDATIONS

Based on the findings of the study, teacher-made videos may be acceptable learning materials for online modalities designed and utilized during the pandemic. These videos were evaluated as acceptable in terms of learning objectives, content, organization and presentation, format and design, learning activities, and assessment. Additionally, the result of this research provides up-to-date and empirical information about the use of videos in teaching a specific subject matter (i.e. elementary statistics). The output teacher-made videos may be provided future researchers and educators a guide and example in making their own videos in their subject areas.

In this new pandemic-induced education system, technology-enhanced instructional materials like videos and other learning media are helpful learning resources in maximizing learning outcomes.

In teaching and learning statistics, the factors and elements highlighted in this study should be considered when developing teacher-made videos. Consequently, these videos may be used as asynchronous learning tools to further students' understanding of concepts in the subject matter.

Future researchers and scholars from different areas of education can obtain useful and detailed information about the development and validation of teacher-made videos, which can be applied not only in mathematics but also in other areas of study like science, literature, arts, and others.

Thus, educational institutions, specifically those in the Higher Education Institutions (HEIs), should consider designing courses or professional development programs on pedagogy and technology-enabled instructional materials. In evaluating acceptability of teacher-made videos, it is highly recommended to design and develop research instruments and questionnaires based on relevant learning theories other than that of Mayer's cognitive theory of multimedia learning. The cognitive load and overload of study participants may also be examined in order to dig deeper into the implications and aspects of videos and other media in the teaching-learning process.

Furthermore, academic institutions and its members should develop and utilize videos to promote optimum learning for the students in various flexible learning modes (e.g. online learning), and empower the teachers to become innovative creators of effective media while integrating appropriate design principles.

V. LIMITATIONS

In terms of limitations, this study focused on the development and evaluation of acceptability of teacher-made videos as asynchronous lecture materials for online learning in elementary statistics during the pandemic. This paper opens more avenues for further researches in terms of the following: potential effect of videos described in this study to students' performance in statistics in an online learning set up; consideration of other factors aside from those that are included in the acceptability questionnaire to further validate the effectiveness of videos for online learning like video length, other video varieties, designs, platforms, etc.; and considering the views or backgrounds of other students from basic to higher education.

CONFLICT OF INTEREST

The author declares no conflict of interest.

ACKNOWLEDGMENT

The author would like to express his heartfelt gratitude to the Aklan State University Research and Development Services Unit, the College of Teacher Education, and the administration for their unyielding support to the research endeavors of the researcher.

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