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Research Article

Development and Validation of Micro-Lecture Videos as Learning Support Material for Grade 7 Science Competencies

Phillip Raymund R. De Oca[1]*, Lyndon G. Villaceran[2], Mark Enrique B. Deoma[2], Joji D. Linaugo[3], Grace M. Abao[4], Marielle Grace A. De Oca[5]

[1]Special Program for Science Technology and Engineering, Bacolod City National High School – Department of Education, Bacolod City Negros Occidental, 6100, Philippines
[2]Science Department, Bacolod City National High School – Department of Education, Bacolod City Negros Occidental, 6100, Philippines
[3]College of Education, Carlos Hilado Memorial State University, Bacolod City Negros Occidental, 6100, Philippines
[4]Curriculum and Implementation Division, Department of Education – Division of Bacolod City
[5]Handumanan Elementary School – Department of Education, Bacolod City Negros Occidental, 6100, Philippines

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**Corresponding author:*
E-mail:
phillipraymund.deoca@deped.gov.ph

ABSTRACT

As students opted for modular distance learning during the pandemic, they were forced to self-regulated learning with little assistance from teachers. Video lectures are materials commonly designed for active learning methods in distance learning. However, studies found that the length of videos has a strong influence on students' control over their learning. Longer videos have issues sustaining students' focused attention to content. This study aimed to develop, validate and evaluate the quality and effectiveness of micro-lecture videos in Physics. Using the developmental research design anchored on the ADDIE model, 7 videos were developed. Videos were quality assured and administered to grade 7 students for evaluation, and feedbacking. Using a developed instrument, an LRMDS standard evaluation tool from the Department of Education, and thematic analysis, quality assurance results, test scores, and interview transcripts were gathered and analyzed statistically and thematically. Results show that despite limited engagement, video lectures are vital so students are guided to self–regulate their learning at their own pace. They also brought positive outcomes, particularly on ownership of learning where students manage and control the pace of their video view, allowing them to replay anytime. On the quality of materials, micro-lecture videos have relevant, logically arranged information, with appropriate content and language that are free of bias. They also have a well-defined purpose, are content-

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friendly, and can engage viewers for a better understanding of concepts. Moreover, end-users responded that the material was easy to use, can be viewed in messenger, and can be downloaded anytime since it has a smaller file size.

***Keywords**: ADDIE model, LRMDS, Micro-lecture Videos, Physics*

Introduction

The pandemic brought significant consequences to education as traditional methods must be cast aside in favor of unconventional means (Chick et al., 2020). Globally, institutions and educational leaders were compelled to revisit instructional strategies suited to local COVID-19 situations and access to the learning platforms. In the Philippines, under the Basic Education Learning - Continuity Plan, the Department of Education reports that 72.5% (6.35 Million) junior high school students opted for printed modular distance learning. Likewise, in a secondary school in central Philippines, learner's enrollment survey shows that 67.5% (5,368) students preferred learning modules. With printed materials, they practice self-regulated learning with little assistance from teachers, relying significantly on asynchronous means to complete the curriculum (Whipp & Chiarelli, 2004; Russo & Benson, 2005).

In education, the use of technology has significantly increased for efficient learning (Ekici, et al. 2012). Developments were timely during the pandemic, where it was critical to pay careful attention to learning materials used in online classrooms (Affouneh et al., 2020). Likewise, in creating instructional materials for online delivery, teachers must be innovative and reflective. As materials must be successful in delivering course contents in a clear way, tailored to the needs of learners. Furthermore, poorly designed online learning materials will result to confusion among learners (Mayer, 2014; Kizilcec et al., 2015).

Video lectures are materials commonly designed for active learning methods in online classrooms to assist and help students own their learning trajectory (Scholtenhuis, 2020). Lo and Hew (2019), posits that they are beneficial as they foster self-paced learning. However, seminal works show that video types such as voice-over recordings of presentation slides (Fogarty 2017; McClelland 2013), lecture captures (Chen and Wu 2015), and demonstration films (Grossman et al. 2013; van der Meij 2017), vary in format, accessibility, duration, purpose, and content. It also found that length of videos has strong influence on students control over their learning. With longer videos having issues on sustaining students' focused attention to content (Zheng, 2022). Thus, short videos that promote better learning engagement are encouraged.

Micro-lectures are regarded as one of the most efficient and widely used blended learning formats (Zhang and Xu, 2015). David Penrose first presented the idea of a "micro-lecture" in 2008, referring to it as "a knowledge burst" that could be utilized as a teaching resource integrated into a variety of micro learning environments. Educators are increasingly using micro lectures, particularly those who have big lecture classes. It consists of a video clip, lasting a minute or two, in which the instructor presents a concept and highlights the key features (Zhang and Xu, 2015). This is consistent with the idea of "flipping" the classroom, which involves altering the structure of the classroom so that students watch the lecture at home before completing their assignments in class with assistance from the teacher (Sweet, 2014; Vandermolen, 2013).

Micro-lectures are instructional videos that are designed to fill the gap in learners understanding of concepts and the time they have to spend in understanding them. Micro-lectures, according to Liu and Wang (2013), are a brief video presentation that sharply focuses on a single topic, is created by teachers to meet the requirements of students, and is in accordance with the learning skills they must acquire. Micro-lectures, according to Wei, Qiu, and Yu (2017), differ from other educational videos in that they a) encourage fragmented learning, b)

allow students to concentrate due to their short runtime, c) only focus on certain parts of the lesson to allow for more focus, and d) support mobile-learning due to their small file size. Having discussed the advantages of using Micro lectures, the innovators seek to evaluate the effectiveness of micro-lectures in delivering the lessons anchored on competencies of Grade 7 Science during an online asynchronous class

The development of the material in this research adheres to a DepEd goal, provide a child-friendly, gender-sensitive, safe, and motivating environment for learners. The use of micro-lecture videos can also help give learners the opportunity to take control of learning, at their own pace, while not plunging them into very long discussions that often make learning inefficient.

Research Questions

This research aimed to develop and validate the quality of micro-lecture videos with evaluation from experts and determine their effectiveness when used in the classroom based on the pretest and posttest scores of grade 7 students.

Specifically, it aimed to answer the following questions

1. What are the micro-lecture videos to be developed?
2. How did the grade 7 students from two group perform when micro-lecture videos are used?
3. What is the quality of micro-lecture videos when quality assured by experts both in content and video development using the Evaluation and Review for development of new Non-Print Materials?
4. What are the experiences of grade 7 students on the use of Micro-lecture videos?
5. What are the strategies to employ for sustainability and improvement of the micro-lecture videos?

Methodology

Research Design

Here, a developmental research design was used anchored on the frameworks of the Instructional Development Design, the ADDIE (Analyze, Design, Develop, Implement, and Evaluation) Model. The descriptive design was also employed for evaluation of materials by experts and its administration to students as end users. Moreover, thematic analysis was done to analyze responses relevant to experience of students on the use of the learning materials.

Subjects

Experts and students were the data sources of this study. Two sets of experts were sought to evaluate content and format. Content experts include representatives from the core of the Science Learning Area of the Curriculum and Implementation Division in a Schools Division from Central Philippines. While experts on format were from the Learning Resource Management and Development System Team of the same Division. They were purposively selected based on their qualifications and expertise in learning resource development.

Other participants were the Grade 7 students from a secondary school in central Philippines. They were purposively selected based on their performance in Science on the previous grading. Equal performance was ensured, so they acclimated together and started on equal footing. Assignment was done randomly via toss coin method, with one group receiving the intervention with asynchronous modality and the other group complying all curriculum requirements with asynchronous modality alone. The tables below show the lists of experts and students.

Table 1. Distribution of Experts

Number of Experts	Specialization
6	Content
6	Format

Table 2. Distribution of Participants

Group	N
Control	40
Experimental	40

Data Gathering Methods

The following procedures were observed by the researchers from the development, validation with experts, implementation, and evaluation. They are cognizant to the frameworks of ADDIE model in instructional material development. Procedures for data collection are described in the pre-implementation, implementation, and post-implementation stages.

Analysis of the Context

Results of the learner's enrollment form was analyzed to determine their needs under the Basic Education Learning Continuity Plan. As nearly 70% of students opted for Modular Printed Approach, learning was static and there is warrant of learning materials to support active learning.

Design of the Learning Support Material

Evaluation was via Content analysis in literature to determine the materials and its design appropriate to the learning needs of students. Gaps synthesized revealed that length of videos has strong influence on students control over their learning. With longer videos having issues on sustaining students' focused attention to content (Zheng, 2022). Thus, short videos that promote better learning engagement are encouraged. Hence, videos developed were aligned to micro-lecture design.

Script Development for Micro-lecture Video

Development of the script was the first step. It came with expert's evaluation to ensure adherence to social content guidelines on the use of language and teaching of social values as well as Government's educational thrusts.

Preparation of Elements

Kinemaster video editor was used for video preparation. Its user-friendly, drag & drop, and professional editing features ensured that transition, sound effects, graphics and other elements were apparent in the micro-lecture videos. It also converted the Powerpoint presentation, added with narrative into a video. Moreover, it subscribed to LRMDS guidelines on content creation to safeguard the videos from issues branding, bias, discrimination, and etc.

Content Creation

Lessons plans aligned to the prescribed learning competencies were developed as guide for the development of the scripts and videos. Also used as reference are the Self-learning modules developed and quality-assured by the Science Learning Area of the Curriculum and Implementation Division. Also prepared was a Powerpoint presentation with slides converted to JPEG pictures for video conversion. Images used are checked to guarantee that they all have creative common licenses, while texts, language and social contents were all reviewed if they are compliant of LRMDS guidelines.

Finalization of Videos

Completed micro-lecture videos were compressed via Freeconvert video compressor so file size is less than 25 Mb and they can be shared via messenger. Decreased file size limits data consumption, an advantage for students without established internet connection. They were subject to field test and quality assurance. Field test was done among grade 7 students in a 7-week timeline. While quality assurance was done by video, social and knowledge content experts.

Evaluation via Achievement of Learners

Field test of the micro-lecture videos was done in 7 – weeks. Students were allowed to acclimate with Physics competencies in the first week before videos lectures were introduced in the experimental group in the second week. To monitor progress of student's performance, pretest and posttest were administered before and after the implementation timeline.

Implementation was done weekly with the topics graphing motion, waves, sounds and waves, light, heat transfer, and charges and types of charging processes.

The instrument used was a 50 item instrument standardized by the Science Learning Area of a Division in Central Philippines. Scores were compared to determine efficiency of the videos as learning support to learners in distance learning modality. Scores and feedbacks were summarized and analyzed to give insights for further improvement of the videos.

Feedbacking of End Users and Experts

Video, social, and knowledge content experts were sought to quality assure and give feedbacks on the conveyance of accurate and reliable contents of the micro-lectures in physics. They also reviewed video elements and gave insights on audio clarity, stability, and practicality. Moreover, their approval was baseline for the final release and uploading of videos to Youtube and in the official portal of the Science Learning Area of a division in central Philippines. Experts' evaluation and feedbacks were also summarized in the results and discussion section for improvement of the videos.

Evaluation and Research Instruments Used

Field test and quality assurance evaluation of micro-lecture videos used a 50 item standardized instrument developed by the Science Learning Area and the instrument on the Evaluation and Review for development of new Non-Print Materials of the Learning Resource Management and Development System of the Department of Education. Validity of the 50 – item multiple choice test was established via face and content validity. Face Validity was done with five experts (Education program supervisor and Master Teachers in Science) using Good and Scates (*Value = 4.93; Interpretation – Validators, strongly agree*), while content validity was established using Content Validity Ratio *($CVR_{CRITICAL}$ of 1 for a panel size of 5 was met, thus the questionnaire is valid)*. On reliability, the instrument was pre-administered with results processed using Kuder Richardson Formula 20 (KR_{20}*=0.81*).

Plan for Data Analysis

Results obtained from the instruments were processed using Mean and Standard Deviation with reference to the range of mean scores shown in tables 3 and 4, while thematic analysis was done to analyze the responses of selected students. The mean is the most common value in a set of numbers, referred to as an expected value, and data is usually collected to make generalizations (Altman & Bland, 2005). Heedless of the distribution, the standard deviation is a reliable indicator of variability. (Altman & Bland, 2005; Choi & Wong, 2016). Below are the scale and scoring guide used to interpret the results gathered from the instruments.

Table 3. Range of mean scores

Range	Interpretation
40.21 – 50.00	Very High
30.41 – 40.20	High
20.61 – 30.40	Average
10.81 – 20.60	Low
10.01 – 10.80	Very Low

Table 4. Mean Scale for Learning Resource Assessment

Factor	Score	Score Requirement	Interpretation
Content Quality	40	Resource must score at least 30 points out of a maximum 40 points to pass this criterion.	1.01-10.75 (Not Satisfactory) *10.76 – 20.05 (*Poor) *20.06 – 30.25 (*Satisfactory*)* *30.26 – 40.00 (Very* Satisfactory)

Factor	Score	Score Requirement	Interpretation
Instructional Quality	40	Resource must score at least 30 points out of a maximum 40 points to pass this criterion	1.01-10.75 (Not Satisfactory) *10.76 – 20.05 (*Poor) *20.06 – 30.25 (*Satisfactory*)* *30.26 – 40.00 (Very* Satisfactory)
Technical Quality	52	Resource must score at least 39 points out of a maximum 52 points to pass this criterion.	1.01-10.75 (Very Satisfactory) *10.76 – 20.05 (*Satisfactory) *20.06 – 30.25 (Poor)* *30.26 – 40.00 (Not* Satisfactory)
Other Findings	16	Resource must score at least 16 points out of a maximum 16 points to pass this criterion.	1.01 – 4.50 *(Not Present)* 4.51 – 8.00 *(Present but very minor and must be fixed)* 8.01 – 11.50 *(Present and requires major redevelopment)* 11.51 – 15.00 *(Do not evaluate further)*

Results and Discussion

Responsive to the innovations statements, the following results are obtained.

Developed micro-lecture vidoes in Physics

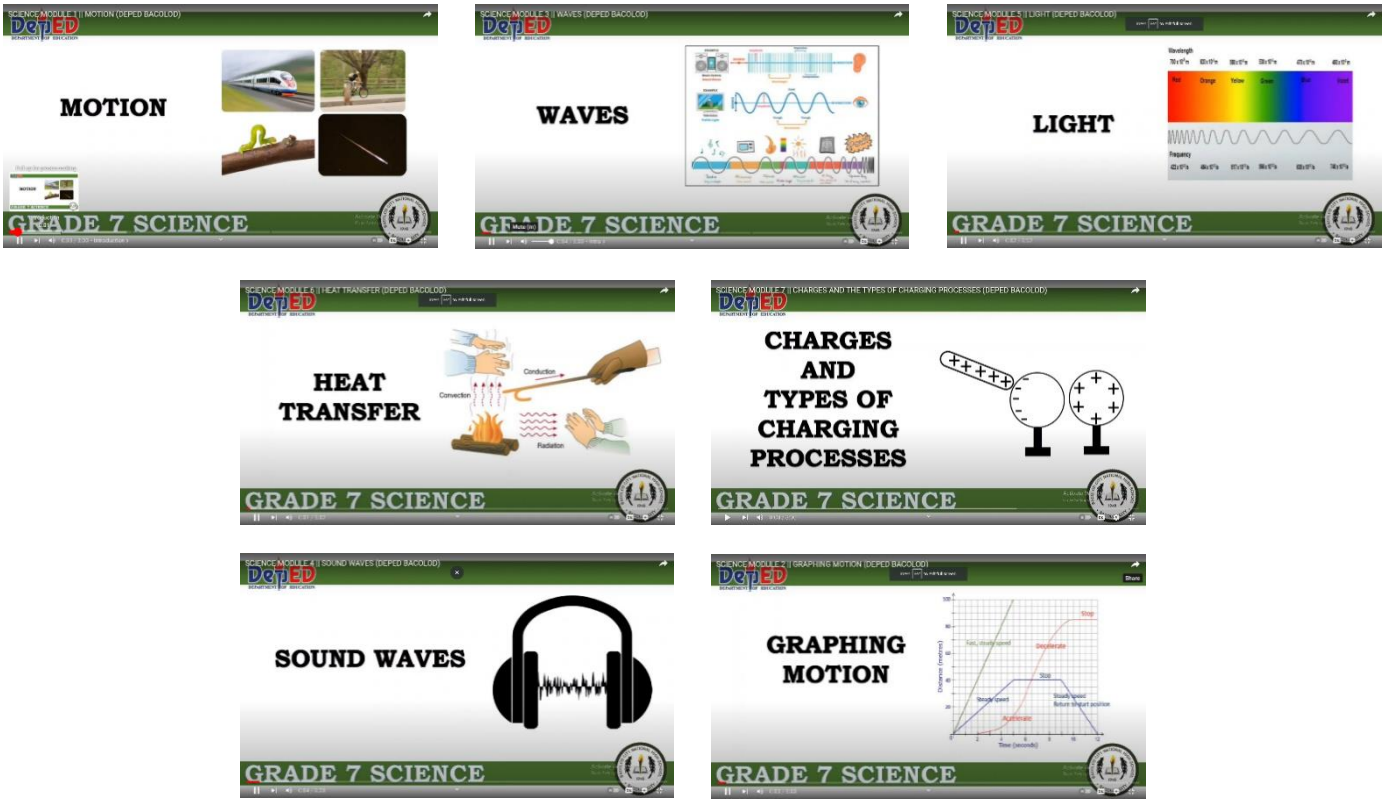

Figure 1. Developed micro-lecture videos

The seven micro-lecture videos have 3-minute length, the lectures are based on *Motion in one dimension, Wave as carrier of energy, The characteristics of light How heat is transferred, Charges and the different charging processes* as content standards. While their learning competencies are *Describe the motion of an object in terms of distance or displacement, speed or*

velocity, and acceleration, Create and interpret visual representation of the motion of objects such as tape charts and motion graphs, Infer that waves carry energy, Describe the characteristics of sound using the concepts of wavelength, velocity, and amplitude, Explain color and intensity of light in terms of its wave characteristics, Infer the conditions necessary for heat transfer to occur, and Describe the different types of charging processes. Moreover, the micro-lecture videos have less than 25 Mb file sizes.

Pretest and posttest scores of Grade 7 students when micro-lectures in Physics are used.

Table 5. Pretest and posttest performance of grade 7 students when micro-lectures in Physics are used

Groups	Test	N	Mean	SD	Interpretation
Control	Pretest	40	20.04	1.8592	Low
	Posttest	40	30.16	1.5990	Low
Experimental	Pretest	40	20.32	1.8868	Low
	Posttest	40	39.92	2.7221	Average

Mean Range	40.21 - 50.00	30.41 - 40.20	20.61 - 30.40	10.81 - 20.60	1.01 - 10.80
Interpretation	Very High	High	Average	Low	Very Low

1.01-10.75 (Not Satisfactory)
10.76 – 20.05 (Poor)
20.06 – 30.25 (Satisfactory)
30.26 – 40.00 (Very Satisfactory)
Content Quality (Resource must score at least 30 points out of 40 points) Passed
Instructional Quality (Resource must score at least 30 points out of 40 points) Passed
Technical Quality (Resource must score at least 49 points out of 52 points) Passed

1.01– 4.50 (Not Present)
4.51 – 8.00 (Present but very minor and must be fixed)
8.01 – 11.50 (Present and requires major redevelopment)
11.51 – 15.00 (Do not evaluate further)
Other Findings (Resource must score at least 16 points out of 16 points) Passed

Table 5 presents the pretest and posttest scores of Grade 7 students in the control and experimental groups, where usual teaching strategies and teaching with micro-lecture videos are respectively administered. Shown are increasing trends for both groups. Mean scores from the pretest and posttest of the experimental group improved from (M = 20.32; SD = 1.8868), interpreted as Average to (M = 39.92; SD = 2. 7221), interpreted as High. While learners from the control group, had pretest and posttest scores, (M = 20.04; SD = 1.8592) and (M = 30.16; SD = 1.5990), both interpreted as Average.

The trend shows positive impact of both approaches to science (physics) performance of grade 7 students. However, higher results from the experimental group indicate effectiveness of the intervention. Here, students are enrolled under asynchronous printed modular approach, and despite limited engagement with the teacher, the videos brought positive outcomes particularly on ownership of learning where students manage and control pace of their video view, allowing them to replay anytime (Algarni and Lortie-Forgues, 2022; Lee and Martin, 2020; Joseph – Richard et al., 2018; Zainuddin, 2018). The result is also positive on teacher's end who can support learning of students and ensure that prescribed competencies are acquired (Azmi, 2017). Moreover, the findings of Le et al (2022), Liu et al., (2022), Tang et al., (2022), Garber (2020), and Elias (2018) all suggested positive role and use of micro-lecture videos on attitude and knowledge of students.

Quality assurance result from experts in content and video development

Table 6. Mean result of the evaluation and review for development of new micro-lecture videos

Factor	N	Mean	SD	Percentage	Interpretation
Content	6	36.33	1.85921	90.83	Very Satisfactory
Instructional Quality	6	37.17	1.88680	92.93	Very Satisfactory
Technical Quality	6	45.67	1.59896	87.83	Very Satisfactory
Other Findings	6	14.33	2.72213	89.56	Do not Evaluate Further

Data on quality assurance responses from content and video development experts are shown in table 6. Results show that experts, both on content and video development, rated the micro-lecture videos in factors Content (M=36.33; SD=1.85921), Instructional Quality (M=37.17; SD=1.88680); Technical Quality (M=45.67; SD=1.59896), interpreted as Very Satisfactory. Results suggest that the micro-lecture videos in Physics are compliant to the standards, specifications and guideline of the Learning Resource Management and Development System of the Department of Education.

On content, results indicate that the material content is accurate and consistent with DepEd learning competencies to reinforce mastery of learning. Information are also relevant, logically arranged, with appropriate content and language that are free of bias. On instructional quality, results suggest that the materials define and achieve their purpose, with graphics, sounds, and colors that can stimulate, and engage viewers. Lastly, the materials based on the mean value for technical quality has audio, visual presentation, speech and narration and video-audio synchronization that are content friendly to the viewers and can significantly improve their understanding of the concept. Results adhere to the findings of Wiphasith et al., (2016), Stapa and Mohammad (2019), Artman (2020), and Yu et al., (2021).

On other findings, obtained mean value (M=14.33; SD=2.72213), with an interpretation, do not evaluate further suggests that the video materials have limited conceptual, factual, grammatical, and typographical errors. Also, results suggest that obsolete information and errors in visuals are not found in the micro-lecture videos. Results are congruent to the findings of Manalastas and De Leon (2021), where content quality focused on grammar, concepts and factual information are established in the developed learning resource material. Moreover, other studies like Lopez et al., (2022), Potane (2022), and Unal (2022), have findings, similar to the present study.

Feedbacks

Thematic insights were gathered from purposively selected learners who are end users of the material to be developed (Ilic, 2022). Feedbacks from learners enable learning resource developers to know what is working and what is not. Their behavior while engaging with the material is also significant. Feedbacks from real time use are helpful information for the innovators to incorporate into the next version of the material.

The micro-lecture material is easy to use and understand

As engagement between teachers and learners was limited in the New Normal, teaching relied heavily with asynchronous classes. Provided with micro-lectures in physics, they find the material easy to use as they can control their pace of learning and have focused attention on content (Zheng, 2022; Fear et al., 2003). Culled from the response of one learner:

> *"The micro-lecture video was easy to use, given that it is posted on Youtube and Messenger, we students can easily access them. Also, we can reply the video anytime in case concepts delivered are missed. The video allows us to master our topics better with the guidance it provides"*

The findings of Algarni and Lortie-Forgues, (2022), Zainuddin, (2018), Le Roux and Nagel (2018), agree with the responses as in their findings students who are end-users are able to

manage and control pace of their video view, allowing them to replay anytime.

The micro-lectures were accessible and requires limited data for download

In a support environment where access to internet is both expensive and limited, the video lectures compressed into smaller file sizes for messenger sharing were able to reach students who preferred modular distance learning due to lack of internet connectivity. Students responded that they can easily access the materials since it is share with the most common communication platform, Messenger. Likewise, with its limited size it consumes less data both when viewed and downloaded. According to one end-user:

> *"We chose the modular distance approach because we don't have internet at home. Also, buying internet load is a burden to my parents. Viewing video lectures in larger size requires big data which will cost us more. But with the use of the micro-lecture videos – with smaller file size, I only need affordable internet load to view them. Likewise, since it is shared via messenger, I can watch it anytime and download easily."*

Summary of Findings

Data gathered were analyzed to answer the research questions set.

Seven (7) micro-lecture videos on topics motion, topics graphing motion, waves, sounds and waves, light, heat transfer, and charges and types of charging processes were completed adherent to the guidelines of developing frameworks of ADDIE model and the Learning Resource Management and Development System of the Department of Education. They all have file size less than 25Mb for them to be delivered to students via Messenger.

Increasing trends are manifested for both groups. However, mean scores from the pretest and posttest of students with micro-lecture videos improved significantly, indicating it positive role in improving knowledge acquisition of students.

Micro-lecture videos in Physics are compliant to the content, instructional quality, technical quality, and other specifications and guidelines of the Learning Resource Management and Development System of the Department of Education.

The micro-lecture material is easy to use and understand, accessible and requires limited data for download.

To sustain and improve the micro-lecture videos, the sustainability plan is proposed in the recommendation section.

Conclusions

Aligned to the research questions raised, results on the performance of students and the quality assurance evaluation of experts are summarized.

Physics is a learning area that requires visualization. Since the new normal limited the engagement of teachers and students, relying mostly on asynchronous discussions, video lectures are vital so students are guided to self – regulate their learning at their own pace. In this study, seven (7) the micro-lecture videos were developed and when evaluated in terms of their impact to learning, they brought positive outcomes particularly on ownership of learning where students manage and control pace of their video view, allowing them to replay anytime.

On the quality of materials, with reference to LRMDS standards, the micro-lecture videos have relevant, logically arranged information, with appropriate content and language that are free of bias. They all have well-defined purpose, with graphics, sounds, colors, audio, visual presentation, narration and video-audio synchronization that are content friendly to the viewers and can stimulate, and engage them for better understanding of the concept. Videos, are also free from grammatical errors and obsolete information, a characteristic that was ensured by the quality assurance evaluation done by experts. Moreover, end-users responded that the material was easy to use, can be viewed in messenger which is the most common and accessible platform for students and teachers, can be downloaded anytime since it has smaller file size, and has limited data consumption when used.

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