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# Development and Validation of Bite-Size Videos in Teaching Earthquakes Among Grade 6 Learners

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**Abstract**

Bite-size videos about earthquakes were developed based on Multimedia Development Life Cycle model by Luther incorporated with the Multimedia Principles to improve the conceptual understanding on earthquakes which was revealed as one of the least learned competencies. Initially, a pre-assessment was conducted to the six Grade 6 teachers handling Science to assess the characteristics of the existing videos they utilized in teaching the concept of earthquakes. Next, the developed BSVs were then assessed by two evaluators in terms of content quality and another four evaluators for the cognitive load, engagement, and technical design and received an 'excellent' rating. Overall, the learning material was rated as excellent which guaranteed quality as an instrument of this study.

**Keywords**: STEM Education, Bite-Size Videos, Multimedia Principles, Earthquakes

## 1. Introduction

Deadly and catastrophic earthquakes were familiar in the Philippines. A sequence of mild to moderate-magnitude earthquakes struck Davao de Oro and other Eastern Mindanao regions on March 6 and 7, 2023 (Joseph, 2013). Education about earthquakes is crucial for students to enhance awareness and increase understanding associated with seismic events. Research on earthquakes highlights that individual with greater awareness and heightened. Understanding can successfully manage the destructive consequences. At this stage, conventional instructional approaches, methods such as drills and theoretical lessons are insufficient, yet creative approaches like videos and virtual reality (VR) technology hold greater potential (Korkmaz, 2023).

Science has made the lives of many convenient; nevertheless, Science is a challenging subject, with many Filipino learners not enjoying it. At every elementary grade level, there are the least competencies learned. With Earth science competencies, in particular, the competencies on the topic earthquakes are identified as being the least learned in Grade 6 learners (Mijares, 2023). In 2022, the Philippines placed 80th out of 81 countries by the

Program for International Student Assessment (PISA), with only 23 percent of students achieving basic competency in science (Malipot, 2023). PISA revealed that 15-year-old Filipino students are five to six years behind their international peers in learning competencies. As a result, President Marcos has issued the Department of Education to step up its efforts to improve the Philippines' performance in the PISA. Continuous improvement is essential, as stressed by DepEd Undersecretary for Curriculum and Teaching (Servallos, 2024).

This information highlights how urgent it is to raise the standard of primary education in the Philippines. The ratings suggest that Filipino students still require teacher assistance and need to engage in tasks that have low cognitive demand, especially those tasks considered prerequisites to higher tasks in science. This situation, therefore, challenges teachers to find new teaching methods that encourage more developmental learning, rather than sticking to conventional teaching methods that do not sustain new improvements in learner performance.

The topic on earthquakes whose competencies were least mastered by the Grade 6 learners was revealed in the regional memorandum 144.202, particularly explaining changes caused by earthquakes, the science teachers are submerged in finding teaching-learning approaches that can make the concepts easier to learn (DepEd, 2020).

Furthermore, research by Santos-Reyes et.al. (2017) indicates that students generally expressed minimal fear of earthquakes, although half demonstrated inadequate understanding. In the same vein, Kirikkaya (2011) assert that students in 4th and 5th grades in Turkey have gaps in their understanding of what an earthquake is and the process behind how it happens. Furthermore, numerous students cited weather conditions as a cause of an earthquake. Most significantly, students did not realize that their region is at considerable risk of earthquakes.

Earthquakes are natural disasters or natural events that have media such as textbooks and worksheets which can help the teachers in the facilitation of earthquake-determined lessons. Alongside conventional teaching techniques like posters, brochures, and drills, some nations have begun to implement a learning environment based on technology (Çoban & Göktaş, 2022).

There have already been many studies conducted in the video media, nonetheless, Ou, et al. (2019) noted that the reviewed studies rarely describe the videos' details. Remarkably, the number of videos, the length of the videos, and the presentation of the content in the videos. Guo et.al. (2014) observed that the average engagement time for videos under 6 minutes was close to 100 percent; thus, the first and most crucial guideline for maximizing student attention to a video lesson was to keep it brief because as the video got longer, student engagement decreased. Also, it was found that students' reports of mind wandering increased and material retention decreased during lengthy video lectures (Risko et.al., 2012).

Hence, it was suggested that in incorporating videos into teaching, the factors that need to be considered are the following: the content in the videos should be engaging, the language and the way of talking is clear and easy to understand, is relevant to the content and objective, is not lengthy, and developmentally appropriate for their age (Abeyseker and Dawson, 2015)

To fill the gap clarified above, the researcher conducted a study on the bite-size video. Bite-size video (BSV) is a micro-video characterized by shortness and crispness and is considered engaging. This study, however, will focus on the development of a micro-learning tool for teaching Earthquakes. This micro-learning tool will be a bite-size video and it will be recommended to be a tool for teaching science topics when proven beneficial in the case of the lesson earthquakes. Integrating technology in the classroom will greatly help fill the knowledge gaps of learners that conventional education cannot provide.

## 2. Objectives of the Study

This study sought to achieve the following research objectives:

1. Assess the existing videos on earthquakes used by the teachers.
2. Develop bite-size videos on earthquakes.
3. Evaluate the developed bite-size videos on earthquakes.

## 3.Methodology

The Bite-Size Videos on earthquakes were developed as detailed in the following subsections.

3.1 Data Gathering Procedure

The Multimedia Development Life Cycle (MDLC) model proposed by Luther is a practical approach to multimedia development in educational settings, such as developing BSVs in teaching earthquakes among grade 6 learners.

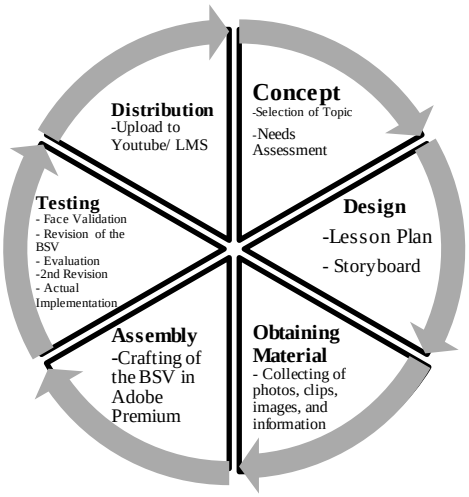


Figure 1. Luther's Multimedia Development Life Cycle Model

The study undergone 6 stages. In the concept stage, it referred to the selection of topic and the results of the assessments for the existing videos used by the teachers were presented. Then, the researcher developed a learning plan and storyboard. Next, the researcher started gathering photos, videos, clip art images, audio, and others. This stage also involved gathering data from the books, modules from the topics related to earthquakes, and results of the pre-assessment. For the assembly, software such as Adobe Premium Animate, Animaker, and others was used to finally develop the BSV. After that, the fifth stage involved testing the developed BSV for learner-respondents from the district of Iligan City, Lanao del Norte. With the help of the panel, together with the thesis adviser co-adviser, and evaluators provided inputs, comments, and suggestions to improve and evaluate the usability and effectiveness of BSV and other research instruments for the face validation. After the face validation, the researcher applied all the necessary revisions to enhance the developed BSVs. Prior to being put into use, the BSV was evaluated by six (6) panel of evaluators for two rounds and was revised for twice also. Two evaluators assessed the content quality of the BSV while four evaluators assessed the cognitive load, engagement, and technical design of the developed BSV.

The BSV was assessed using two sets of rating sheet. One score sheet from DepEd (2020) for the content quality and another adapted and modified Instructional Video Evaluation Scale (IVES) based on Kay's (2020) composed of cognitive load, engagement,

and technical design. After that, it underwent another round of revisions based on the comments and suggestions of the panel of evaluators. Then, to hear the thoughts on the improvements of the BSVs, the researcher let the panel of evaluators to re-evaluate the revised BSVs. Finally, the final product was implemented to the one of the public schools in Iligan City. students the goal and objective of the study for them to become fully aware. At the end of the implementation, the learning material was enhanced based on the comments and suggestions of the students and observing teachers.

3.2 Needs Assessment Questionnaires for Science Teachers

To determine the need for developing bite-size videos, the researcher made questionnaire aimed to identify areas for improvement in the existing videos used for teaching about earthquakes. It was made up of questions relative to the teacher's comments on the frequent videos they used and suggestions to improve the videos they utilized. After the survey, the respondents reviewed their responses, comments, and suggestions on what were the strategies and materials they utilized. The respondents of the pre-assessment were the six (6) In-Service Teachers handling Science 6 subjects from Iligan City. An interview was administered to them using the developed and evaluated needs assessment questionnaire. Prior to the survey, the respondents were given a letter of consent to signify their agreement to voluntarily participate in this study. After the survey, the respondents reviewed their responses, comments, and suggestions on what were the strategies and materials they utilized. Results from the needs assessment survey were then tabulated and subjected to content analysis.

Table 1: Learning Plan in Teaching the Concept of Earthquakes

| Day | Activity | Objective/s | Method/s | Assessment |
|---|---|---|---|---|
| 1 | Orientation | To orient the learner-respondents about the nature and purpose of the study and to conduct the pretest. | Verbal<br><br>Paper and Pen Test | Pretest Score |
| 2 | **Day 1: How Earthquakes Occur** (Motivation-Activity) | To identify how earthquakes occur. | Bite-Size Video/ Hands-on Activity | PrObEx Chart |
| 3 | **Day 2: Types of Earthquakes and how are they measured** (Discussion on Types of Earthquakes and Intensity vs Magnitude) | To determine the two types of earthquakes<br><br>To differentiate magnitude and intensity | Bite-Size Video/ Think-Pair-Share Activity | Reflection (Oral Presentation) |
| 4 | **Day 3: Changes in the Earth's Surface due to Earthquakes** (Discussion on the Effects of Earthquakes) | To describe the changes in the earth's surface due to Earthquakes | Bite-Size Video | Formal Assessment: Q&A |
| 5 | **Conduct the Posttest and Perception Questionnaire** | To assess the understanding of the learners and ask for their comments and suggestions on the developed BSV. | Paper and Pen Test | Posttest Score and Perception Answers |

3.3 Designing of the BSVs in teaching Earthquakes

To establish a road map for the teacher of what had been taught and what needs to be taught, a learning plan was crafted of the BSV (done by the Researcher). This plan outlines teaching goals, learning objectives, and strategies to achieve them in developing the said BSVs.

3.4 Expert Validation.

The developed BSVs were evaluated and rated by panel of evaluators, and in-service teachers. It utilized the score sheet from DepEd (2020) for the content quality and another adapted and modified Instructional Video Evaluation Scale (IVES) based on Kay's (2020) composed of cognitive load, engagement, and technical design.

3.5 Revision

The comments and suggestions of the evaluators were considered in improving the developed BSVs in teaching earthquakes among Grade 6 learners.

3.6 Data Analysis

Mean was used for the analysis of ratings in the needs assessment questionnaire, and the developed BSVs. For the qualitative part, the responses of the teachers in the needs assessment questionnaire were collected and subjected to content and thematic analysis. Experts' Rating of the Developed BSVs in Teaching Earthquakes will be categorized into 1) Excellent (mean score 4.00 – 3.25), 2) Very Satisfactory (mean score 3.24 – 2.50), 3) Satisfactory (mean score 2.49 – 1.75), and 4) Poor (mean score 1.74 – 1.00).

## 4. Results and Discussion

The needs assessment questionnaire results were the basis for developing the BSVs in teaching earthquakes. This was evaluated by the panel of evaluators and in-service teachers.

4.1 Needs Assessment of the Science Teachers

Six (6) public school science teachers were the respondents for the needs assessment. Table 1 provides teachers' responses during the needs assessment. Specifically, the questionnaire included was made up of questions relative to the teacher's comments such as the characteristics on the frequent videos they used and suggestions to improve the videos they utilized. The questionnaire undergone a thorough evaluation from the panel prior to implementation. Revisions were made based on the comments and suggestions from the panel. Lastly, the questionnaire was then administered to the teachers. The survey questionnaire helped the researcher identify what were the strengths and weaknesses of the existing videos for teaching earthquakes

The summary of responses of science teachers on the development of BSVs in teaching earthquakes is shown in Table 1. The following are videos utilized by KI1-KI6 in teaching earthquakes: foreign educational videos, localized video lessons, and documentaries. The table shows that the most mentioned code is foreign educational videos. This implied that most of the grade 6 teachers handling science utilize foreign educational videos such as Dr. Binocs Show, Da Vinci's Video, and Learn Bright Videos for Kids were making use of in teaching earthquakes. Key informants 1 and 5 mentioned that "In utilizing these videos helped us make understand the lesson but the problem they encountered is that the speaker in these videos talk too fast.

Table 1. Summary of Responses of Science Teachers

| | |
|---|---|
| What are the existing videos you utilized in teaching the topic on earthquakes? | -"Videos from YouTube such as Dr. Binocs Show (KI1, KI2, KI4, KI5, KI6)"<br>-"Da Vinci's Video (KI3)"<br>-"Learn Bright's Video for kids (KI1) (KI4)"<br>-"Localized interactive video lessons engages students actively, it enhances retention and understanding of the students about the topic, (KI1) (KI2), (KI5), (KI6)"<br>-"Teacher Jem's Video (KI3)"<br>-"Science 6 Video lesson (KI5, KI6)"<br>-"Documentaries offer real-world case studies that can help students understand the human and geographical context of earthquakes (KI2)".<br>-"I usually used the discovery learning so my students will be engaged in the teaching-learning process (KI5)."<br>-"I love inquiry-based learning because I wanted my students to observe and understand the concepts through hands-on activities (KI6)." |
| Are the existing videos adhered to Mayer's Principles of Multimedia? | -"Significantly yes, it enhances understanding and promotes deeper learning, fostering curiosity and excitement (KI4)."<br>-"Yes, since it is brief so it somehow follows but some principles were not observed (KI1) (KI5)."<br>-"Yes, it makes concepts simple, clear, and easy to remember (KI2)."<br>-"No. the videos consist of pictures not related to the topic. It just distracts the learners (KI3)"<br>-"No, the speaker talks too fast (KI1) (KI5) (KI4)."<br>-"Improvements are needed in length, design, language, and pacing (KI3) (KI6). |
| What is your suggestions that needs to be include in developing BSVs? | -"Contextualized videos and learning activities (KI1)."<br>-"More quality-assured localized video lessons that are readily available online and offline (KI2)".<br>-"Make the videos more interactive (KI5)"<br>-"Don't design the video with the usual classroom setting. Let the students feel like they are on a field trip (KI2)"<br>-"Encourage viewers to explore further by providing links to additional resources such as articles, websites, or online courses related to earthquakes and Earth science (KI3)." |

The existing videos were assessed to determine if they adhere to Mayer's principles of multimedia learning. The responses from teacher-respondents were analyzed to identify the strengths and weaknesses of the videos used by the teachers. Mayer (2017) proposed the following principles of multimedia learning: (1) multimedia principle; (2) coherence principle; (3) signaling principle; (4) redundancy principle; (5) spatial contiguity principle; (6) temporal contiguity principle; (7) segmenting principle; (8) pre-training principle; (9) modality principle; (10) voice principle; (11) personalization principle; and (12) image principle. Analysis of the table above revealed that four key informants observed strengths in the existing videos, noting that they effectively adhere to both the Multimedia Principle and the Coherence Principle. These videos were brief, provided clear understanding, and the concepts were simple and easy to remember, aligning with the characteristics of the Multimedia Principle and Coherence Principle (DeBell, 2019). With this foregoing information on the adherence to the Multimedia Principle, it could be said that the videos effectively combined text, images, and audio, which helps in better understanding and retention of information and the use of multimedia elements made the content more engaging and interesting for viewers (Parvin, et al., 2019). With the adherence to the Coherence Principle, the videos were observed to avoid extraneous information, focusing only on relevant content, which prevented cognitive overload, and thus, demonstrated simplicity and clarity. Furthermore, it showed brevity and this concise nature of the videos ensured that learners could grasp the concepts quickly without unnecessary distractions (Lang et al. 2020).

4.2 Validation of the Developed Bite-Size Videos in Teaching Earthquakes

The developed BSVs was evaluated by three (2) Science master teachers, two (2) Multimedia Specialists, and another two (2) ICT experts. Their comments and suggestions were considered for improving the learning material.

Table 2. Summary of Experts' Rating of the Developed BSVs in Teaching Earthquakes

| Components | Mean | Description |
|---|---|---|
| Content Quality | 4.00 | Excellent |
| Cognitive Load | 3.86 | Excellent |
| Engagement | 3.84 | Excellent |
| Technical Design | 3.93 | Excellent |
| Overall Average | 3.91 | Excellent |

Table 2 revealed that the content evaluators rated the developed BSVs in terms of content quality as "passed". This meant that the content of the BSVs were consistent with topics/skills found in the DepED Learning Competencies for Science and Grade 6 learners, developed contribute to enrichment, reinforcement, or mastery of the identified learning objectives, accurate, up-to-date, logically developed, and relevant to real- life situations. the engagement had the lowest rate but still excellent. Engagement was rated as satisfactory during the first evaluation due to the fact that (a) the pace of the video was not conducive to learning and (b) the teacher's voice and delivery was too fast. To address these issues, the researcher adjusted the pacing of the videos and recorded the voice over again in a normal pacing, clearer and more understandable way. As for the cognitive load, it had the second lowest rating because the initial BSV's background music used was high than the voiceover. Thus, in the revision, the back ground music were dropped to 50% to clearly hear the teacher's voiceover.

Meanwhile the rest of the components in the rubric were given high ratings as reflected in the mean values. Hence, the developed BSVs had an overall rating of Excellent. As compared to the previous ratings of the Panel of Evaluators, the revised developed BSV garnered higher ratings. The three factors namely; cognitive load, engagement, and technical design got an 'excellent' rating. This indicates that it can be utilized as an instructional material by the Grade 6 teachers in teaching the science concept on earthquakes to be able to describe the changes in the earth's surface. Overall, the developed BSVs adhered to Mayer's 12 Principles of Multimedia Learning. Some of which are, the Coherence Principle, which simply said, cut out the extras. The researcher and video editor used only information the learner absolutely needs. It was observed in the BSVs that it used simple text and visuals that relate directly to the learning topic. Next is the signaling principle by having slides or scenes that clearly separate sections. This was supported by DeBell (2019) when he mentioned the importance of signaling principle as separating sections in videos were quick and easy way to signal to the learner that they were moving on to the next topic. Next, the redundancy principle. It was mentioned by one of the learner-respondents that personally, she enjoyed reading text on screen. It helps her learn and reinforced the audio.

## 5. Conclusion and Recommendations

In summary, the Grade 6 teachers in charge of science disclosed that the existing videos on earthquakes were good but needs improvements. Also, the key-informants mentioned that the existing videos do not observe the principle of multimedia such as the personalization principle, image principle, and segmenting principle. Results revealed the needs to implement interventions, such as creating brief contextualized interactive video, ideally under ten minutes, a Filipino speaker who speaks with normal pacing and utilize simple words. The Bite-Size Videos (BSV) were developed following Luther's Model: concept, design, obtaining materials, assembly, testing, and distribution. All of which are associated with the Department of Education's K-12 Curriculum. The developed BSVs were evaluated by a panel of evaluators as 'Excellent' (M = 3.61) in terms of cognitive load, engagement, and technical design. Revisions were also made based on the suggestions of experts. Additionally, during the final evaluations of the revised BSVs, the

panel of evaluators, rated this teaching and learning tool an 'Excellent' rating (M= 3.91) in terms of content quality, cognitive load, engagement, and technical design.

To enhance the study, the following recommendations are presented. It will be recommended to be a tool for teaching science topics when proven beneficial in the case of the lesson earthquakes. Incorporate varied activities to actively involve students in learning. Design activities to assess students' initial understanding and address misconceptions or the least learned competencies. This BSV research work could be a reference to future researchers who may like to conduct other studies about learning instruction activities and learners' performance using the BSV approach.

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## Appendix

**Need assessment questionnaire**

The questions below pertain to your needs as a teacher in teaching the topics under the topic of earthquake. Your experience and opinions will be very much appreciated.

What are the pedagogical approaches that you have employed in teaching Earth and Space specifically the topic of earthquakes? Do you integrate videos in teaching the concept of earthquakes to the grade six learners?

What is/are the video/s that you utilized in teaching earthquake? What are the frequent videos you use? Can you rank your top 3 videos used? (Please attach the link of the video/s below)

What can you say about the videos that you utilized? Does it follow the Principle of Multimedia?

What are the problems that you have encountered in utilizing those videos (content and design) in teaching the concept of earthquakes?

Other comments/suggestions in terms of the content and design to be included in developing videos to teach the concept of earthquakes.

Do you think incorporating videos help in teaching earthquakes in enhancing the conceptual understanding of the students? Why?