DEVELOPMENT AND VALIDATION OF FLIPBOOK IN EARTH AND LIFE SCIENCE

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ABSTRACT

This paper focused on the development and validation of a Flipbook in Earth and Life Science, a Senior High School subject in the Philippine K-12 curriculum. Purposive sampling technique was employed in determining the validators of the essential learning competencies and the developed Flipbook. Using Lawshe's content validity formula, 28 out of 67 learning competencies in the subject were identified as essential based on the evaluation of ten subject matter experts who identified the content to be included. The developed Flipbook in Earth and Life Science consisted of twelve lessons and each lesson consisted of the following: a) overview of the lesson, b) learning objectives, c) pre-assessment, d) discussions, e) post-assessment, and d) references. A validation tool was used by eight (8) experts to evaluate the a) content, b) pedagogy, c) format, and d) technological factors of the developed Flipbook. Moreover, descriptive statistics was also used in analyzing the ratings of the experts. The Flipbook undergone revisions until all criteria has been satisfied. Results revealed that the Flipbook in Earth and Life Science is valid and acceptable in terms of content, pedagogy, format, and technological. The experts provided positive overview of the module. Therefore, the Flipbook in Earth and Life Science is generally commendable and can be used as a learning material or reference in teaching Earth and Life Science in Senior High School.

Keywords: Flipbook, electronic module, development, validation, earth and life science

INTRODUCTION

In education, Science is the linking field to technology, industry, and economic development. In the curriculum of the Philippine Educational System, Science education faces monumental change in terms of curriculum and approach as the system transformed into K to12 Enhanced Basic Education Program. One is the decongestion of the competencies and arrangement in spiral progression manner, and second is the introduction of the Senior High school (grades 11 to 12). The changes have been transpiring, and challenges come along such as deficiency in instructional and learning materials and low performances of students in science.

In Senior High School, Earth and Life Science is one of the subjects to be taken for 80 hours or 20 weeks as prescribed in the Enhanced Basic Education Act of 2013. The subject motivates Filipino students to pursue careers in Science, Technology, Engineering, and Mathematics (STEM) needed in building an internationally-competitive and innovative science nation and to promote scientific literacy and caters to the characteristics and preferences of the 21st-century learners (Dela Peña, Gracilla & Pangilinan, 2016).

However, Filipino students showed low performances in international and national studies (PISA, 2018 and Department of Science and Technology, 2011) and there are studies about the low performances in science. According to Natividad, Mangulabnan, and Canlas (2019), the unsatisfactory performances in Science are attributed to the large class size, limited learning resources, and the imminent shortage of classrooms throughout the country due to the

cramping of students every year in the public school (Dacumos, 2015; Dela Cruz, 2012). The deficiency of educational facilities (Salem & Alamarat, 2011) and instructional materials (Ogbu, 2015) threaten the learning process and passing rate of the students. Thus, the Department of Education addresses the concern in different ways through workshops and training in providing innovative teaching strategies and learning materials and, with the technology developing rapidly and continuously and using e-modules in distance learning are the new ways students learn and progress.

With the advancement of technology in recent times, different perspectives are needed to adapt to the trend and pace of cognitive development of the new-generation learners through interactive learning strategies using electronic learning modules. Aside from that, as the situation is demanding for the need to consider distance education, there is also the need for the creation of learning materials like e-modules.

At present, e-modules are widely integrated into the different disciplines and show positive impact on the learning process of students. One example of an e-module used in education is Flipbook multimedia or digital Flipbook (Mardikaningsih & Kurniasar, 2018). Flipbook multimedia or digital Flipbook is a learning media that is different from an ordinary printed book. It has interactive features for the students and supports various outputs and file format (.swf and .exe) or HTML. It is also a reliable software designed to convert PDF files to digital interactive publications (Flip builder, 2010).

The Cognitive Development theory of Piaget (1954) supports the concept of electronic modules and instructional materials. Piaget suggests that learners take an active role in the learning process when they observe and perform activities with the support of materials that enhance their understanding and creativity in a specific idea or knowledge. Another theory that supports the development of the electronic modules in the form of Flipbook is the Cognitive Theory of Multimedia Learning (CTML) (Mayer, 2014). It asserts that students learn more deeply from interactive pictures and activities rather than from words alone.

The utilization of an electronic module such as a digital Flipbook can significantly increase the memory and comprehension level of the students in understanding the different concepts in science. E-modules aid explanations and make the learning of the subject matter understandable and motivating to students during the teaching and learning process (Isola, 2010; Abdu-Raheem, 2014). With the various techniques in implementing the material, the teaching-learning process becomes innovative and captivating (Espinosa, 2018). It is expected that the module will benefit learners as interactive activities integrated into the e-module can recreate classroom learning settings and practical methods (Torrenfranca, 2017).

Aside from adding to the plethora of educational resources and assist teachers in presenting the lessons logically, sequentially, and innovatively, the Flipbook is expected to motivate students to understand the relevance of the environment to living things and increase performance and comprehension of learners in the said field. More so, since it is in electronic format, the Flipbook may be opened and used by learners at any place and at any time provided they have the needed device. Even if face-to-face learning shall be put in place again in the near future, e-modules like the Flipbook will not lose their viability as learning tools because the educational landscape is expected to change brought by the fast-evolving technologies and the changing needs of the society. The study used the framework in the development and validation of a digital Flipbook in Earth and Life Science which followed the Computer-Based Instruction (CBI) model. According to Priyanto (2007), CBI has three stages: development, validation and output.

OBJECTIVES OF THE STUDY

The study aimed to develop and validate Flipbook in Earth and Life Science for Senior High School. Specifically, the study sought to 1) develop a Flipbook in Earth and Life Science for Senior High School anchored on the identified essential contents; and 2) validate the developed Flipbook in terms of a) content, b) pedagogy, c)

design/format, and d) technical/technological factors.

METHODOLOGY

The study utilized Research and Development (R&D) design (Mayer, 2009). It is the methodical study of designing, developing, and evaluating instructional programs, processes, and products that must meet the criteria of internal consistency and effectiveness that supports technological advancement and innovations in education.

Purposive sampling was used to identify validators. This study had two sets of validators: the group which identified the essential content, and the group which evaluated the developed Flipbook.

The first set of validators comprised of ten subject matter experts who have been teaching earth and life science subjects for 5 to 20 years. They were responsible for the content validity of the electronic module using Lawshe's Content Validity method (Lawshe, 1975). The professional judgment of the experts was sought to gather evidence that will support the adequacy of the objectives and content of the Flipbook in Earth and Life Science. The experts utilized the DepEd curriculum guide and Most Essential Learning Competencies (MELCs) in judging the essential and not essential learning competencies in Earth and Life Science. The Content Validity Ratio was calculated using the formula CVR= (Ne - N/2)/ (N/2), where Ne represents the number of panelists indicating "essential," and N represents the total number of panelists.

When all panelists agree an item is "essential," the CVR will be 1.00 (adjusted to 0.99 in the Lawshe's table for ease of manipulation), and if none of the validators marks the item as "essential," the CVR will be 0. Therefore, the topic is rejected. A negative result and less than 50% of the experts rated the topic as essential, the item is also rejected (Lawshe, 1975).

The second set of validators comprised of eight members was responsible for evaluating the developed Flipbook in Earth and Life science utilizing the Evaluation Rating Sheet for DE and ODel module designed by the College of Education of Pampanga State Agricultural University (PSAU). Five subject matter experts in science education validated the pedagogy and content factors of the Flipbook, while three information and communication specialists validated the Flipbook for the format / design and technical / technological factors.

As this study used the Computer-Based Instruction (CBI) model as framework, the three stages of (1) development, (2) validation, and (3) output were followed (Priyanto, 2007).

In the development phase, the baseline module was created in the form of slides through MS PowerPoint. Each lesson included: (a) overview of the lesson which provided a summary of what is expected to be seen in the lesson; (b) learning objectives anchored on the identified essential learning competencies a learner should acquire after the lesson; (c) pre-assessment which determines learners' baseline knowledge about the concept; (d) discussions which comprised the activities and lessons aligned with the objectives; (e) post-assessment which measured learners' understanding of the concept and retention of gained information; and (d) references used in the lesson. To note, hyperlinks, animations, images, and interactive assessments were added to each lesson to entice the learners.

The baseline module was then converted into a portable data format (PDF) file; then, the file was converted into a flipbook using the Flip Builder pro 2.4.1 maker. The software mentioned was used to convert PDF files to a digital interactive publication (Flip Builder, 2010). The developed Flipbook was then subjected to validation. The Flipbook had to undergo revisions to address the observations and recommendations given by the validators.

RESULTS AND DISCUSSIONS

1. Development of the Flipbook

Table 1 reflects the phases involved in the development of Flipbook in Earth and Life Science: planning, designing, analysis and development. In the planning phase, learning materials, information and content for the Flipbook were gathered, and the software to be used was identified. In the designing phase, the layout or design, and the

parts of the Flipbook were determined. In the analysis phase, the essential learning competencies to be included were determined.

Table 1
Module development phases

Phases	Activities or Description
Planning phase	Gathering and examining learning materials in Earth and life Science
	Determining the software or application to be used in creating the electronic module in Earth and Life Science
Designing phase	Determining the lay-out or design of the e-module in Earth and Life Science.
	Determining the parts to be included in the e-module
Analysis phase	Content validation of the learning competencies in Earth and Life Science by experts using the Lawshe's method
Development phase	Creation of the electronic module using the Flip Builder pro maker based on the determined learning competencies

Initially, there were 67 learning competencies taken from the DepEd curriculum guide and Most Essential Learning Competencies (MELCs). However, only 28 were identified as essential after content validation was done by the subject matter experts. Although there were still 28 learning competencies, these were clustered based on the nature of the topic and 12 lessons were determined.

2. Validation of the Flipbook in Earth and Life Science for Senior High School

The validity of research is important to determine the suitability of the module developed. According to Lawshe (1975), the credibility of a module is determined based on the views of experts. The experts chosen shall have the qualifications and expertise in the language, education, technology, and modules. The researchers appointed five experts in science and three experts in ICT. The Flipbook in Earth and Life Science had undergone validation until all items in the tool were responded with "yes" by the validators. The researcher applied the experts' opinions, suggestions, and recommendations in the modification of the flipbook. The following table shows the results of the validation.

2.1 Content. Data presented in Table 2 shows the validation of the Flipbook as to content.

Table 2
Validation as to content

Factor 1: Content	First validation	
	Mode	DR
1. The topics/lessons included in the module are very relevant to the main goal of the course and greatly contribute to the achievement of the specific lesson objectives	5	agreed
2. The module provides information that are very important and useful to the students who will be utilizing it	5	agreed
3. Adequate information is being provided in every lesson with links and references included to guide students for further research activities	5	agreed
4. The content is presented clearly using language that is understandable and suited to the level of the target learners	5	agreed
5. The knowledge and ideas being presented in every unit are accurate, recent, and free from errors using terminologies that suit the distinct characteristics of the target learners	5	agreed
	n = 5	

Based on the results, it revealed that on the first validation, the five validators agreed that the flipbook met all the specific standards. Based on the validators' responses, the content of the module was adequate and accurate in information, clearly presented, recent, and relevant to the essential learning competencies identified. The good result is relevant as updated, accurate, and informative content of the module can increase and widen the understanding of learners in science (Ilma, Susanti, and Purnomo, 2020).

2.2 Pedagogy. Data presented in Table 3 presents the validation of the flipbook as to pedagogy. Based on the results during the initial

validation, the five validators agreed that the flipbook met the all the objectives except objective 2.6.

Table 3
Validation as to pedagogy

Factor 2: Pedagogy	first Validation		Second Validation	
	Mode	DR	Mode	DR
1. Objectives are well-formulated giving clear direction and establish a sense of expectancy among students	5	agreed		
2. Prior knowledge of students is properly assessed to bridge the gap between *what they already know* and *what they have to know*	5	agreed		
3. Various motivational and cognitive strategies are properly embedded in every lesson/unit to keep students on track	5	agreed		
4. Tasks or activities required in the module are very relevant to the main objectives of the course and lessons and must be realistic considering the resources available (e.g., time, materials, equipment, etc.)	5	agreed		
5. The module provides provision for individual differences by supporting diverse learners with different learning styles, preferences, interests, and experiences	5	agreed		
6. Assessment tools included ensure the development of higher- order thinking skills such as critical and creative thinking	4	not all agreed	5	agreed
7. The module also provides good feedback mechanism so learners can regularly receive formative feedback on learning (i.e., they can track their performance, monitor their improvement, test their knowledge)	5	agreed		
		n = 5		

One validator did not agree on the higher-order thinking development of the learners on the assessment part. Therefore, it was modified using Bloom's taxonomy to develop higher-order thinking evaluation and to ensure development in students' learning process. This was considered as using higher-order thinking assessment ensures the development of critical thinking of the learners. The researcher modified some questions in the pre-assessment and post-assessment following the higher-order thinking assessment skills (Limbach and Waugh, 2010). In the second validation, objective 2.6 was already satisfied. From that standpoint, it can be said that the assessment tools included in the flipbook ensure the development of higher-order thinking skills.

2.3 Design/Format. Table 4 flashes the validation as to format.

Table 4
Validation as to technical/technological aspect

Factor 4: Technical/Technological	First Validation	
	Mode	DR
1. Use of the module does not require equipment or applications beyond what is typically available to the students (e.g., operating systems, browsers, application software)	3	agreed
2. The module can be accessed by students either through the internet (online) or offline by providing them both hard and electronic copy (from CD, flash drive and other modes of transferring files)	3	agreed
3. The module can be embedded or fully integrated into a Learning Management System for wide dissemination and accessibility	3	agreed
4. The module has a user-friendly interface and navigational tools that even novice users can easily follow	3	agreed
5. The module provides students opportunity to interact with the teacher and other students through various communication tools provided such as email, messenger, video- conferencing etc	3	agreed
	n = 3	

All validators agreed that the flipbook met the standard in objectives 3.1, 3.3, 3.4, and 3.5 in the first round of validation. Validator 1 said that the flipbook was sequentially organized, and graphics were motivating with the use of the hyperlink and captivating images {*it is good that you used hyperlink and pictures because these motivate the students to listen and learn*}. Validator 2 said that the module was labeled neatly, and easy to understand with clear directions {*easy to follow, and easy to click the buttons*}. However, Validator 3 stated on the first validation that some lessons were congested and suggested to observe proper spacing. With the observations of Validator 3, the Flipbook was revised and during the second validation, all validators agreed that the flipbook met all the objectives as to format/design.

Table 4 highlights the validation as to technical/technological factor. The three validators agreed that the flipbook met the specific objectives in the mentioned factors. The flipbook is easy to use and, learners can open the e-module without any other application. The validators considered the Flipbook useful in distance learning and can be provided to learners via e-mail or through USBs and can be opened offline with Validator 1 saying {*this is a helpful module that we can use in online classes and modular classes, also we can send it through different modes like online and offline*}. Therefore, Flipbook provides an interactive tool in distance learning.

CONCLUSIONS

Based on the findings of the study, the following conclusions are hereby presented:

1. The Flipbook in Earth and Life was developed following the Computer-based Instruction Model as guide and the software Flip Builder pro 2.4.1 as platform. The contents were identified by considering the essential learning competencies evaluated by the ten experts using the Lawshe's content validity ratio (CVR).
2. The Flipbook in Earth and Life Science was validated by Science and ICT experts in terms of a) content, b) pedagogy, c) format, and d) technical/technological. The validators agreed to all the items pertaining to the factors for validation which means that the module satisfies the features as a learning material.

It is therefore concluded in this study that the developed Flipbook in Earth and Life Science is acceptable and valid as a learning material for Senior High School.

RECOMMENDATIONS

Considering the conclusions drawn from the study, the following are recommended:

1. The digital flipbooks may be incorporated in the teaching and learning process to motivate learners and enhance the learning skills and critical thinking of the learner.
2. The digital flipbooks can be used in different subjects or disciplines to encourage students to use technology for learning.
3. The Flipbook in Earth and Life Science can be further evaluated in terms of its usage and effectiveness using experimental design.

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