Development and Acceptability of E-module for Flipped Classroom

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ABSTRACT

This design research aimed to develop an e-module as a tool for Mathematics in the Modern World in a flipped classroom model. The respondents of this study were first-year college students for the researcher-made test, acceptability of the e-modules and interview, and five experts for the evaluation of the acceptability of the e-module. The data-gathering instruments were a researcher-made test, students' and experts' evaluation questionnaires, and interviews. Data analysis techniques employed were frequency count, percentage, mean, standard deviation, and thematic analysis. The study revealed that there were eight least learned lessons of first-year college students in Mathematics in the Modern World. The developed e-module in Mathematics in the Modern World has the following parts: title, learning objectives, overview, discussion, references, evaluation activity, answer key, checkpoint, and the key to correction. The acceptability of the developed e-modules as evaluated by the experts and the students in general and in terms of different criteria was rated "Highly Acceptable". Furthermore, the students agreed that the e-module was unique and innovative, provided immediate feedback, flexible, and effective. Thus, the e-module indeed served its purpose to cater to the needs of the 21st-century learners of a technology-enhanced instructional material that is flexible, innovative, interesting, and acceptable which would facilitate their construction of knowledge through videos and coming to class prepared in a flipped classroom model. It is recommended that further research be conducted to ascertain the effect of the developed e-module on students' academic performance and develop more e-modules for relevant subjects.

Keywords: *E-module development, E-module, Mathematics in the Modern World, Design research, Flipped classroom*

INTRODUCTION

The use of technology in education has become imperative and inevitable, not a luxury because of its positive effects on the teaching and learning process (Ja'ashan, 2015). Since technology has become an integral part of our lives, it has penetrated all areas of teaching and learning at the Higher Education level. Education (more so math education) is in the midst of a change driven by technological development. Technology is entering many facets of math teaching and learning. Technology is a valuable tool in the teaching and learning of mathematics, for it can empower mathematics students as well as Mathematics instructors.

Siemens, Gašević, and Dawson (2015) discussed that education technology has gone through three distinct generations of development and now a fourth is emerging. This fourth-generation includes distributed and digitally shaped technologies: adaptive learning, distributed infrastructures, and competency models. Greater emphasis will be placed on the process of 'stitching' together distributed interactions with learners who control their preferred toolsets. Video in education is one element of those 'distributed interactions' and the role that video plays within education, and how that role develops was explored in this study. Bransford, Brown, & Cocking (2000) discussed the use of video in the classroom and the importance of interactivity in helping students to learn by being able to re-visit and review the material. They emphasized the potential of technology to help to learn, but only if it is used properly. Day (2008) found that video usage can be a way to decrease the in-class time spent on information

transfer and increase the in-class time available for more engaging learning activities that facilitate learners' active knowledge construction.

Mathematics in the Modern World, as a new general education subject of CHED (Commission on Higher Education) based on CMO No. 20. s. 2013 needs learning resources such as books and modules. Although there are some developed modules like that of Navejas (2017) that integrates Pedagogical Content Knowledge (PCK) in her module of the said subject and that of Fernandez (2018) that utilizes the module to address the anxiety of students in mathematics, there are few available resources that utilize videos and other audio-visual materials for the aforementioned subject because it is a newly implemented subject of CHED. Thus, the researcher pursued the development of e-modules in the form of videos as a tool for the flipped classroom for the learners of the 21st century.

Hence, this study aimed to develop e-modules that were compilations of videos for selected topics in *Mathematics in the Modern World - (MMW)* in response to the demand of 21st-century students of technology-enabled learning material in a flipped classroom model. E-module can be defined as a digitalized module created interactively. It can also be regarded as a medium for independent learning because it is equipped with self-study guides. Unlike the usual modules, e-modules present videos and animations to enable users to learn actively. Using an e-module is one way of integrating ICT in the learning process. By developing the e-module, it is expected that students can learn the material easily, effectively, and efficiently (Fajaryati, et al., 2017).

In line with this, most of the learners of the 21st century prefer to learn the content in their respective subjects with the use of computer technology. As recommended by The Partnership for the 21st Century learning (2015), curriculum and instruction should enable innovative learning methods that integrate the use of supportive technologies, inquiry- and problem-based approaches, and higher-order thinking skills because we live in a technology and media-suffused environment. According to Wondergem (2017), why would the students be inclined to sit through a long lecture, when they can watch the same content through multiple engaging podcasts or videos? How can we engage these learners without compromising the educational process? These are pressing questions to educators that challenged the teachers today on how to create, evaluate, and effectively utilize media and technology to better facilitate learning in this generation of technology-savvy learners. This is now the time where flipped classrooms as one of the emerging strategies in teaching the 21st-century students come in.

A flipped classroom is one where students are introduced to the content at home, and practice working through it at school. In this blended learning approach, face-to-face interaction is mixed with an independent study via technology. Students watch pre-recorded videos at home, then come to school to do the homework armed with questions and at least some background knowledge. This doubles student access to teachers–once with the videos at home, and again in the classroom, increasing the opportunity for personalization and more precise guiding of learning. In the flipped classroom model, students practice under the guidance of the teacher, while accessing content on their own (Teach Thought Staff, 2016).

Proponents of flipped classrooms assert that increased student-teacher interactions give teachers more opportunities to provide feedback to students. For example, a small pilot study funded by the Gates Foundation observed that during a five-week summer school program in which students received instruction through the Khan Academy website along with support from a teacher, the teacher spent significantly more one-on-one time with students than she had in her traditional classroom; thus, she was able to provide more feedback and immediately correct student misperceptions (Greenberg, et al., 2011). Moreover, Karabulut-Ilgu, et al., (2017) cited some benefits of flipped learning as follows: Flexibility – students could be able to rewatch the lecture videos. They could pause and rewind the videos, take notes, and solve

example problems while watching the lecture videos. Having access to course materials for 24/7 provided flexibility for students with different learning preferences and personal commitments; Student engagement – researchers found that students came to class better prepared and they devoted more time and formed better study habits compared to traditional classroom approaches; and Class attendance – although the findings in terms of class attendance varied, some researchers found that the flipped format increased attendance and retention rate.

For the flipped classroom to materialize and help cater to the varied learners of today, the teacher must have developed a pre-recorded video lecture or module for students' personal use at home to gain background knowledge. Traditional educational practices require a thoughtful change to meet the needs of this generation. They want to be part of the process of learning, not passive bystanders. They are resourceful learners whose attention span is hindered by a constant bombardment of information.

This study is anchored on the e-learning theory of Mayer & Moreno (2007) and Sweller (2005) as cited by David (2015) that consists of cognitive science principles that describe how electronic educational technology can be used and designed to promote effective learning. Another foundation of this study is based on Anchored Instruction (Bransford, Sherwood, Hasselbring, Kinzer, & Williams, 1990) that involves the use of an "anchor" material or media, often a video, to create a shared experience among learners and a beginning point for further learning on a topic.

Furthermore, constructivism is also evident in this study. This is a learning theory asserting that individuals form or construct much of what they learn and understand (Schunk, 2012). In constructive learning theory, learners do not transfer knowledge from the outside world into their memories but they build personal meanings and interpretations based on experiences and interactions (Ertmer & Newby, 1993). When deploying video and considering its educational effect, it can be helpful to keep the constructivist perspective clearly in focus to ensure that the student is assisted in taking an active role in constructing the relevant knowledge. The process involved and variables are presented in the following paradigm.

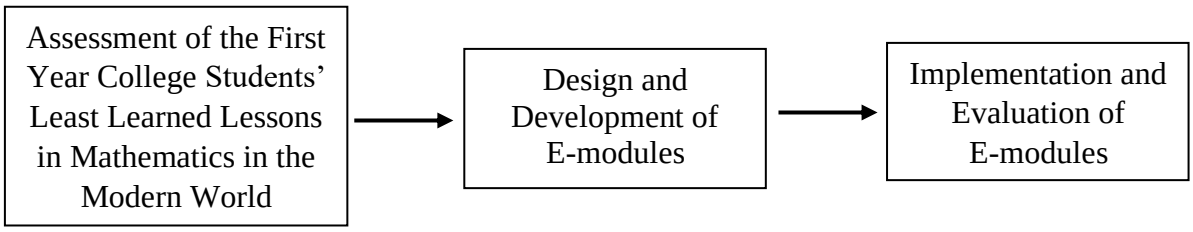


Figure 1. Paradigm of the study on the development and evaluation of the e-modules.

Statement of the Problem

Specifically, this study aimed to answer the following questions: (1) What are the least learned lessons of first-year college students in Mathematics in the Modern World?; (2) What instructional materials can be developed to cater to the least learned lessons of first-year college students in Mathematics in the Modern World?; (3) What is the level of acceptability of the developed e-module as a tool for the flipped classroom in terms of (a) Learning Objectives; (b) Content; (c) Organization and Presentation; (d) Format and Design; (e) Learning Activities; and (f) Assessment as evaluated by the experts and students?; and (4) What are the experiences of the students in using the e-module?

METHODOLOGY

This study utilized design research using the Analysis-Design-Development-Implementation-Evaluation (ADDIE) Model of McGriff (2000) as its research design because it aimed to develop and evaluate an e-module as a tool for the flipped classroom. Of the two purposes of design research, this study utilized developmental studies that purport to develop research-based solutions for complex problems in educational practice. This type of design research is defined as the systematic analysis, design, and evaluation of educational interventions with the dual aim of generating research-based solutions for complex problems in educational practice, and advancing our knowledge about the characteristics of these interventions and the processes of designing and developing them (Plomp, 2013).

Since this study focused on the design, development, and evaluation of e-modules in the form of videos based on the least learned lessons of the students in the subject Mathematics in the Modern World, design research was an appropriate research design.

Respondents of the Study

This research involved 77 students from the three randomly selected intact classes of first-year college students of the three colleges and schools of the Aklan State University which offered the subject MMW – Mathematics in the Modern World in the first semester AY 2018-2019 for the assessment of the least learned lessons using the researcher-made test. Also, 113 Bachelor of Secondary Education (BSEd) students of the College of Teacher Education of the same university were the participants of the tryout of the developed e-module and the student respondents for the evaluation of the acceptability of the said e-module because they were currently taking the subject during the conduct of the study. Four BSEd students, one from every area of specialization namely: Mathematics, English, Science, and Social Studies were chosen for the interview about their experiences in using the e-module. Every specialization has a representative in the study to ensure the heterogeneity and adequacy of the respondents. Cluster sampling was used in this study to select the respondents randomly. Five experts in the field of educational technology and information technology, mathematics instructors handling the subject MMW, curriculum development and instructional materials development, and teacher implementers of the e-module were likewise included as respondents for the evaluation of the acceptability of the e-module.

Research Instruments

Researcher-made test for *Mathematics in the Modern World*, students' and experts' evaluation questionnaire on the acceptability of the e-module, and interview schedule were the instruments used in this study. These instruments were validated by experts excluding those who evaluated the acceptability of the e-modules, depending on the nature of the instrument. The researcher-made test was a 50-item multiple-choice test administered to first-year college students who have taken the subject to determine the least learned lessons. These least learned lessons were the basis for developing acceptable e-modules to improve students' performance in these lessons. It was pilot tested to establish its reliability and was found reliable with a reliability coefficient of .87. In addition, the students' and experts' evaluation questionnaire was a Likert scale type to evaluate the acceptability of the e-module. It was found out to be reliable with a reliability coefficient of .89. Kuder-Richardson 20 or KR 20 was used to analyze the internal consistency reliability of the researcher made test while Cronbach's alpha was used for the students' and experts' evaluation questionnaire. The interview schedule was used to guide the researcher in interviewing to solicit the experiences of the students in utilizing the e-modules after the tryout.

Data Gathering Procedure

The process of gathering pertinent data in this study was based on the ADDIE model. Figure 2 below the shows each phase in the procedure.

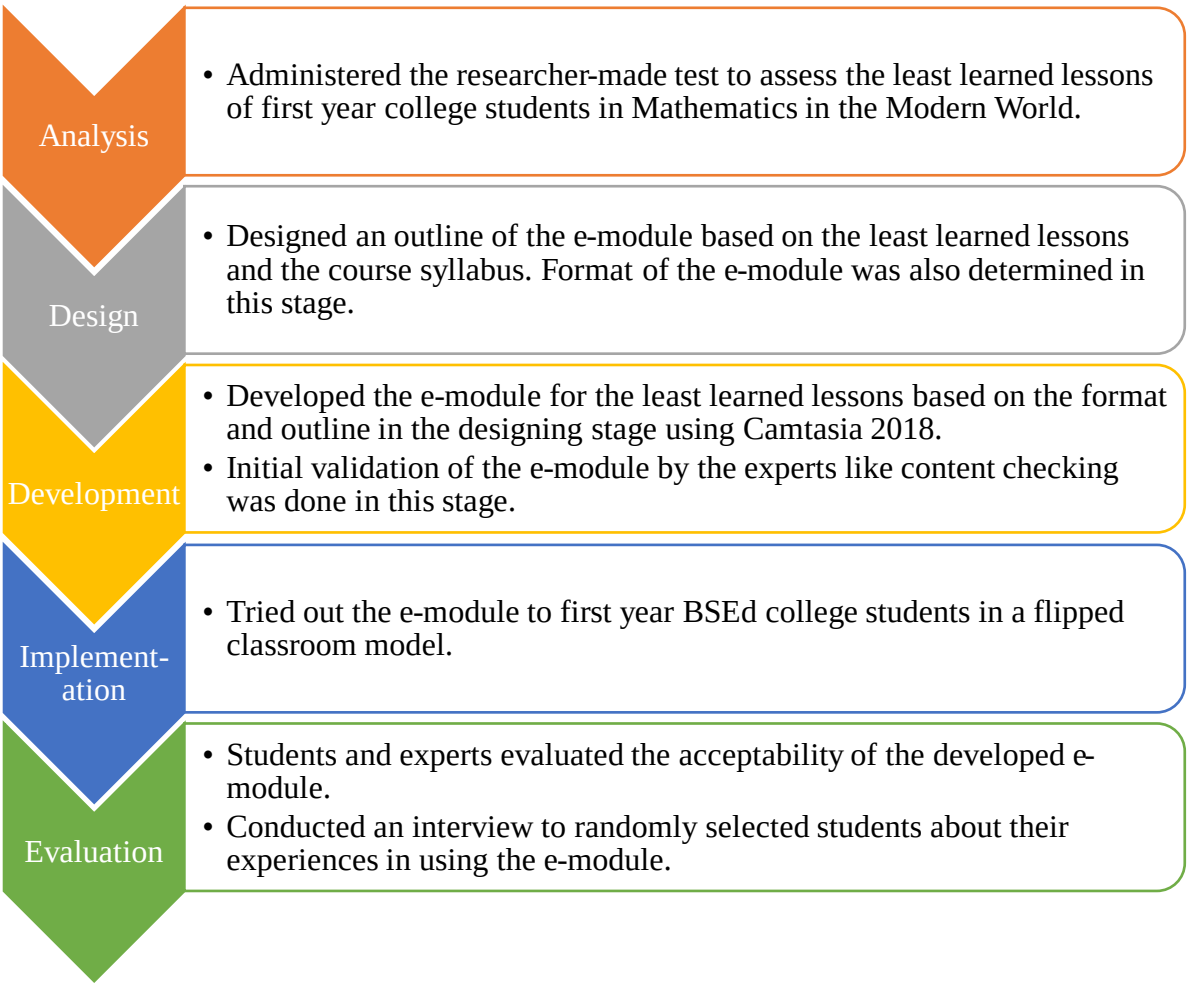


Figure 2. The research procedure on the conduct of the study.

Data Analysis

Moreover, descriptive statistics namely frequency count, percentage, mean, and standard deviation were employed to analyze and interpret quantitative data. Thematic analysis was used to analyze qualitative data.

RESULTS AND DISCUSSION

The study revealed the eight least learned lessons of first-year college students in *Mathematics in the Modern World* as shown in Table 1.

The least learned lessons of first-year college students for the first four chapters of MMW were the following: In chapter 1, the two least learned lessons were "Patterns and Numbers in Nature and the World" showing only 44 or 57.14% of the students answered the items in this topic correctly and "The Fibonacci Sequence" where 56 or 72.73% of the students answered the items correctly. For the second chapter, the number one least learned lesson is "Elementary Logic: Negation, Connectives and Quantifiers" showing 29 or 37.66% of the respondents answered the items correctly while the second least learned lesson in this chapter is "Expressions, Sentences and Variables" where 36 or 46.75% of the respondents answered

the items correctly. For chapter 3, "Inductive and Deductive Reasoning" and "Polya's Four Steps in Problem Solving" were the two least learned lessons in this chapter where 24 or 31.17% for the former and 43 or 55.84% for the latter, of the students, answered the questions in these topics accurately. Lastly, in chapter 4, the bottom two least learned lessons were "Measures of Dispersion" and "Probability and Normal Distribution" showing 10 or 12.99% and 16 or 20.78% of the students answered the items in these two topics correctly. The ones with ranks 1 and 2 were considered as least learned lessons per chapter.

Due to the low performance of the students in the least learned lessons as disclosed in Table 1, the researcher developed an e-module is a form of video with corresponding activity sheets per module, as a tool for the flipped classroom model. This supports the findings in the study of Fajaryati, et al., (2017) that by developing the e-module, it is expected that students can learn the material easily, effectively, and efficiently. In addition, Day (2008) found that video usage can be a way to decrease the in-class time spent on information transfer and increase the in-class time available for more engaging learning activities that facilitate learners' active knowledge construction.

Furthermore, the developed e-module in Mathematics in the Modern World has the following parts: title, learning objectives, overview, discussion, references, activity sheet, and answer key as shown in figure 3. Moreover, it has two distinct features that were included in the e-modules namely the checkpoint and key to correction, that helped students reflect on their progress.

The e-modules were in video format that could be played by the students using their smartphones, laptops, or tablets. These ranges from 30 – 40 minutes depending on the lesson tackled. Students could just listen and watch the videos then answer the questions after a subtopic was discussed to check their understanding. They could pause and play the video whenever they want, hence making it flexible.

Table 1. Least Learned Lessons in Mathematics in the Modern World

Topic	*f* (correct responses)	n	%	Rank
Chapter 1 – Mathematics in Our World				
1. Patterns and Numbers in Nature and the World	44	77	57.14%	1
2. Fibonacci Sequence	56	77	72.73%	2
3. Mathematics for organization, prediction, control, and as an indispensable tool	58	77	75.32%	3
Chapter 2 – Mathematical Language and Symbols				
1. Expressions, Sentences and Variables	36	77	46.75%	2
2. Four Basic Concepts: Sets, Functions, Relations, and Binary Operations	38	77	49.35%	3
3. Elementary Logic: Negation, Connectives and Quantifiers	29	77	37.66%	1
Chapter 3 – Problem Solving and Reasoning				
1. Inductive and Deductive Reasoning	24	77	31.17%	1
2. Polya's Four Steps in Problem Solving	43	77	55.84%	2
3. Problem Solving Strategies	45	77	58.44%	3
4. Mathematical Problems Involving Patterns	55	77	71.43%	5
5. Recreational Problems Using Mathematics	46	77	59.74%	4
Chapter 4 – Data Management				
1. Gathering, Organizing, Representing, and Interpreting Data	69	77	89.61%	6
2. Measures of Central Tendency	40	77	51.95%	4
3. Measures of Dispersion	10	77	12.99%	1
4. Measures of Relative Position	50	77	64.94%	5
5. Probability and Normal Distribution	16	77	20.78%	2
6. Linear Regression and Correlation	18	77	23.38%	3

This format is in accordance with the statement of Acuram (2015) that the format and style of a module may differ depending on its purpose and the institution where it is developed. Basically, the components of each module should be title, overview, objectives, discussion of content, self-check test, and evaluation activities, and references. It also follows the list of components of a typical module enumerated by Aguirre & de Cadiz (2013) which includes the title, overview, objectives, learning activities, and post-test.

The figure below exposes the necessary parts of the developed e-module.

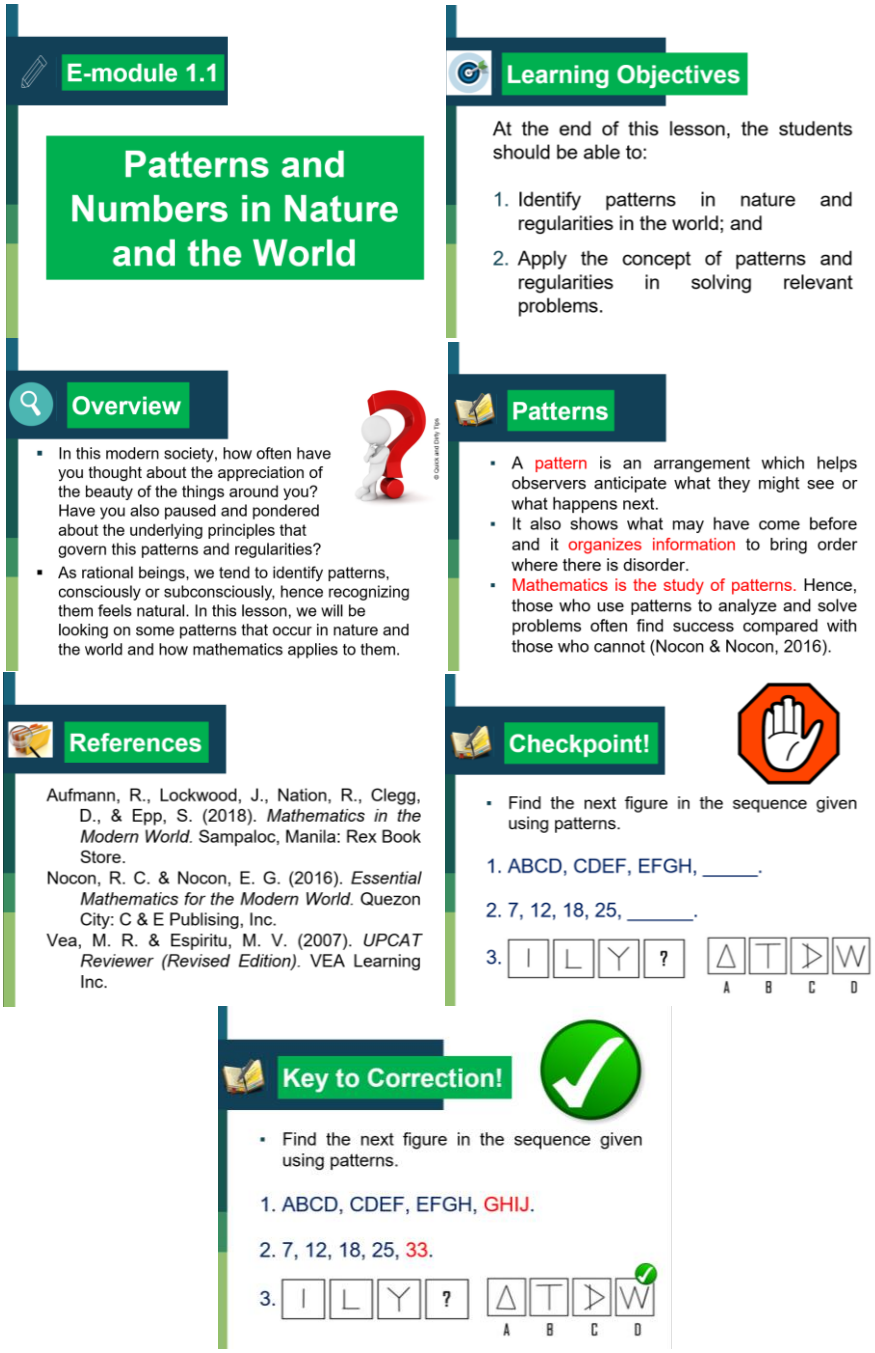


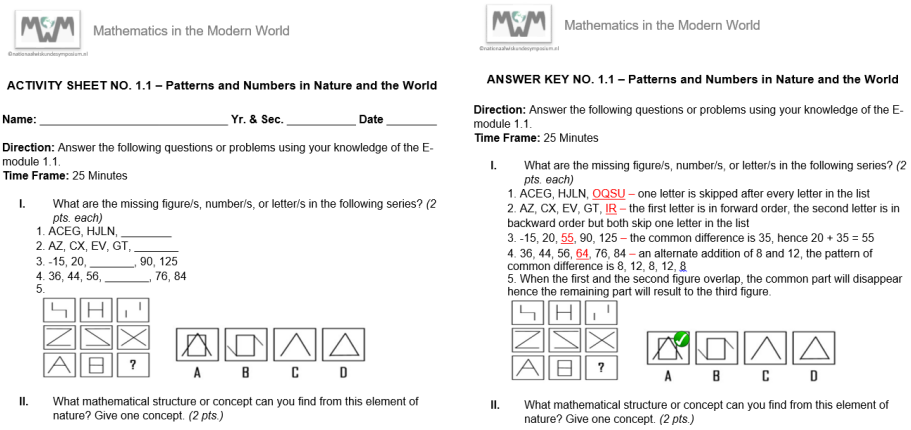
Figure 3. The necessary parts of the e-module.

Different e-modules were tried out to different sections to maximize the validity of the students' evaluation of the acceptability of the e-module. For the BSEd students majoring in Mathematics, e-module 1.1 or "Patterns and Numbers in Nature and the World" was utilized;

e-module 1.2 or "The Fibonacci Sequence" was used for the BSEd students majoring in Social Studies; for the BSEd students major in English, e-module 2.2 or "Expressions, Sentences, and Variables" was used; and e-module 3.1 or "Inductive and Deductive Reasoning" was utilized for BSEd students major in Science.

These e-modules were given to the students a day before the face to face instruction for them to watch the videos at home. During the actual class, they were encouraged to ask questions to clarify their understanding of the videos and the teacher acted as a facilitator. After a short discussion, worksheets were given as forms of assessment whether they learned the concepts from the watched e-modules.

Figure 4 shows an example of an activity sheet to be performed by the students in the classroom in a flipped classroom model. A sample answer key is also provided for the teachers to guide them on how to check the works of the students.



Mathematics in the Modern World

ACTIVITY SHEET NO. 1.1 – Patterns and Numbers in Nature and the World

Name: _____ **Yr. & Sec.** _____ **Date** _____

Direction: Answer the following questions or problems using your knowledge of the E-module 1.1.
Time Frame: 25 Minutes

I. What are the missing figure/s, number/s, or letter/s in the following series? *(2 pts. each)*
1. ACEG, HJLN, _____
2. AZ, CX, EV, GT, _____
3. -15, 20, _____, 90, 125
4. 36, 44, 56, _____, 76, 84
5.

A B C D

II. What mathematical structure or concept can you find from this element of nature? Give one concept. *(2 pts.)*

Mathematics in the Modern World

ANSWER KEY NO. 1.1 – Patterns and Numbers in Nature and the World

Direction: Answer the following questions or problems using your knowledge of the E-module 1.1.
Time Frame: 25 Minutes

I. What are the missing figure/s, number/s, or letter/s in the following series? *(2 pts. each)*
1. ACEG, HJLN, OQSU – one letter is skipped after every letter in the list
2. AZ, CX, EV, GT, IR – the first letter is in forward order, the second letter is in backward order but both skip one letter in the list
3. -15, 20, 55, 90, 125 – the common difference is 35, hence 20 + 35 = 55
4. 36, 44, 56, 64, 76, 84 – an alternate addition of 8 and 12, the pattern of common difference is 8, 12, 8, 12, 8
5. When the first and the second figure overlap, the common part will disappear hence the remaining part will result to the third figure.

A B C D

II. What mathematical structure or concept can you find from this element of nature? Give one concept. *(2 pts.)*

Figure 4. Sample activity sheet and answer key.

It was also found out that the acceptability of the eight developed e-modules as evaluated by the experts and the students in general and in terms of learning objectives, content, organization, and presentation, format, and design, learning activities, and assessment was rated "Highly Acceptable". Table 2 shows the overall acceptability of the eight developed e-module.

As to the overall acceptability of the e-module, it has an overall rating of "highly acceptable" (M = 4.75, SD = 0.06). This shows that the e-module has excellently met the standards and no revision is needed. In particular, the students have rated the assessment part as the highest with a mean of 4.87 and SD of 0.27. Also, for the experts, the learning objectives obtained the highest rating (M = 4.80, SD = 0.45). In terms of the average mean, the highest rating was attributed from the learning objectives (M = 4.83, SD = 0.04) but the lowest rating was accounted from format and design (M = 4.66, SD = 0.15) yet both were highly acceptable.

In general, the overall rating of the students in terms of overall acceptability was "highly acceptable" (M = 4.83, SD = 0.03) and a similar overall rating of "highly acceptable" was found out from the experts (M = 4.68, SD = 0.09).

Based on the result, the respondents agreed that the e-module is highly acceptable in terms of learning objectives, content, organization and presentation, format and design, learning activities, assessment, and in terms of its overall rating. This implies that the developed e-module is worthy and can serve as an instructional material in a flipped classroom model that will help students learn at their own pace.

This result is under the study of Robles (2009) who cited that the development of the learning package was found to be reliable as revealed by the high percentage obtained in the strongly agree category of the instrument. The developed Computer Assisted Learning Package

(CALP) was valid as to its objective, contents, manner of presentation, and usefulness and therefore could be used as instructional material for enrichment and remediation.

Table 2. Overall Acceptability of the Eight Developed E-modules

	Students		Experts		*SD*	*Mean*	*Description*
	M	*SD*	*M*	*SD*			
Learning Objectives	4.85	0.23	4.80	0.45	0.04	4.83	Highly Acceptable
Content	4.83	0.23	4.72	0.52	0.08	4.77	Highly Acceptable
Organization and Presentation	4.83	0.23	4.60	0.79	0.16	4.71	Highly Acceptable
Format and Design	4.77	0.30	4.56	0.77	0.15	4.66	Highly Acceptable
Learning Activities	4.82	0.24	4.72	0.63	0.07	4.77	Highly Acceptable
Assessment	4.87	0.27	4.68	0.72	0.13	4.78	Highly Acceptable
Overall Rating	4.83	0.03	4.68	0.09	0.06	4.75	Highly Acceptable

Note: Description is based on 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 addition, the students' experiences in using the e-module were the following: the e-module was unique, innovative, and easy to understand that makes it interesting and exciting; it has immediate feedback because of the presence of practice exercises to check their progress, and it is an effective and flexible instructional material that helps students learned the lessons seamlessly.

They asserted that the e-module was interesting and exciting to learn with because it was easy for them to comprehend the e-module.

> Jay further added, *"Easy and interesting sir, kasi ano sir… mahambae ko nga easy kasi kung tutuusin abi sir hay mas madali akong makaeubot kato sa e-module kaysa sa ginadiscuss it teacher sir…"* (It was easy and interesting because actually, I can comprehend easily the e-module compared to the actual discussion of the teacher…).

In fact, the presence of the checkpoint section and an explanation after that part made the e-module student-friendly as what Anne told the researcher. The conversational tone of the e-module conveyed the social presence of the teacher which guided the students well in learning the lesson.

> Anne: *"Ahm… by just looking at the video sir, it really… it is like a friendly type of module which is… may mga checkpoint like for example… they are describing a specific term in mathematics, then provide examples, then later on it will give short… activities in order for the student to evaluate how he or she will going to know and understand the given lesson…"* (By just looking at the video, sir, it's really a friendly type of module which contains checkpoints like for example describing a specific term in mathematics, then examples are provided, then later on it will give short activities in order

for the students to evaluate how much he/she have understood the given lesson).

These results conform to the quantitative analysis because the students have rated the learning activities and assessment part of the e-module as highly acceptable, suited to the level of the students. Moreover, these statements support the findings of Cox (2017) that students prefer technology because they believe that it makes learning more interesting and fun. Subjects that students deem challenging or boring can become more interesting with virtual lessons, through a video, or when using a tablet.

Furthermore, these findings agree with the result of the study of Nardo & Hufana (2014) that the exposure of the students to appropriate activities heightened their understanding. The result implies that the activities in the modules were suitable for the students. The concepts that were presented were deepened by the tasks that the students worked on. It also substantiates the recommendation of Woolfitt (2015) that videos should incorporate active elements (such as quizzes) or be combined with other learning activities.

Like with any medium, the content and message of a video has to be constructed well in order to support learning. Sometimes text or images are a better format for conveying information, such as for comparing multiple examples or dense, detailed content that learners will need to revisit repeatedly.

CONCLUSIONS

Some students still struggle in the subject Mathematics in the Modern World as evinced by their least learned lessons since it's a new subject in the revised general education courses. The e-module which was not only consists of the basic parts such as learning objectives and discussion but also contains distinct features namely, checkpoint and key to correction, helped students reflect on their learning progress through self-assessment.

The e-module has excellently met the standards and no major revision is needed as reflected in the evaluation by the experts and the students. The learning objectives, content, organization and presentation, format and design, learning activities, and assessment were acceptable for the intended users.

Thus, the developed e-module is fitted to help the students learn the concepts in the subject Mathematics in the Modern World easily. The e-module indeed served its purpose to cater to the needs of the 21st-century learners of a technology-enhanced instructional material that is flexible, innovative, interesting, and acceptable which would facilitate their construction of knowledge through videos and coming to class prepared in a flipped classroom model.

IMPLICATIONS

The findings of this study have led to certain implications for both theory and practice.

For theory, the results of this study affirmed that by developing the e-module, it is expected that students can learn the material easily, effectively, and efficiently (Fajaryati et al., 2017). Furthermore, the findings also attested what Day (2008) found out that video usage can be a way to decrease the in-class time spent on information transfer and increase the in-class time available for more engaging learning activities that facilitate learners' active knowledge construction. It also affirms the findings of Cox (2017) that students prefer technology because they believe that it makes learning more interesting and fun. Subjects that students deem challenging or boring can become more interesting with virtual lessons, through a video, or when using a tablet.

For practice, the results of this study revealed that the developed e-module composed of videos and activity sheets was highly acceptable for the students and the experts as indicated by the quantitative analysis. It was also validated by the students in their experiences in using the e-module as they agreed that the said instructional material is interesting, exciting, easy to

understand, flexible, innovative, and consequently an effective aid in learning. This result was aligned to the stand of Bishop & Verleger (2013) that the flipped classroom approach allows students to learn at their own pace, as they can stop, backtrack, and review while watching videos. Motivation appears to increase when students know that they need to apply or discuss the out-of-class content during face-to-face class time.

Since we are now in the digital age, teachers and other educators have to take this idea into consideration when it comes to instructional material development. This is supported by Day (2008) that in "light of contemporary learning theory, the traditional one-to-many lecture still prevalent in most classrooms is arguably not the most educationally effective" (p. 19). This statement can be attributed largely to the inherent lack of learner engagement in often passive lecture settings. Lengthy lectures that transmit large amounts of information are less and less matched to current student learning desires. Hence, technology-enhanced instructional materials like the e-module in the form of videos paired with an innovative flipped classroom strategy are one of the new trends today.

When deploying video and considering its educational effect, it can be helpful to keep the constructivist perspective clearly in focus to ensure that the student is assisted in taking an active role in constructing the relevant knowledge. Consequently, the use of e-modules in a flipped classroom should be built on a constructivist perspective and must be therefore learner-centered.

RECOMMENDATIONS

Hence, it is recommended that teachers are encouraged to create, develop, and utilize technology-based instructional tools and strategies to provide interesting and meaningful experiences to the learners.

Students, being the main beneficiaries of the study, may not confine their learnings within the four walls of the classroom; instead, they may explore other means of learning the subject like in the flipped classroom model where lectures can be done at home in the form of videos.

School administrators, specifically those in the higher education institutions, may develop projects, such as instructional materials development and enhancement pieces of training for teachers in terms of pedagogy and instructional materials design since these elements play a crucial role in improving students' learning and achievement. The school can tap the curriculum planners and designers of the institution to plan pieces of training and seminars especially in the integration of technology in teaching through innovative instructional materials so as to cater to the needs of the 21st-century learners.

Policymakers may investigate the suitability of the instructional materials to the level and needs of the students in this new generation thereby finding means to integrate technology in the teaching and learning process.

Textbook writers may consider using e-modules in the form of videos as supplementary materials aside from the textbooks that they are publishing to better facilitate learning in this technology-suffused education system.

More in-depth research on the e-module developed in this study to ascertain the effectiveness of this instructional material composed of videos is very much encouraged.

Acknowledgment

The author would not have been able to complete this research without these amazing and inspiring individuals who supported him in this feat.

His deepest gratitude to the Department of Science and Technology led by Sec. Fortunato T. dela Peña and the DOST-Science Education Institute (DOST-SEI) headed by Dr. Josette T. Biyo for the research fund granted to him through the Capacity Building Program in Science

and Mathematics Education (CBPSME). Without all the assistance from DOST, he would not have finished this research study.

A big thanks also to his research adviser, Dr. Roberto G. Sagge Jr., who has become one of his biggest helping hands all throughout this research endeavor. He is thankful to have an adviser who never fails to motivate him even in times when he feels like giving up. The researcher also wants to thank him for sharing his research materials and his valuable time, insights, and ideas.

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