Contextualized Learning Module_Madrazo & Dio.edited version1

by Ryan V Dio

General metrics

74,819	10,181	785	40 min 43 sec	1 hr 18 min
characters	words	sentences	reading time	speaking time

Score

This text scores better than 84% of all texts checked by Grammarly

Writing Issues

388	15	373
Issues left	Critical	Advanced

Writing Issues

4	**Clarity**	
4	Wordy sentences	
15	**Correctness**	
9	Unknown words	
3	Misspelled words	
1	Faulty subject-verb agreement	

1	Determiner use (a/an/the/this, etc.)	
1	Improper formatting	

Unique Words

Measures vocabulary diversity by calculating the percentage of words used only once in your document

17%

unique words

Rare Words

Measures depth of vocabulary by identifying words that are not among the 5,000 most common English words.

43%

rare words

Word Length

Measures average word length

5.3

characters per word

Sentence Length

Measures average sentence length

13

words per sentence

Contextualized Learning Module_Madrazo & Dio.edited version1

22 Journal on Mathematics Education, Volume xx, No. x, September, pp. xx-xx

Madrazo & Dio, Contextualized Learning Modules in Bridging Students' Learning Gaps in Calculus with Analytic Geometry Through Independent Learning 23

ISSN 2087-8885

E-ISSN 2407-0610

Journal on Mathematics Education

Volume xx, No. x, September xxxx, pp. x-xx

1

CONTEXTUALIZED LEARNING MODULES IN BRIDGING STUDENTS' LEARNING GAPS IN CALCULUS WITH
ANALYTIC GEOMETRY THROUGH
INDEPENDENT LEARNING

Anthony L. Madrazo1,2, Ryan V. Dio2

1Bicol University Graduate School, Legazpi City, Albay, Philippines

2Sorsogon State College, Sorsogon City, Sorsogon, Philippines

anthonymadrazo5@gmail.com

Abstract

The transition of the educational system in the Philippines vastly affects the basic and higher education. Mismatched of pre-requisite Mathematics learning competencies from the basic education level occurred when the student reached higher education. This descriptive-developmental method of the study utilized the developed contextualized learning modules for the bridging course on the identified learning gaps in Calculus with Analytic Geometry for the Bachelor of Secondary Education (BSEd) major in Mathematics. Real-world concepts and situations featuring the Province of Sorsogon, Philippines were integrated into the learning modules while promoting independent learning. The content, format, presentations and organizations, accuracy, and up-to-datedness of information of the learning modules passed on the evaluation of 13 experts (Mathematics Professors) from the different Higher Education Institutions (HEIs) in the Bicol Region, Philippines. Also, the students were very much satisfied with the utilization of the learning modules that bridged their learning gaps in the conic section through independent learning.

Keywords: bridging course, learning gaps, independent learning, contextualized learning modules

How to Cite: Madrazo, A.L., Dio, R.V. (2020). Contextualized Learning Modules in Bridging Students' Learning Gaps in Calculus with Analytic Geometry through Independent Learning. Journal on Mathematics Education, x (x), xx-xx.

INTRODUCTION

Instructional material is human or non – human device and facility that can be used to ease, encourage, improved, and promote teaching and learning

activities to improve and facilitate effective processes of instruction (IGI Global, 2018; Matarazzo, Durik, & Delaney, 2010; Fradd, Lee, Sutman, & Saxton, 2001). Furthermore, instructional materials function as the extension of the experience of learners, supplement and complement the teacher's verbal explanations making learning experience, and clarify, vitalize, emphasize instruction and enhance learning in the process of transmitting knowledge, ideas, skills, and attitude (Oladejo, Olosunde, Ojebisi, Isola, 2011). It has a large effect on student learning (Chingos and Whiteburst, 2012; Olayinka, 2016). It could be in the form of modules or self – learning materials that are user – friendly where students can learn on their own with minimal or no guidance of a teacher (Kalim, 2013; Lai, & Hwang, 2016).

Self-learning materials are advantageous because users learn on their own; they can study without disturbing their normal duties and responsibilities; it can be administered in single-use, small or even large group; it can be implemented with flexibility; more appropriate to more mature students; they have control of their learning; and it is widely accepted by the present educational systems where method demands smart classroom (Charles and Rajasekar, 2014). The use of modules in lectures has a positive effect on learning (Kariman, Harisman, Sovia, Prahmana, 2019).

The advantages of self-learning materials demand more time and effort in designing learning activities and outcomes according to the needs and context of the students and would guarantee to learn. One of the approaches introduced by the curriculum developers in the Philippines is the contextualization of learning modules where subject content is matched with the instructional material strategies relevant to students. Localization as a component area of contextualizing abstract content topics of the subject is used in linking new content to the local experiences that are familiar to

students so that learning becomes more efficient and relevant to them (Bringas, 2014; DepEd Order No. 35, 2016; UNESCO-IBE, 2020).

In contextualization, students develop new skills, knowledge, abilities, and attitudes through the presentation of subject matter in a meaningful and relevant context such as in previous experience, real-life, and workplace (Rivet and Krajcik, 2008; Bringas, 2014). This method of teaching and learning builds upon a similar concept of putting academic activities into perspective to achieve the best teaching and learning outcomes through the promotion of localized curricula (Androitis, 2017). It links concepts into the practical or real-world context which are meaningful to students (Baker, Hope, and Karandjeff, 2009). It is an acceptable body of knowledge because it is grounded from various pedagogical theories such as motivation theory, social learning theories, problem –based learning, and learning styles (Androitis, 2017). Furthermore, contextualization consumes much time for preparation, unavailability of the local materials, difficulty in pedagogy, not applicable to all topics, and student's differences are some of the identified challenges. On the other hand, contextualization increased the learning engagement, students have better retention of concepts, increased the conceptual understanding, and helped students pass their assessment. Local materials/ information is the other view of mathematics teachers which is about the use of available materials in the surrounding of the students or using the community in the lesson (Reyes, Insorio, Ingreso, and Hilario, 2019). Consequently, learner's experiences from the environment are utilized to build mathematics ideas, realize, and understand the need for accuracy and use in mathematics and real-life situations. It also aims to give awareness on how to mathematize their culture and use it to learn formal mathematics. This is assumed to motivate students to recognize mathematics as part of everyday life; enhance student's

ability; and deepen their understanding of all forms of mathematics to make meaningful mathematical connections (Alangui, 2017).

Scaffolding has an integral part in contextualization. It is a process that allows the students to work in a contextualized setting and solve problems while focusing on building associated skills (Khare, 2018). The first step in scaffolding is contextual support followed by a series of actions and interactions to balance the routine of scaffolding procedure. The interaction of thinking individuals is the next step. Along the process, the initiated interaction must go naturally without any pushing force. Then, the heart of scaffolding, which is the contingency step, wherein the success of the assistance to the learner is shown in the learner's response and/ or reaction. It could be repeated, changed, or even deleted. Then, the task is handed over the learner which is the determinant whether the learner is ready to do a similar task without the help of another person (van Lier, 1996, cited in Amerian & Mehri, 2014). Learner's experiences from the environment are utilized to build mathematical ideas, to realize and understand the need for accuracy, and to be used in mathematics and in[1] real-life situations. John Dewey also believed that children learn best through interaction with the environment and are capable of learning with adult guidance, to piece together their worldview based solely on critical interaction with the physical evidence all around them (Sarian, 2018).

An increase in student' engagement characterizes high-quality teaching and learning. Engaged students are taking ownership of their learning (Ashwin & McVitty, 2015).

As students take ownership of their learning, they are engaging in independent learning. Independent learning or independent study is a process, method, and philosophy of education in which a student acquires knowledge by his or her efforts and develops the ability for inquiry and critical evaluation (The Higher

Education Academy, 2014). Besides, it is a learning process of the method where students take ownership and control of their learning, set goals, make choices, and decisions how to meet his learning needs, take responsibility for constructing and carrying his learning, monitor progress toward achieving his learning goals, and self – assess the learning outcomes (Livingston, 2019). Whereas, self – assessment components support in assessing student knowledge (Biehler, Fischer, Hochmuth, and Wassong, 2010).

Meanwhile, one of the four stages of Jean Piaget's (1896 – 1980) theory of cognitive development in which the last stage is the formal operational stage (12 years old and above). At this stage, young adults begin to think abstractly and reason about hypothetical problems. Also, at this stage, they begin to use deductive logic or reasoning (Cherry, 2019). Critical thinking or higher-order thinking skills were already developed which essential in independent learning. The age bracket of the students is included at this stage which entails that independent learning or self – learning is already recommended to college students as an alternative form of learning.

The Commission on Higher Education (CHED) Memorandum Order (CMO) No. 105, 2017 orders all higher education institutions (HEIs) to accommodate all students regardless of senior higher (SHS) they graduated from. This order leads to a diversity of students in the majority of college programs which includes the Bachelor of Secondary Education (BSEd) major Mathematics program. Senior high school is the additional grades (Grade 11 and 12) level to K - 12 Basic Education program of the Philippines in response to the global demand for quality education. The senior high school offers various tracks/strands which are divided into Academic tracks, Non – academic or specialized track, Sports track, Art and Design track, and General Academic Track (GAS). Academic tracks offer Accountancy, Business, and Management

(ABM), Humanities and Social Sciences (HUMSS), and Science, Technology, Engineering, and Mathematics (STEM). Non – academic tracks are Technology – Vocational – Technology (TVL) where students can get National Certificates (NC) in Agri – Fishery Arts, Home Economics, Industrial Arts, and Information, Communication and Technology (ICT) (DepEd, 2014).

By design, each track is preparation for related careers. For example, the STEM track leads the students to sciences, technology, engineering, and mathematics-related courses, and of these is BSEd – Mathematics. As per the implementation of CMO No. 75, s. 2017, the majority of enrollees in BSEd – Mathematics is non –STEM. In Calculus with Analytic Geometry subject of the program students must have the prerequisite knowledge on Pre – Calculus and Basic Calculus which are only offered in the STEM track. This entails that the majority of the students have a learning gap on the subject and one of these is about the topic Conic Section. As emphasized, teachers teaching the subject should be aware of the prerequisite learning competencies so that correct intervention may be made to address the least mastered learning competencies (Herrera & Dio, 2016). To bridge the identified learning gap, contextualized learning modules were developed while adhering to the principles of independent learning

On the other hand, bridging courses that offer new approaches and learning opportunities enhances student's knowledge and helps them overcome deficiencies (Gordon and Nicholas, 2013; Qualifications and Curriculum Authority, 2009). Furthermore, teaching and learning in a bridging course need to ensure that previous learning is consolidated to provide a solid platform for progression. Consequently, a substantive period of induction involving a rigorous program of initial and diagnostic assessment must be given from the heart of the bridging course.

Hence, students with a background in mathematics or advanced mathematics and who had enrolled in a bridging course associated with higher marks compared to students with no advanced mathematics (Poladian and Nicholas, 2013). Moreover, there is a relationship between a student's performance in secondary mathematics and their performance in higher mathematics (Jennings, 2009).

In this light, this study developed learning modules for Calculus 1 with Analytic Geometry used for bridging course of non – STEM BSEd Mathematics students. The learning modules were also contextualized and designed which promotes independent learning. These were also evaluated by experts (jurors) along with content, format, presentation and organization, accuracy and up – to – datedness of information, and presence of the features. Furthermore, the students also evaluated the acceptability of the learning modules.

METHODOLOGY

The descriptive research method was used in this study to describe the characteristics of the phenomenon introduced (Bhat, 2019) and assess the changes with phenomenon over an extended period (Jaikumar, 2018) through a developmental research design. The implementation of the study was anchored on Analyze, Design, Develop, Implement, and Evaluate or simply ADDIE concept. The ADDIE approach is a product developmental concept applied for constructing performance-based learning adopting the Input – Process – Output (IPO) paradigm (Branch, 2009).

In the Analyze phase, the concept is to identify the probable causes for a performance gap, thus, topics in the Senior high school mathematics of both STEM and Non-STEM tracks were mapped to the topics of Calculus with Analytic Geometry subject of BSEd Math to determine the learning gap. In the

Design phase, the mapping and identified learning gaps were validated by experts to verify the desired performance and appropriate testing methods. Meanwhile, learning resources are generated or validated in the Develop phase. The four learning modules about conic sections (circle, parabola, ellipse, hyperbola) were made based on the identified learning gap identified from the non – STEM graduates. These learning modules were contextualized featuring things, tourist attractions, products, and situations to the locale of students in Sorsogon, Philippines. Learning modules were designed for independent learning and used as supplementary instructional materials for the conduct of bridging course for 2nd year BSEd – Mathematics students in Calculus with Analytic Geometry.

The learning environment is prepared, and students are engaged during the Implement phase. The 18 BSED Mathematics students who were officially enrolled in one State College were selected to utilize the developed contextualized learning module through independent learning mode of study under the bridging course sessions. The bridging course with four learning modules about the conic sections lasted for 18 hours which was evenly distributed in a three-weeks period[2] with pretest and posttest scheduled in the first day hour and last day hour, respectively.

The Evaluate phase, the learning modules were evaluated by 13 experts (Mathematics Professors) from seven higher education institutions (HEIs) in Bicol Region (Region V), Philippines using the adopted Evaluation Rating Sheet for Print Resources from Guidelines and Process for LRMDS Assessment and Evaluation (DepEd, 2009). Jurors evaluated the learning modules using the 7 indicators for content evaluation, 18 indicators for the format, 5 indicators for presentation and organization, and 6 indicators for accuracy and up – to – datedness of information (DepEd, 2009). Each criterion is determined by

accumulated points from the specified indicators. Jurors also evaluated the presence of the features, contextualization (DepEd, 2016), and independent learning (Mckendry and Boyd, 2012). The presence of features was quantified using a weighted mean. After the conduct of the bridging course, the students who used the developed contextualized also evaluated the acceptability of the learning modules using the instrument of Espinar and Ballado (2016). Similarly, acceptability is measured by the weighted mean. The students' comments were also analyzed. Thus, the Evaluate phase assesses the quality of instructional products and processes, before and after implementation. (Branch, 2009; McGriff, 2000; Kurt, 2018; Cullata, 1995). In this concept, the first four are sequential but the Evaluate phase is continuous in conjunction with others (Clark, 1995).

Frequency count was used to interpreting jurors' evaluation of content, format, presentation, and organization, and accuracy and up – to – datedness of information. The analysis and quantification of the data were made using the MS Excel and interpreted using the interval used from the study of Owusu – Manu, (2017).

RESULTS AND DISCUSSIONS

Learning Gap of Non – STEM students to Calculus with Analytic Geometry

Based on CMO No. 75, s. 2017, the adapted course description of Calculus with Analytic Geometry is: The course equips the students with knowledge and skills needed to be able to determine limits of the functions, to differentiate and integrate algebraic, exponential, logarithmic, and trigonometric functions in one variable. It also includes exposure to more challenging problems covering the continuity and areas of the region. Explicitly specified that includes more

challenging problems about areas of the region. This topic is one of the major practical applications of the integration of calculus itself.

The specified prerequisite subjects of Calculus with Analytic Geometry are College Algebra, Trigonometry, and Geometry (CMO No, 75, 2017). The topic conic sections (circle, parabola, ellipse, and hyperbola) are not included in any of these subjects. Likewise, it is not also included in the subject itself Calculus with Analytic Geometry based on its course description because it focuses more on limits and continuity, differential, and integral calculus.

Conic sections are one of the topics in Pre – Calculus subject in SHS STEM, other SHS strands/ tracks do not offer this subject (Ascano, Martin, Olofernes, and Tolentino, 2016). This entails that this topic is a learning gap of all non – STEM graduates studying BSEd – Mathematics. Book authors proved that conic sections are in the topic area of the region bounded by the curve. Anton, Bivens, and Davis (2012) used the concepts of conic sections in their published book to determine the area of the region bounded by equations. Find the area of the region that is enclosed between the curves y=x2 and y=x+6 (Example 2, p.415). Find the area of the region enclosed by x=y2 and x=y+2 (Example 4, p. 417). Show that the area of the ellipse in the accompanying figure is πab (Exercise Set 6.1, no. 50, p. 420). These examples show that the concepts of conic sections are prerequisites for the area of the region bounded by equations/curves. The first two examples are parabolas that open upwardy=x2 and rightwardx=y2, respectively. The latter example is to prove the formula of ellipse x2a2+y2b2=1 using integral calculus.

Larson and Edwards (2019) also used conic sections to illustrate the concept of areas of the region bounded by equations/curves in their Calculus book. Find the area of the region bounded by the graphs of fx=2-x2 and gx=x (Example 2, p. 446). Find the area of the region between the graphs of fx=3x3-x2-10x and

gx=-x2+2x (Example 4, p. 447). Find the area of the region bounded by the graphs of x=3-y2 and x=y+1 (Example 5, p.448). These examples used parabolas to illustrate areas of the region bounded by equations/curves. The first function in Example 2 is a parabola that opens downward, and so with the second equation in Example 4. Hence, the first equation in Example 5 is a parabola that opens leftward.

Furthermore, Stewart (2016) also used conic sections to illustrate the area of regions. More of his examples are also used in parabolas which only requires basic integration. In Chapter 7 (Techniques of Integration) in Exercises 7.3 (pp. 491 – 492, no. 34), one of the exercises stated Find the area of the region bounded by the hyperbola 9x2-4y2=36 and x=3. He also added that in determining the area of circle and ellipse, an integral of the form a2-x2dx where a>0 will be used. This requires a technique of integration, specifically trigonometric substitution.

Contextualized Learning Modules for Bridging Course in Calculus with Analytic Geometry

In various parts of the modules, different things relevant to the students were used to illustrate the concepts of conic sections. Local materials were used in the introduction to easily catch their attention and interest.

Figure 1. Sorsogon "Timitim"

The circle is traced in the image of coconut (locally called "niyog"[3] in the entire Philippines, and "lubi"[4] in the local dialect of Sorsogon"), put in the Cartesian plane, label the parts, and which eventually used to introduce the circle as one of the conic sections in the learning module. Coconut is one of the most abundant products of Sorsogon. From real objects, the students learned the abstract concepts of the circle. Then, the abstract concepts were applied again

into situational problems. One of these is "timitim" (see Figure 1) which one of the local delicacies of Gubat, Sorsogon. The word "timitim" is derived "patikim – tikim" or tasting. Its main ingredient is "kamoteng kahoy" or cassava. The real-world application of the concept is also integrated with the concluding assessment of the students. For example, the trace of circles on the ceiling of Sts. Peter and Paul Cathedral which situated in the middle of Sorsogon City, Sorsogon being the sole city of the province.

Besides these, there are many other real objects and situations used to illustrate or apply the concepts of the circle in the learning module. This contextualization is an avenue for students to learn, understand, and appreciate the concept of mathematics beyond.

Figure 2. Sorsogon Rompeolas Lighthouse

Meanwhile, the concept of the parabola is introduced using the traced of the parabola in an image of Fatima Church which is also situated at Sorsogon City, Sorsogon. After the students understand the concepts of a parabola, they applied the concepts back into real-world situations. One of these is the arch of the doorway of Lighthouse or "Parola" (see figure 2) at Sorsogon City Boulevard or locally called "Rompeolas" at Sorsogon City, Sorsogon. The arch at the doorway of the lighthouse is somewhat parabolic. The concepts parabola is also applied to other different situational problems such as radio signal satellite dish, the cable of suspension bridges, sound reflector, bridge arch, and television dish antenna. All of these depict the concept of the parabola.

Figure 3. "Pili" Fruit

Meanwhile, the concept of the ellipse in the learning module was introduced using the orbit of the moon to earth, orbits of planets to the sun, the elliptical image of the earth, and castle nut, scientifically called "canarium ovatum" and

which is locally called "pili" (entire Philippines). Figure 3 is the image of pili which depicts the concept of the ellipse.

The concept of an ellipse is also applied in various real-world situational problems such in pili sculpture in Sorsogon City Boulevard where both the sculpture and its platform are both elliptical, the orbit of the planet where the star is situated at one of the foci, semi-elliptical dome and tunnel, Colosseum at Rome, and Sputnik I (artificial satellite) orbit.

Figure 4. Sorsogon City Crossroads

An image in the middle of Bulusan Lake at the foot of Mt. Bulusan, Bulusan, Sorsogon, the mountains around the lake, and its reflection to the water traces the image of the hyperbola. This scenery is used to introduce the concept of the hyperbola. Also, the portion in the ceiling of Sts. Peter and Paul Cathedral which also illustrates hyperbola besides other conic sections in the same image. This is also used to present the concept of the hyperbola. The same images were also used in different scenarios to assess students' understanding of the concepts. Moreover, other real-world scenarios where students can apply the concepts are also integrated into the learning module such as the hyperbolic mirror for panoramic photography, explosion scenario which also illustrates the concept, hyperbolic shaped pillar, long-range navigation (LORAN), and the aerial view of crossroads at Sorsogon City (see Figure 4). This is a crossroads of roads to the south of Sorsogon Province and Bacon District, Sorsogon City. The sides of the roads illustrate hyperbola.

These contextualization features of the modules were based on students' experiences in their environment. The mind naturally seeks meaning in a context related to a person's current environment that makes sense and is useful (Ampa, Basri & Andriani, 2013). Contextualized Teaching and learning are putting academic activities into perspective. This is a process linking

concepts into practical or real-world context (Androitis, 2017). It is a concept of relating content into meaningful and relevant situations to the students (Baker, Hope & Karandjeff, 2009). The use of contextualization increased learning engagement, students have better retention of concepts, increased the students' conceptual understanding, and helpful to pass the assessment (Reyes, Insorio, Ingreso, and Hilario, 2019). The promotion of localized curricula is a way of encouraging such relevance in different local, cultural, and socio-economic contexts which can allow learning to become more meaningful and relevant (UNESCO – IBE, 2020).

Another feature of the module is the promotion of independent learning or independent study. It is a process, method, and philosophy of education in which a student acquires knowledge by his or her efforts and develops the ability for inquiry and critical evaluation (The Higher Education Academy, 2014). In this method or learning process, learners have ownership and control of their learning. They can set goals, make choices, and decisions about how to meet his learning needs, take responsibility for constructing and carrying out his learning, monitor his progress toward achieving his learning goals, and self-assess the learning outcomes (Livingston, 2019).

The integration of this in the learning modules allow the users to understand the concepts. Precise and simple language/ medium of delivery was one of the key components of learning modules. Besides, illustrations and graphs were labeled accordingly to visually explain the concepts. Concrete and relevant things were used to introduce and visually understand the concepts, which eventually narrowed to abstract ideas. This gives ease to students to apply these abstract ideas to real-world situations. The transition is from real object representation to abstract ideas and applied back to real-world scenarios.

In the discussions, the required or relevant prerequisite ideas in the solution were reviewed. For instance, the distance formula is essential to derive the equations of each conic section. Along the process of deriving the equations of conic sections, related mathematical concepts, or processes to simplify were considered. Color coding is a cueing instrument which gives highlight and ease to readers to do the algorithm, such as in similar terms, and related mathematical concepts. Color-coding components in a printed module give learners ease of recognition (Maile and Cooper, 2018).

Furthermore, related ideas/ concepts/ mathematical terms were summarized into table/s which enable the readers to see and grasp the relatedness of each concept to one another. For example, in an ellipse, relativeness of center, foci, vertices, covertices, major axis, minor axis, and the standard equation was put into one table. Giving the relatedness of information was provided to give the users a general outlook on how to execute the step by step solutions.

Solutions to examples were readily prepared with complete and comprehensive explanations on how to deal with the problems so that users can easily understand the concepts. Similar problems (Quick Check) were also prepared with final answers (Quick Check Answers) were written at the back of the module. These problems allow students to work on their own, self – assess and monitor their progress on the topic. Modules or self-learning materials must be student-friendly where students still learn the lesson without the help or guide of a teacher (Kalim, 2013). There are also concluding assessment according to learning objectives, arranged from easy to difficult one.

In light of this, the four (4) developed learning modules for four (4) types of conic sections (circle, parabola, ellipse, and hyperbola) featured students' experiences, things, and situations that are meaningful and relevant to them through contextualization. The use of local subjects from students' locale

(Sorsogon) such as tourist destinations, landmarks, or even situations made their experiences, things, situations are more meaningful and relevant to the concepts (localization). Also, the integration of independent learning helped the non – STEM graduates BSEd – Mathematics students address the knowledge and skills gap (Qualifications and Curriculum Authority, 2009). It enhances students' knowledge and helped them overcome their deficiencies. The self – assessment component supported assessing students' knowledge (Biehler, Fischer, Hochmuth, and Wassong, 2010).

Jurors' Evaluation of the Learning Modules

Evaluation is one of the major determinants of determining the quality of the developed learning modules. It also means determining the value that will eventually yield information such as worthiness, appropriateness, goodness, validity, and legality of something (Kizlik, 2014). Relative to this, to determine the validity of the developed learning modules, the researcher used the Guidelines and Process for LRMDS Assessment and Evaluation for Print Resources (DepEd, 2009). This instrument evaluated the learning modules in terms of content, format, presentation and organization, and up-to-datedness of information. The summary of jurors' evaluation of the learning modules is presented in Table 1. Generally, it can be depicted from the table that all learning modules accumulated points to achieve the minimum required points of each criterion.

Table 1. Jurors' summary of points of learning modules evaluations

Criteria

Points to pass

(DepEd, 2009)

Module 1:

Circle

Module 2:

Parabola

Module 3:

Ellipse

Module 4:

Hyperbola

Average

Remarks

Average

Remarks

Average

Remarks

Average

Remarks

Content

at least 21 of 28

26

Passed

25

Passed

24

Passed

24

Passed

Format

at least 54 of 72

66

Passed

63

Passed

62

Passed

62

Passed

Presentation and organization

at least 15 of 20

18

Passed

17

Passed

18

Passed

17

Passed

Accuracy and up –to –datedness of information

at least 18 of 24

22

Passed

22

Passed

22

Passed

22

Passed

This infers that the content of the learning modules is suitable for the non-STEM graduates of BSEd-Mathematics students' level of development. This entails that the scope, range, and depth of content and topics are appropriate to the learning needs of the students. The level of difficulty of the learning modules is appropriate for the age and stage of learning of the students. The level of detail of the learning modules is appropriate for the achievement of the specified learning outcomes for these students.

The idea of age appropriateness is anchored on Jean Piaget's (1896–1980) theory of cognitive development. Based on Piaget's theory, there are four (4) stages of cognitive development and one of these is the formal operational stage (12 years old and above). At this stage, where students belong as young adults, they begin to think abstractly and reason about hypothetical problems. Abstract thought emerges, and begin to use deductive logic, or reasoning from general principle to specific information. People think more scientifically about the world around them (Cherry, 2019). They think independently through the problems and situations. They can view the relationship of the real things or situations to an abstract concept, and the abstract concept to situations or problems applied to the real-world. This is in congruence with the deductive and inductive reasoning in the formal operational stage of Piaget's cognitive development.

The result tells that the learning modules contributed, support, and support to the achievement of the specific objectives. It also reinforces, enriches, and/or leads mastery of competencies of the program. Each learning module developed higher cognitive skills of students such as critical thinking, creativity, inquiry, problem solving, and among others. Gradually, the use of learning modules for the bridging course increased the responsibility for their learning since the learning modules promoted independent learning. The interpretation is important for the students to avoid the pitfall of looking for the right answer, rather than the principle, salient facts, and point of view to arrive at the right answer (Heick, 2019).

The learning modules are also free of ideological, cultural, religious, racial, and gender biases and prejudices. This implies that the social content and values and perspectives are fairly presented and does not violate the Social Content Guidelines (DepEd, 2009). The learning modules enhanced the development of desirable values and traits such as pride of being Filipino, scientific attitude and reasoning, desire for excellence, love for country, desire to learn new things, ability to know right from wrong, respect, and critical and creative thinking. Love for country, pride in being a Filipino, and respect were the primary values/traits promoted by the learning modules through contextualization.

The integration of these values/traits is attuned to the framework of an ethnomathematical curriculum model. In the model, learners' experiences with the environment are utilized to build mathematical ideas to realize and understand the need for accuracy and use in mathematics and real-life situations. The model also aims to give awareness on how to mathematize their culture and use it to learn formal mathematics (Alangui, 2017).

Moreover, the instructional materials' format in terms of prints, design and layout, paper and binding, and size and weight of resources contributed to visual representations for easy understanding of the concepts. It can also be inferred that the format of the developed contextualized learning modules helped the learners to grasp the concept being imparted. In support, the importance of programmed instruction in mathematics learning. With programmed instruction, learners determine their own pace and progress and eliminate frustration with themselves, fellow learners, and subject matter. It allows also the students to discover facts by themselves and be responsible for their learning (Oginni and Owolabi, 2012).

The presentations in the learning modules were engaging, interesting, and understandable. There was a logical and smooth flow of ideas that made it clear and evident to the target readers. Also, the vocabulary level was appropriate to the experiences and understanding of the students. New, technical, or complex terms were strategically, clearly, and consistently explained in the learning modules which are appropriate/ suitable to the age and level of the respondents. The length of sentences used was suitable to the target reader which also considered the complexity of sentence patterns (simple, compound, or complex). Varied and interesting sentences and paragraph structures were used to enhance meaning-making. In meaning-making, the topic sentences in paragraphs were strategically and effectively used and placed. They use knowledge and understanding to create their own spoken, written, and visual texts (DepEd, 2016).

The result on accuracy and up – to –datedness of information implies that most of the jurors identified very minor errors such as conceptual, factual, grammatical, and computational, use of obsolete information, or other errors (i.e. illustrations, diagrams, pictures, maps, graphs, and tables). There were no

conceptual errors found in the presentation of content that may lead to the development of misconceptions or misunderstanding of the topics. Also, there was no factual error found which connotes that the presentation of factual content was accurate and up-to-date, and without outdated information, improper use of statistics, inaccurate graphs, oversimplified models, examples, or simulations. Committing minor errors should not be exaggerated, rather it should be handled sensitively, and teachers and learners should be open to mistakes, and to actively use them in becoming prepared for the test that counts. The identified minor errors can still be used as a way to facilitate new learning, enhance memory for the generation of correct responses, facilitates active learning, and directs the attention of the learner, and let the teacher be aware of the focus of discussion (Metcalfe, 2017).

The jurors also evaluated the learning modules in terms of the presence of the features of contextualization, and independent learning which is presented in Table 2. Result reveals experts (jurors) are indeed satisfied that contextualization and independent learning features are present in the learning modules.

Table 2. Presence of the features of learning modules

Features

Module 1:

Circle

Module 2:

Parabola

Module 3:

Ellipse

Module 4:

Hyperbola

Overall

Average

Remarks

Average

Remarks

Average

Remarks

Average

Remarks

Average

Remarks

Contextualization

3.68

VS

3.58

VS

3.57

VS

3.46

S

3.57

VS

Independent learning

3.41

S

3.25

S

3.48

S

3.30

S

3.36

S

Legend: S – Satisfactory, VS – Very Satisfactory

The presence of contextualization implies that the learning modules were able to relate the subject matter conic sections to practical, applicable, and meaningful situations that are relevant to students' daily lives. These situations were supported by facts and theories that embed the cultural, historical, ideological fabric, and/or personal experiences of students. Correspondingly, contextualization is defined as a process of matching the content and instructional strategies relevant to students (DepEd Order No.35, s. 2016). Contextualized teaching and learning (CTL) is defined as a process of linking concepts into a practical or real-world context which is an acceptable body of knowledge grounded from various pedagogical theories such as motivation theory, social learning theories, problem-based learning, and learning styles (Androitis, 2017). Similarly, CTL is defined as a concept of relating content into meaningful and relevant situations to students. Relevant context and curriculum/instructional material are two of the core elements in characterizing CTL design and implementation (Baker, Hope, and Karandjeff, 2009). Furthermore, in contextualization, students can develop new skills, knowledge, and abilities, and attitudes through the presentation of subject

matter in the meaningful and relevant context of previous experience, real-life, and the workplace (Bringas, 2014).

Hence, localization adapts local conditions related to context through teaching and learning in the curriculum (Bringas, 2014). Similarly, localization is linking new content to the local experiences that are familiar to students to make learning more efficient, and relevant to them (DepEd Order No.35, s. 2016). As reflected, the jurors believed that the learning modules relate the learning content to local information or the situation of Sorsogon Province. Localization is another way of contextualization which delimits the scope to a local setting that is familiar and relevant to students. The learning modules were able to relate the context to the local environment of Sorsogon and they were also culturally responsive to the local setting and adapted the local conditions. Contextualization leverages students' knowledge by bringing the students' concepts from their home and community to classroom situations, allows the students to have fun, made the lessons relevant and meaningful, and lessons were effectively and efficiently delivered. Students developed a better understanding of mathematics concepts if these are related to their lives (Reyes, Insorio, Ingreso, and Hilario, 2019)

The learning modules were programmed or designed in such a way that the needed support from the facilitator was minimized. Furthermore, since the learners need to learn the concepts independently, they can also program their learning targets where they are comfortable. It is a self – sufficient and complete instructional material that allows the students to learn the lesson by themselves (Kalim, 2013).

Students' Acceptability of the Learning Modules

To validate the response of the experts, the students also evaluated the acceptability of the contextualized learning modules. Table 3 presents the evaluation of the students along with the acceptability of the developed contextualized learning modules in conic sections. The table reveals that all learning modules are very much acceptable (VMA) to students along with the different indicators.

Timeliness has the highest acceptability among the students. This implies that the developed contextualized learning modules and their features are rightful to use as an urgent, tactical, transformative solution to the 21st-century educational challenges and issues (NEDA, 2017). This is also per the provision in the 1987 Philippine Constitution, Article XIV, Section 10 which mandates the conduct of scientific research that supports indigenous, appropriate, self-reliant scientific and technological capabilities, and their application to the country's productive systems and national life (Philippine Official Gazette, 2018).

Table 3. Summary of acceptability of the developed contextualized learning modules

in conic sections

Criteria

Module 1: Introduction to Conic Sections, and Circle

Module 2: Parabola

Module 3: Ellipse

Module 4: Hyperbola

Mean

Mean

Mean

Mean

Clarity

3.94**

3.93**

3.90**

3.86**

Usefulness

3.89**

3.87**

3.85**

3.85**

Suitability

3.76**

3.76**

3.76**

3.78**

Adequacy

3.84**

3.84**

3.85**

3.85**

Timeliness

3.98**

3.98**

3.98**

3.96**

Language, Style, and Format

3.83**

3.81**

3.79**

3.80**

Illustrations

3.92**

3.81**

3.81**

3.82**

Presentations

3.94**

3.93**

3.96**

3.93**

Overall

3.88**

3.86**

3.85**

3.84**

Legend: ** - Very Much Acceptable (VMA)

The learning module is useful for the students because it can be considered as an alternative tool, and through its activities, students can exercise their mind, ability, and skills., as affirmed by one of the students. Another student added, the learning module presents/ consists of illustrations or examples that are locally [Sorsogon] common that makes us visualize/ understand.

In contrast, suitability has the lowest average but still, these are interpreted as Very Much Acceptable (VMA). It could be inferred that the contextualized learning modules were suitable to address the learning gap of the non-STEM graduates BSEd – Mathematics students in Calculus with Analytic Geometry subject. The activities included taking into consideration the varying attitudes and capabilities of the learners. Responding to the learners' differences is one of the challenging tasks in crafting the modules. Furthermore, this implies that the learning modules were able to cater to the individual learning needs of the learners. The learning activities included in each learning module were suitable for the prescribed main topic. Also, the learning activities were relevant, interesting, and self-motivating. The learning enrichment activities were also adaptable to classes with large numbers. In relation, one of the students emphasizes that through activities of the learning modules, they were able to exercise their minds, ability, and skills. Another student also stresses that the figures used in the learning modules helped them better understand the topic. Indeed, key concepts and generalizations were clarified which ensured that all learners gained understanding and learning. Assessments followed the instructional episodes. Critical and creative thinking was one of the objectives in the process. Hence, the tasks, activities, and procedures required the students to understand and apply the meaning. Varied tasks and learning activities were considered in the learning modules for different students. The learning modules engaged and motivated the students through drill and practice (Singh, 2014).

The use of clear and simple information allowed them to easily understand the concept/s being presented in each learning module. The concepts for each learning activity were also arranged logically. Each learning module was designed and programmed from simple to complex concepts to let the learners

determine the interrelationship of the concepts, and so that it will guide them to easily understand the concepts. Moreover, each contextualized learning module considered the learner's level of comprehension in the delivery of information/ concepts.

Considering the logical arrangement or progression of concepts in learning is guided by the Scaffolding Theory by Lev Vygotsky (1896 – 1934). The effectiveness of using Scaffolding Theory in the teaching-learning process depends on many things, and on the independent working time and students (van de Pol, Volman, Oort, & Beishueizen. 2015).

This result is in consonance to some student's comments. One of the students emphasized, [The Learning module] Provide examples that is easy to understand especially to those students who do not encounter some of the mathematical terms. Another student also stresses, well-prepared module, and for this, it can help the student to understand the topic easily. Furthermore, one student believes, the module presents real-life situations that boost students to think critically.

Usefulness indicates that each learning module is useful because it helped the learners think logically and critically, and simple and comprehensible. Contents increased the knowledge, understanding, and proficiency/skill of the learners, and provided adequate information on the topic presented in each learning module. The learning modules provided an opportunity for the development/ enhancement of mathematical skills. The learning modules presented several/adequate information in line with the targeted competencies of each topic. Also, it encouraged students to become actively involved in learning activities. Students became actively involved in the learning activities because each learning module was designed/programmed for independent learning. They assumed ownership of and responsibility for their learning. Each learning

module stimulated the learners' analytical thinking skills. Since the learning activities in each module were arranged/organized from simple to complex concepts, the learners sought to relate the new concepts with previous ones. This showed the interrelationships of the learning activities for a holistic understanding of each concept.

These are related listed the advantages of learning modules in teaching mathematics. Through the use of learning modules, (1) learning become more effective; (2) it establishes a system of assessment besides mark or grade; (3) users are responsible for their learning; (4) they can also study without disturbing the normal duties and responsibilities; (5) it can be administered to single-use, small group, or even large group; (6) can be implemented in the flexible pattern; (7) appropriate to mature students; (8) learners have control of their learning; (9) learners accept greater responsibility for learning; and (10) it is widely accepted by the present educational system (Charles and Rajasekar, 2014).

As a result, one of the students mentioned, it [learning module] is more comprehensive than a book because it explains clearly every topic and uses words that are more simple [simpler] and suits to our level of understanding. This attests to the idea that the developed contextualized learning modules were useful to the students because they were highly informative. The discussions were very comprehensive and further enhanced with the use of simple but clear and authentic illustrations and explanations that are suitable to their level of understanding.

In terms of adequacy, the students also considered the learning modules as very much acceptable. This confirms that sufficient information on each topic was provided. Besides, only the expected learning was delivered. The learning modules also contained a variety of situational activities that catered to the

learning objectives. The salient terms/information needed for the learning activities were well-defined/ recapitulated. This was done in each learning module to avoid termination of the transition of the delivery of information. Adequate learning activities were provided to enhance students' knowledge, skills, and attitudes. To provide continuous delivery of the information, concepts, and principles were explained well. These concepts and principles were also applied to real-world situations/scenarios so that learners could relate the abstract concepts and principles into concrete realities. This technique is assumed to have developed a holistic understanding of the concepts and principles of conic sections. One student stress[13] that the learning modules provide sufficient information about the subject matter. And, another student highlighted that the learning modules used catchy illustrations or objects, like for example the castle nut or pili nut which is popular and abundant in the Sorsogon, Philippines.

Undeniably, the use of problem situations promotes better critical thinking, which also provides motivation and mechanism to organize knowledge. These also develop students' ability to be more reflective and metacognitive (Belecina & Ocampo, 2018). From the results and affirmation of the students, the use of sufficient salient information, clues, situational activities, and real-world problems increased their motivation and served as a mechanism to develop critical thinking skills. They became reflective and metacognitive as they determined the context from real objects to abstract and applied them to real objects or situations again.

It was also very much acceptable to learners that the contextualized and localized learning modules used proper or appropriate illustrations, the spacing of items, and optimum print size. The positioning of the response sections varied in the learning modules. The learning module observed correct

grammar and used clear and comprehensive vocabulary and language. The learning modules used familiar vocabulary to ensure comprehension, understanding, and learning. Technically, each learning module is used to structure, style, and format appropriate to the level of the learners.

In consonance, given the number of terms encountered in the course which varied based on students' ability and readiness, words were judiciously selected to teach them the new concept and continue to remember the previous one. The consistent and purposeful use of vocabulary building greatly assisted the students, and the language used was clear to facilitate understanding of concepts (Riccomini, Smith, Hughes, & Fries, 2015). Large prints were provided for the accessibility of the materials. Usability attributes include ease of learning task presented, utility, functionality, and satisfaction with the learning experience. Written contents are readable to allow understanding of the learners. Legibility influence the readability as it gives ease to the learner to distinguish letters and words while reading (Maile & Cooper, 2018).

One student stated that the learning modules provide a concise, readable text or information that is considered as a clear, and appropriate tool for learning. Another student observed that there are a lot of styles and formats used to easily understand the context. The developed contextualized learning modules were able to transmit the concepts and principles to the students using understandable language. The clear, simple, concise, readable, and appropriate language that is suitable to their level of understanding was used to deliver well the concepts and principles to the learners. Also, the explanations were very comprehensive. The learning modules were infused with visually attractive, relevant, and understandable figures and illustrations that guided

the students to easily understand the concepts and principles of conic sections.

In other words, the language, style, and format used in the contextualized learning modules aided the comprehension, understanding, and learning of the concepts in the developed material. The use of clear and simple, and consistent and purposeful language gave ease to the user in understanding the concepts. Moreover, the style and format made each contextualized learning module accessible, useful, and readable. These made it easy for the students to learn the concepts.

Moreover, the learners also found the illustrations very much acceptable as they were clear and simple which aroused their interest and made their learning effective and enjoyable. Illustrations also provided concrete visual clues. Hence, these illustrations guided the students to follow instructions. Lastly, each contextualized learning module used illustrations relevant to the topic. The simple and relevant illustrations used in the learning modules were effective in arousing their interest and in helping them gain learning. Learners were able to perform the tasks and found them enjoyable. Diagrams, illustrations, and photographs need to be included to assist the learners in performing the task (Maile and Cooper, 2018). Illustrations assist learning (Maile & Cooper, 2018).

One student affirms that the illustration introduced or used in the modules is appropriate and relevant on the topic and it clearly shows some key points on how the student can/ will understand the topics. As added by another student, the module was attractive and organized, the topics are clear and provide concrete visual clues and information, and it is orderly sequenced and easy to follow. The presentations of topics in the contextualized and localized learning modules were also very much acceptable to the learners. Topics were

presented logically and were orderly sequenced. The directions used in the learning modules were concise, readable, and easy to follow. The topics also fit the sequence of the course. One student affirms that the learning module (output) is good, and its ideas are well – presented. Another student added that the modules are remarkably interesting and knowledgeable (informative) because the topics are well presented and discussed.

Corollary to these, the learners were able to develop logical, creative, and critical thinking. One of the characteristics of the most effective instructional design to facilitate the learner's mastery of knowledge and procedure is the logical sequence flow of information. Moreover, steps reflect occupational steps, prerequisite knowledge, and abilities and difficulties. Learners can master a comprehensive body of knowledge or a complex process (Maile and Cooper, 2018).

The module is helpful for those students especially the student who takes Mathematics as their major that [who] did not take STEM while they are [were]in senior high school. With the help of the module, the lesson gets more exciting and it serves [s] as the bridge in a learning gap between other strand and STEM students, one of the students affirms.

This comment from one of the students concluded that the developed contextualized learning modules help them bridged the learning to the subject Calculus with Analytic Geometry. These learning modules serve as supplementary materials to learn the concept independently. It excites them to learn. These are affirmed by their evaluations of acceptability of the learning modules, and jurors' evaluations of the learning modules. This result finds support from the study of Setiyani, Putri, Ferdianto, & Fauji (2020) where the

developed learning modules were positively evaluated by experts (validators) and students which means that it has a great impact to learn mathematics.

CONCLUSIONS

The developed learning modules on conic sections for the conduct of the bridging course of non – STEM BSEd Mathematics students were in accordance with[14] the identified learning gap of the students. The integration of contextualization in the learning modules allow the students to bridge the identified learning gaps in mathematics concepts through an independent learning approach. The learning modules positively validated by jurors' (experts' – Mathematics Professors) evaluations along with content, format, presentation and organization, accuracy and up – to – datedness of information, and presence of the features (contextualization, and independent learning). Furthermore, students' evaluations revealed that the developed contextualized learning modules on conic sections are very much acceptable along with clarity; usefulness; suitability; adequacy; timeliness; language, style, and format; illustrations; and presentations. Consequently, for further development of quality supplementary materials that promote independent learning and holistic development of critical thinking, it is highly recommended to contextualized or even localized the concepts. It can be used in the conduct of different academic remediation such as bridging course, remote learning such as in times of unwanted circumstances such as pandemic (e. g. COVID-19), and among others. It is also highly recommended to test the effectiveness of the use of contextualized learning modules.

ACKNOWLEDGMENT

The authors are grateful to Bicol University Graduate School (BUGS) to the privilege of pursuing this study, support, and assistance; to Sorsogon State College (SSC) for allowing the researchers to implement the developed learning modules and conduct the bridging course. The authors are also thankful to the Department of Science and Technology (DOST) through the Capacity Building Program in Science and Mathematics Education (CBPSME) for financial assistance.

REFERENCES

Alangui, W.V. (2017). Ethnomathematics and culturally relevant mathematics education in the Philippines (Chapter 8). https://www.researchgate.net/publication/318675820_Ethnomathematics_and_Culturally_Relevant_Mathematics_Education_in_the_Philippines

Amerian, M. & Mehri, E. (2014). Scaffolding in sociocultural theory: Definition, steps, features, conditions, tools, and effective considerations. Scientific Journal of Review, 3 (7) 756 – 765, ISSN 2322 – 2433. https://www.researchgate.net/publication/265598722_Scaffolding_in_Sociocultural_Theory_Definition_Steps_Features_Conditions_Tools_and_Effective_Considerations

Ampa, A.T., Basri D., & Andriani, A.A. (2013). The development of contextual learning materials for English-speaking skills. International Journal of Education and Research, 1 (9). https://www.semanticscholar.org/paper/The-Development-of-Contextual-Learning-Materials-Ampa-MuhammadBasri/b71ffb1110a87223d47d734d1f9b0838490c578a

Andriotis, N. (2017). Contextualized learning: Teaching made it highly effective. www.efrontlearning.com/blog/2017/06/contextualized-learning-effective-learning.html

Anton, H., Bivens, I., and Davis, S. (2012). Calculus: Early transcendentals. John Wiley & Sons, Inc., United States of America. ISBN 978-0-470-64769-1. https://www.pdfdrive.com/calculus-early-transcendentals-10th-edition-d52069751.html

Ascano, J.P., Martin, J.L.L., Olofernes, A.D., and Tolentino, M.A.C. (2016). Precalculus Learner's Material. Department of Education, Pasig City, Philippines 1600.

Ashwin, P. & McVitty, D. (2015). The meanings of student engagement: Implications for policies and practices. The European Higher Education Area, Springer. https://link.springer.com/chapter/10.1007/978-3-319-20877-0_23#citeas

Baker, E.D., Hope, L., & Karandjeff, K. (2009) contextualized teaching and learning handout. https://files.eric.ed.gov/fulltext/ED521932.pdf

Belecina, R.R. & Ocampo, J.M. (2018). Effecting change in students' critical thinking in problem-solving. EDUCARE: International Journal for Educational Studies, Vol. 10 (2), Minda Masagi Press, Bandung, Indonesia, and BRIMAN[15] Institute BS Begawan, Brunei Darussalam, ISSN 1979 -7877. http://journals.mindamas.com/index.php/educare/article/view/949/857

Bhat, A. (2019). Descriptive research: Definition, characteristics, methods, examples, and advantages. www.google.com/amp/s/www/questionpro.com/blog/descriptive-research/

Biehler, R., Fischer, P.R., Hochmuth, R., and Wassong, Th. (2010). How to support students learning mathematical bridging – course using an ITS? Remedial Scenarios in European project Math – Bridge. http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.174.8927&rep=rep1& type=pdf

Branch, R.M. (2009). Instructional Design: The ADDIE Approach. Springer New York Dordrecht Heindelberg London, New York, USA, e-ISBN 978-0-387-09506-6, DOI 10.1007/978-0-387-09506-6. http://docshare01.docshare.tips/files/31015/310158097.pdf

Bringas, H. A. (2014). Location and contextualization-slide share. https://www.slideshare.net/lenferndz/localization-contextualization?qid=0c47ddd6-3f97-46e5-a6d9-0e6302495188&v=&b=&from_search

Charles, A. & Rajasekar, P. (2014). The modular approach of teaching mathematics for the selected topics at plus one level. Golden Research Thoughts, ISSN 2231-5063. https://www.academia.edu/24868026/MODULAR_APPROACH_OF_TEACHING_MATHEMATICS_FOR_THE_SELECTED_TOPICS_AT_PLUS_ONE_LEVEL

Cherry, K. (2019). The 4 stages of cognitive development: Background and key concepts of Piaget's theory. https://www.verywellmind.com/piagets-stages-of-

cognitive-development-2795457

Chingos, M. & Whiteburst, G. (2012). Choosing blindly: Instructional materials, teacher effectiveness, and the common core. https://eric.ed.gov/?id=ED530985

Clark, D. (1995). ADDIE Timeline. http://www.nwlink.com/~donclark/history_isd/addie.html

Commission on Higher Education Memorandum Order No. 105, s. 2017 (2017). Policy on the Admission of Senior High School to the Higher Education Institutions Effective Academic Year 2018-2019. CMO-No.-105-s.-2017-Policy-on-the-Admission-of-Senior-High-School-to-the-Higher-Education-Institutions-Effective-Academic-Year-2018-2019.pdf

Commission on Higher Education Memorandum Order No. 75, s. 2017 (2017). Policies, Standards, and Guidelines for Bachelor of Secondary Education (BSEd). https://ched.gov.ph/wp-content/uploads/2017/11/CMO-No.-75-s.-2017.pdf

Cullata, R. (2020). ADDIE Model. https://www.instructionaldesign.org/models/addie/

Department of Education (2014). Contextualization and Localization. https://www.slideshare.net/DodsDodong/localization-and-contextualization04162014?qid=8f974de7-5d13-4fa9-908d-6b2ab7373475&v=&b=&from_search=1

Department of Education (2015). Contextualization and Localization. https://www.slideshare.net/jaredram55/contextualization-andlocationntotapg10?qid=0f4a889e-fe86-4028-9a4a-e7eefe867c23&v=&b=&from_search=4

Department of Education (2016). Curriculum Contextualization. https://www.slideshare.net/rtipolo/contextualization-presentation?qid=8fb95e6d-2115-41c9-8fd1-24fd4037bf56&v=&b=&from_search=3

Department of Education (2009). Guidelines and Processes for LRMDS Assessment & Evaluation V1.0. https://lrmds.deped.gov.ph/docs/LRMDSGuidelines.pdf

Department of Education (2016). K to 12 Curriculum Guide English. Pasig City, Philippines. https://www.deped.gov.ph/wp-content/uploads/2019/01/English-CG.pdf

Department of Education (2014). K-12 Updates, Outline of Presentation, SHS Curriculum and Its Requirements, DM No. 4, s. 2014. https://www.ceap.org.ph/upload/download/201410/885411289_1.pdf

Department of Education (2018). K to 12 General Information. http://www.deped.gov.ph/k-to-12/faq

Department of Education Order No. 35 (2016). The Learning Action Cell as a K to 12 Basic Education Program School-Based Continuing Professional Development Strategy for the Improvement of Teaching and Learning. https://www.deped.gov.ph/wp-content/uploads/2016/06/DO_s2016_035.pdf

Espinar, M. and Ballado, R. (2017) Content validity and acceptability of a developed worktext in Basic Mathematics 2. Asia Pacific Journal of Multidisciplinary Research, 5, (1), P-ISSN 2350-7756, E-ISSN 2350-8442. http://www.apjmr.com/wp-content/uploads/2016/12/APJMR-2017.5.1.10.pdf

Fradd, S.H., Lee, O., Sutman, F. X., & Saxton, M. K. (2001). Promoting science literacy with English language learners through instructional materials development: A case study. Bilingual Research Journal, 25:4, 479-501, DOI: 10.1080/15235882.2001.11074464

Gordon, S. & Nicholas, J. (2013) Students' conceptions of mathematics bridging courses. Journal of
Further and Higher Education, 37:1, 109-125, DOI: 10.1080/0309877X.2011.644779

Heick, T. (2019). The 6 facets of understanding: A definition for teachers. https://www.teachthought.com/critical-thinking/6-facets-of-understanding-definition/

Herrera, C. & Dio, R. (2016). Extent[16] of Readiness of Grade 10 Students for General Mathematics of Senior High School in Sorsogon City, Philippines. Asia Pacific Journal, Arts and Sciences, Vol. 3 No. 4, 1 -8, E – ISSN 2362 – 8030. http://oaji.net/articles/2017/1710-1485756132.pdf

IGI Global (2018). What are the instructional materials? https://www.igi-global.com/dictionary/relevance-of-the-use-of-instructional-materials-in-

teaching-and-pedagogical-delivery/48956

IGI Global (2019). What is information accuracy? https://www.igi-global.com/dictionary/exploratory-study-information-quality-satisfaction/14304

Jaikumar, M. (2018). Developmental research design. Retrieved 16 April 2020 from https://www.slideshare.net/maheswarijaikumar/developmental-research-design

Jennings, M. (2009). Issues in bridging between senior secondary and first-year university mathematics. http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.458.3020&rep=rep1&type=pdf

Kalim, T. (2013). Instructional materials. https://tamannakalim.wordpress.com/2013/10/20/instructional-materials/

Kariman, D., Harisman, Y., Sovia, A., & Prahmana, R.C.I. (2019). The effectiveness of guided – discovery-based module: A Case study in Padang City, Indonesia. Journal on Mathematics Education, 10 (2), 239 – 250. https://files.eric.ed.gov/fulltext/EJ1218114.pdf

Khare, K. (2018). Contextualizing learning using scaffolding. https://medium.com/a-teachers-hat/contextualizing-learning-using-scaffolding-a6046434fc88

Kizlik, B. (2014). Measurement, assessment, and evaluation in education. http://www.cloud.edu

Kurt, S. (2018). ADDIE Model: Instructional Design. https://educationaltechnology.net/the-addie-model-instructional-design/

Lai, C.-L., & Hwang, G.-J. (2016). A self-regulated flipped-classroom approach to improving students' learning performance in a mathematics course. Computers & Education, 100, 126–140. doi:10.1016/j.compedu.2016.05.006

Larson, R., and Edwards, B. (2019). Calculus early transcendental functions, 7th Edition. Cengage Learning, Inc., Boston, USA. ISBN: 978-1-337-55303-2. https://www.pdfdrive.com/calculus-early-transcendental-functions-e175913158.html

Livingston, K. (2019). Independent learning. https://link.springer.com/referenceworkentry/10.1007%2F978-1-4419-1428-6_895

McGriff, S.J. (2000). Instructional System Design (ISD): Using the ADDIE Model. Instructional Systems, College of Education, Penn State University. https://www.lib.purdue.edu/sites/default/files/directory/butler38/ADDIE.pdf

Maile, C. A. & Cooper, M. S. (2018). The CIMC guide to developing modules for self-paced learning: A handbook for teachers. Oklahoma Department of Career

and Technology Education, Curriculum and Instructional Materials Center (CIMC). https://grdspublishing.org/index.php/people/article/view/2249/3699

Manila Times (2014). Science education realities. www.manilatimes.net/science-education-realities./100096/

Matarazzo, K.L., Durik, A.M. & Delaney, M.L. (2010). The effect of humorous instructional materials on interest in a math task. Motivation and Emotion, 34, 293–305. https://doi.org/10.1007/s11031-010-9178-5

Mckendry, S., and Boyd, V. (2012). Defining the "independent learner" in UK higher education: Staff and students' understanding of the concept. International Journal of Teaching and Learning in Higher Education, 24, (2), 209-220, ISSN 1812-9129. https://files.eric.ed.gov/fulltext/EJ996267.pdf

Metcalfe, J. (2017). Learning from errors. Annual Reviews. https://www.annualreviews.org/doi/pdf/10.1146/annurev-psych-010416-044022

National Economic and Development Authority (2017). Philippine Development Plan 2017-2022. National Economic and Development Authority, Pasig City, Philippines

Oginni, O. I. & Owobali, O. T. (2012). Integration of programmed instruction into mathematics and science teaching: A panacea to students dwindling interest in mathematics and science in Nigerian schools. European Journal of Educational Research, 1, (3). https://files.eric.ed.gov/fulltext/EJ1086380.pdf

Oladejo, M.A., Olosunde, G.R., Olebisi, A.O., and Isola, O.M. (2011). Instructional Materials and Students'Academic Achievement in Physics: Some Policy Implications. European Journal of Humanities and Social Science, Vol. 2, No. 1, ISSN 2220-9425. https://www.researchgate.net/profile/Maruff_Oladejo2/publication/265076250_Instructional_Materials_and_Students'_Academic_Achievement_in_Physics_Some_Policy_Implications/links/544203640cf2a6a049a5cc04/Instructional-Materials-and-Students-Academic-Achievement-in-Physics-Some-Policy-Implications.pdf

Olayinka, A.R.B. (2016). Effects of Instructional Materials on Secondary Schools Students' Academic Achievement in Social Studies in Ekiti State, Nigeria. World Journal of Education, Vol. 6. No. 1, E-ISSN 1925-0754. https://files.eric.ed.gov/fulltext/EJ1158251.pdf

Organization for Economic Cooperation and Development (2019). 2018 Programme for International Student Assessment. https://www.oecd.org/pisa/PISA%202018%20Insights%20and%20Interpretations%20FINAL%20PDF.pdf

Owusu-Manu, D., et al. (2017). An empirical assessment of innovation practices of quality surveying firms in Ghana. Journal of Construction Project Management and Innovation, 7, SI (1): 1843-1858, ISSN 2223-7852. https://www.researchgate.net/publication/32214463_An_empirical_assessment_of_innovation_practices_of_quality_surveying_firms_in_Ghana

Philippine Official Gazette (2018). The 1987 Constitution of the Republic of the Philippines-Article XIV. http://www.officialgazette.gov.ph/constitution/the-1987-constitution-of-the-republic-of-the-philippines/the-1987-constitution-of-the-republic-of-the-philippines-article-xiv/

Poladian, L., and Nicholas, J. (2013). Mathematics bridging courses and success in first-year calculus. Retrieved http://deltaconference.org/documents/program/1A-4-Poladian2013.pdf

Qualifications and Curriculum Authority (2009). Advanced bridging course for post – 16 learners, ISBN 978 – 1 – 84962 – 026 – 0. http://archive.teachfind.com/qcda/orderline.qcda.gov.uk/gempdf/1849620954/QCA094254_Post16_Advanced_Bridging_Courses.pdf

Reyes, J.D. Insorio, A.O., Ingreso, M.L.V., and Hilario, F.F. (2019). Conception and application of contextualization education. International Journal of Educational Studies in Mathematics, 6(1), 1-18, ISSN 2148-5984. https://dergipark.org.tr/download/article-file/664590

Riccomini, P. J., Smith, G.W., Hughes, E., & Fries, K. (2015). The language of mathematics: The importance of teaching and learning mathematical vocabulary. Reading & Writing Quarterly, Overcoming Learning Difficulties, 31:3, 235 – 252, ISSN: 1521 – 0693. https://www.researchgate.net/publication/276443539_The_Language_of_Mathematics_The_Importance_of_Teaching_and_Learning_Mathematical_Vocabulary

Rivet, A.E. & Krajcik, J. S. (2008). Contextualizing instruction: Leveraging students' prior knowledge and experiences to foster an understanding of middle school science. Journal of Research in Science Teaching, 45 (1), 79-100. https://doi.org/10.1002/tea.20203

Sarian, D. (2018). Dewey and progressivism. https://www.frcs.org/2017/07/10/dewey-and-progressivism/

Setyani, Putri, D.P., Ferdianto, F., & Fauji, S.H. (2020). Designing A Digital Teaching Module based on Mathematical Communication in Relation and Function. Journal on Mathematics Education, 11(2), 223-236. http://doi.org/10.22342/jme.11.2.7320.223-236.Singh, H. (2014). Differentiating Classroom Instruction to Cater Learners of Different Styles. Indian Journal of Research, Vol. 3 (12), ISSN - 2250-1991. https://www.researchgate.net/publication/283490706_Differentiating_Classroom_Instruction_to_Cater_Learners_of_Different_Styles

Sorsogon 101 (2019). Rotonda from above. https://web.facebook.com/Sorsogon101/

Stewart, J. (2016). Calculus early transcendentals, 8th edition. Cengage Learning, Inc., Boston, USA. ISBN: 978-1-285-74155-0. https://www.pdfdrive.com/calculus-early-transcendentals-8th-edition-e189947262.html

The Higher Education Academy (2014). Independent Learning. https://heacademy.ac.uk/system/files/resources/independent _learning.pdf

UNESCO International Basic Education (2020). Training Tools for Curriculum Development. A Resource Pack. http://www.ibe.unesco.org/fileadmin/user_upload/COPs/Pages_documents/Resource_Packs/TTCD/sitemap/Module_4/Module_4_2_concept.html

van de Pol, J., Volman, M., Oort, F., & Beishueizen, J. (2015). The effects of scaffolding in the classroom: Support contingency and student independent working time in relation to[19] student achievement, task effort, and appreciation of support. Springer (2015). https://link.springer.com/content/pdf/10.1007/s11251-015-9351-z.pdf

Villareal, M. (2018). Timitim ng Gubat, Sorsogon!! Hindi kita malilimutan. Hanggang sa muli!. https://www.webstagramsite.com/media/BpNxfg5nilc

Weinberg, A. E., Besile, C. G. & Albright, L. (2011). The effect of an experiential learning program on middle school students' motivation toward mathematics and science. https://www.tandfonline.com/doi/pdf/10.1080/19404476.2011.11462086

Yve (2015). Pili Nut. https://yvonnenovela.wordpress.com/2015/06/30/pili-nut/

1.	~~in~~	Wordy Sentences	Clarity
2.	three weeks	Wordy Sentences	Clarity
3.	*niyog*	Unknown Words	Correctness
4.	*lubi*	Unknown Words	Correctness
5.	*timitim*	Unknown Words	Correctness
6.	~~timitim~~ → time Tim	Misspelled Words	Correctness
7.	*patikim*	Unknown Words	Correctness
8.	*tikim*	Unknown Words	Correctness
9.	~~kamoteng~~ → among	Misspelled Words	Correctness
10.	*kahoy*	Unknown Words	Correctness
11.	*canarium*	Unknown Words	Correctness
12.	*ovatum*	Unknown Words	Correctness
13.	~~stress~~ → stresses	Faulty Subject-Verb Agreement	Correctness
14.	~~in accordance with~~ → by, following, per, under	Wordy Sentences	Clarity
15.	~~BRIMAN~~ → BRIAN	Misspelled Words	Correctness
16.	The extent	Determiner Use (a/an/the/this, etc.)	Correctness
17.	*doi*	Unknown Words	Correctness
18.	~~knowledge and~~ → knowledge and	Improper Formatting	Correctness
19.	~~in relation to~~ → about, to, with, concerning	Wordy Sentences	Clarity