EXTENT OF CONTEXTUALIZATION OF THE TEACHER-MADE LEARNING MATERIALS IN GENERAL MATHEMATICS AND ALIGNMENT TO THE LEARNING COMPETENCIES

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Abstract:

In the Philippines, the Department of Education (DepEd) emphasized the production and utilization of contextualized learning materials (CLMs) to make learning meaningful and relevant to students. This study aimed to determine the extent to which teacher-made learning materials in General Mathematics were contextualized and aligned with the prescribed learning competencies. The researcher utilized the descriptive-evaluative design using an adapted evaluation tool as the main instrument in the data gathering. Six Senior High School (SHS) General Mathematics teachers from private schools in Alicia, Isabela, Philippines participated in the study. They were purposely selected based on the criteria that they have created their learning materials in "functions and their graphs" in the first semester of 2020-2021. The researcher gathered data from scanned teacher-made learning materials and evaluator ratings on contextualization and alignment. The results revealed that contextualization was evident in the materials, but only to a satisfactory or poor extent. Moreover, the contents of the materials demonstrated a high percentage of alignment with the prescribed learning competencies. The teachers revealed that lack of time, limited knowledge of contextualization, difficulty in matching competencies in a real-life context, and students' differences hindered their capability to contextualize. Contextualized learning materials featuring the real-life contexts of Alicia, Isabela, on the least contextualized lessons, were prepared as an output. Teachers could use the researcher-made CLMs as supplementary learning materials. These learning materials were further recommended for validation and pilot testing to determine their effectiveness.

Keywords: Alignment; Contextualization; Learning materials; Problems encountered by teachers; Real-world situations

Introduction

Mathematics is a discipline applied in various daily activities (Das, 2012). It was one of the core subjects that had to be taken by students in the primary and secondary levels of education. However, it was widely accepted that math was a difficult subject that enticed the attention of only a few (Ganal & Guiab, 2014). It was also an alarming observation that Filipino students were generally poor in mathematics. The Filipino students' poor performance in mathematics could be reflected in the PISA 2018 results which showed that the Philippines received a mean score of 353 points, lower than the OECD average of 489 points (Department of Education, 2019). The National Achievement Test (NAT) results also disclosed that students' math success, with a mean of 48.63%, fell short of the Department of Education's projected passing percentage of 50% (Peteros et al., 2019). As mentioned by Cubillas (2020), the students' low performance could be due to the students' lack of conceptual understanding of fundamental mathematics concepts.

Curriculum contextualization, which aimed to foster a thorough understanding of mathematical concepts through active and relevant learning, addressed these issues. Contextualization was the educational process of relating the curriculum to a setting, situation, or area of application to make the competencies relevant, meaningful, and useful to all learners (Department of Education, 2015). It was classified into two levels: localization and indigenization. Localization refers to connecting a lesson's content to the learners' local knowledge and experiences. On the other hand, indigenization incorporated the socio-cultural, bio-geographic, and historical context of the learners' community into the curriculum. The contextualization of learning materials (CLMs) was highly regarded as curriculum support that enhanced instruction. The RA 10533, also known as the Enhanced Basic Education Act of 2013, emphasized the development and production of materials that were suitable to the students' needs and contexts (Official Gazette, 2013). It adhered to constructivist learning theory which asserted that learning occurred when learners could produce knowledge and form meaning based on their experiences. In Valenzuela (2016), the socio-cultural constructivism

theory of Vygotsky suggested that the learners' environment dramatically influenced how and what they think. Crawford (2001), cited in Musyadad and Avip (2020), discussed the REACT strategy of contextualization, which was also based on constructivism. It was composed of five primary forms of contextual learning, namely: relating (learning in the context of life experience), experiencing (learning in the context of exploration), applying (applying concepts and information learned in a useful context), cooperating (learning in the context of sharing, responding, and communicating with other students), and transferring (learning in the context of existing knowledge).

Context-based instruction in mathematics promoted active participation and higher student engagement in learning (Brown & Redmond, 2017). According to Pardilla (2020), students could have a better understanding of topics when the resources were relevant to their educational needs and environment. Recent studies revealed that CLMs such as lesson plans (Buan et al., 2021), learning modules (Domingo, 2017; Madrazo & Dio, 2020), students' worksheets (Arnilawati et al., 2018), and strategic intervention materials (SIMs) (Adonis, 2020; Cubillas, 2020) effectively assisted students in mathematics learning. Pardilla (2020) further pointed out that the development of relevant learning materials was a vital task for teachers. They were responsible for making learning responsive and comprehensible to learners since they directly interacted with the students and their environment (Jimes et al., 2013). As teachers designed contextualized instruction through the integration of their students' local contexts, they must begin by setting goals and objectives because they provided the direction for the instructional process. Urbano (2020) stated that it was essential to analyze the alignment of the teacher's instruction with the curriculum's standard learning competencies. Scheerens (2016) further discussed that the alignment between the intended curriculum and the implemented curriculum, which could be reflected in the utilized learning materials, ensured the attainment of educational outcomes.

The DepEd's Basic Education Learning Continuity Plan (BE-LCP) also highlighted the importance of quality learning resources in light of the recent changes to the educational landscape brought about by the Covid-19 pandemic (Department of Education, 2020). Teachers, especially in private schools, had been developing their learning materials since the start of the pandemic. As they crafted their learning materials, they must be evaluated to ensure that they adhered to the DepEd's mandate of providing students with developmentally appropriate materials based on the curriculum's learning standards and addressed the learners' specific needs, backgrounds, and characteristics.

In this light, this study aimed to evaluate the quality of teacher-made learning materials in General Mathematics to ensure that they were relevant to the local setting of the students and that they were in line with the required learning competencies, which were known as the most essential learning competencies (MELCS). Specifically, it aimed to: (1) identify the contextualized parts of the teacher-made learning materials; (2) determine the extent of contextualization of the teacher-made learning materials and the alignment to the learning competencies; (3) identify Mathematics teachers' problems in preparing contextualized learning materials; and (4) prepare supplementary learning materials for least contextualized lessons.

Materials and Methods

A descriptive-evaluative research design was utilized in the study. Six teacher-respondents from two selected private secondary schools in Alicia, Isabela, Philippines, participated in the study. Purposive sampling was utilized in the selection of the respondents because of the criteria imposed such as experience in teaching General Mathematics in the Senior High School (SHS) and having developed their learning materials on the topics 'functions and their graphs' during the first semester of the school year 2020-2021. Ten (10) teacher-made materials were collected for the whole unit. They were composed of text-based (print or non-print) materials such as PowerPoint materials (LM #1) and learning modules (LM #2).

The researcher did document scanning to identify the contextualized parts of the teacher-made learning materials in each topic using the REACT strategy on contextualization as the basis. Furthermore, the collected materials were evaluated by three experts using an adapted evaluation tool. The tool was composed of two parts: (1) the alignment checklist and (2) the contextualization rating scale. The alignment checklist was patterned to the instrument used in the study by Urbano (2020) which requires a yes or no response whether or not the instructions in the materials were aligned to the MELCs. The contextualization rating scale employed a four-point Likert scale (4- very satisfactory, 3- satisfactory, 2-poor, and 1- very poor) to assess how well the materials met the twelve indicators of contextualization adapted from the study of Nangpuhan (2019). The evaluation tool had undergone validation and reliability tests with

a computed Cronbach's Alpha value of 0.94, interpreted as very highly reliable. In addition, a validated researcher-made written questionnaire with open-ended questions was utilized to identify the problems encountered by teachers in preparing CLMs in mathematics.

Descriptive statistics such as the mean and weighted mean were utilized in the analysis of the evaluators' ratings in terms of contextualization while frequency counts and percentage distribution were used to describe the number of aligned MELCs and instruction in the learning material. Moreover, a thematic coding technique was utilized to analyze the teachers' responses to the problems they encountered in contextualizing their learning materials. Finally, based on the results, the researcher identified the least contextualized competencies in the unit by the ranking of the weighted mean ratings. CLMs following the format of a self-learning module (SLM) on the least contextualized competencies were prepared.

Results and Discussions

1. Contextualized Parts of the Teacher-made Learning Materials

The REACT strategy on contextualization was used as the basis for identifying the contextualized parts of the teacher-made learning materials in each of the five lessons, namely: key concepts of functions, rational, one-to-one and inverse, exponential, and logarithmic functions. Each contextualized item was categorized into situations, problems, and activities.

Table 1. Contextualized Contents on 'Key Concepts of Functions'

Sample of Contextualized Contents
Contextualized Situations • "The assignment of region 2 provinces to their capitals." (LM #1) • "A two-day sale was held at SM malls during the end of the month. Frank bought a pair of shoes for ₱1,200 at 20% discount. Represent the original price of the shoes as a function." (LM #1) • "Peter's phone loses 10% of its battery every hour. Write a function representing the amount of its battery charge after x hours." (LM # 2)
Contextualized Problem • "A local delivery service charges a fixed delivery fee of ₱30 for a maximum distance of 2km. Every exceeding distance is charged with an additional fee of ₱8 per km. If the customer paid a delivery charge of ₱62, how far is the distance traveled by the delivery rider?" (LM #1)
Contextualized Activities • Performance task (Group task) "Form a group of 5… Define the piecewise function that models the tax structure of the Philippines…comment whether you think the tax rate is fair or not. Compare the amount of tax deducted from taxpayers with various levels of income and create a report of your findings…" (LM # 1) • "Determine whether it is a function or a mere relation (LM #2) $B = \{(Philippines, Asia), (China, Asia), (Italy, Europe), (Ghana, Africa)\}$ $B = \{(Philippines, Asia), (China, Asia), (Italy, Europe), (Ghana, Africa)\}$ $C = \{(Aguinaldo, March), (Quez\square n, August), (Laurel, March), (Roxas, January)$ $C = \{(Aguinaldo, March), (Quez\square n, August), (Laurel, March), (Roxas, January)$„

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As shown in Table 1, the teacher-made materials on 'key concepts of functions' employed contextualized items such as situations related to what the students already knew. For instance, the assignment of Region II provinces to their capitals was familiar knowledge to the students used in introducing the concept of functions. Contextualized problems were also identified. They required applications of the concepts learned to solve real-world problems. The problems also utilized everyday objects, events, and places familiar to the students. Contextualized performance task activity that promoted collaborative learning among learners was also identified, particularly from LM 1.

Table 2. Contextualized Contents on 'Rational Functions'

Sample of Contextualized Contents
Contextualized Situations • "Cristy can create a full-length video presentation for their English task in 4 days. Her classmate, Rachel can create the same full-length video presentation in 3 days. If they work together, what equation can be used to determine the number of days it would take for them to complete the video presentation?" (LM #1) • "The distance from Manila to Baguio is around 250 kilometers. Construct a function *s* where s is the speed of the travel that describes the time (hours) it takes to drive from Manila to Baguio." (LM #2)
Contextualized Problem • "A student attends one of the Universities in Santiago City. She travels a 24-kilometer distance every day from Alicia to Santiago City. a) Construct a function (s), where s is the speed of travel that describes the time it takes to drive from Alicia to Santiago. b) Determine how long will it take the students to reach Santiago city if the average speed of the vehicle is 40 kilometers per hour? 50 kilometers per hour?" (LM #1)
Contextualized Activities • "Solve for the following problems on rational functions: (*sample item from the activity on* LM #1) 1. Vincent bought 15 kilograms of fruits consisting of mango and banana for her fruit stand business. He bought P720 worth of mango and P360 worth of banana. If the cost of a mango is P20 more than that of a banana, how many kilograms of each fruit did he buy?" • "Estimate the average monthly cost that your family spent on food. Allot an amount A(x) to each member x of your family. a) Write an equation that shows the relationship between A(x) and x. b) Construct a table of values of the resulting function (at least 10 values), and sketch its graph. c) What does the graph tell you in practical terms? Discuss its meaning in practical terms." (LM #2)

Table 2 presents some of the contextualized contents of the materials on rational functions. The identified items showed practical applications of rational functions in real-life contexts. Actual data (e.g., distance from Manila to Baguio; distance from Alicia to Santiago) and some familiar contents such as places and tasks/activities related to students' experiences, were also employed in the construction of the items.

Table 3. Contextualized Contents on 'One-to-one and Inverse Functions'

<table>
<tr><th>Sample of Contextualized Contents</th></tr>
<tr><td>Contextualized Situations
• "The relation pairing every human being into its DNA molecule." (LM #1)
• "Suppose you ride a bus traveling at a speed of 70 km per hour from Isabela to Manila. If you have traveled 100km, what function will define the time it took the bus to travel the given distance?" (LM #2)</td></tr>
<tr><td>Contextualized Problem
• "Engineers have determined that the maximum force t in tons that a particular bridge can carry is related to the distance d in meters between its supports by the following function: $t(d) = (\frac{12.5}{d})^3$ $t(d) = (\frac{12.5}{d})^3$. How far should the support be if the bridge is to support 6.5 tons? Construct an inverse function to determine the result." (LM #2)</td></tr>
<tr><td>Contextualized Activities
• "Activity: Think-Pair-Share! Choose a pair and solve the following problems (LM 1)
Your mother called and told you that your little brother has a 105.8°F temperature. Do you have any reason to worry about your brother? The relationship between temperatures in degrees Fahrenheit (°F) and in degrees Celsius (°C) is given by °F=95°C+32. What is the corresponding value in degrees Celsius of 100°F?"
• Sample item from the activity on LM 2
Suppose that your aunt from the US wants to send you money. She asks for the current foreign exchange rate from US dollars to pesos.
a. What function will you use to convert the money to peso if the current exchange rate is at P50.25 per USD?
b. Complete the table by converting the US dollar to the peso.
<table>
<tr><td>$</td><td>10</td><td>15</td><td>20</td><td>25</td><td>30</td></tr>
<tr><td>P</td><td>50.25</td><td></td><td></td><td></td><td></td></tr>
</table>
c. Find the inverse of the function to determine the value of a U.S. dollar in terms of Philippine peso using the given exchange rate."</td></tr>
</table>

Table 3 presents the contextualized content of the teacher-made learning materials on 'one-to-one and inverse functions'. They utilized familiar knowledge to the students such as the assignment of a human being to its DNA. The learning materials contained adequate problem-solving items that involved the application or the concept in a useful context (e.g., determining the needed distance between the bridge's supports to carry a certain amount of force; converting a US dollar to peso); etc. Additionally, a collaborative task was also observed in LM 1, using the think-pair-share technique.

Table 4. Contextualized Contents on 'Exponential Functions'

<table>
<tr><th>Sample of Contextualized Contents</th></tr>
<tr><td>Contextualized Situation
• "Laboratory findings show that the SARS causing coronavirus, upon reaching maturity, divides itself into two after every hour. Define a function that represents the number of cells of the virus after 1 day if it started with just one cell?" (LM #1)</td></tr>
<tr><td>Contextualized Problems
• "A certain barangay in Alicia has a population of 10,000 that is increasing at the rate of 5% each year. Find the population of that barangay after 2 years." (LM #1)
• "Mr. Reyes bought a brand-new Toyota Vios last 2018 for P875,000. The car's value depreciates by 21% yearly. After how many years can one buy the car at about half its original price?" (LM #2)</td></tr>
<tr><td>Contextualized Activities
• "Activity: Work in pairs & answer the following problems on exponential functions (sample item from the activity in LM #1)</td></tr>
</table>

1. Maine decides to participate in an investment that yields 3.75% interest annually. If she invests P12500, how much will her investment be after 5 years?" • Fold-and-Cut Activity (students were asked to get a strip of paper and they were instructed to fold and cut the paper, and repeat the procedure continuously, taking note of the number of cuts and the number of pieces of paper produced. Students investigate the relationship between the number of cuts/folds and the number of papers produced, and represent them as a function) (LM #2)

As shown in Table 4, the contextualized items found in the materials on 'exponential functions' included relatable and familiar situations to the students' backgrounds and experiences. The problem-solving items were based on the practical and useful application of the concepts learned. Some items also utilized actual information to construct the contextualized situations and problems (e.g., the depreciation rate of Toyota Vios). Contextualized activities were also present such as collaborative learning from LM 1 (by working in pairs) and the discovery learning activity, the fold and cut activity, which employed the experiencing strategy.

Table 5. Contextualized Contents on 'Logarithmic Functions'

Sample of Contextualized Contents
Contextualized Problems • "Angela and her friends attended a concert featuring their favorite boy band group. The concert's sound intensity is given by 10-2Wm2. What is its corresponding sound intensity in decibels?" (LM # 1) • "The value of $[H^+]\,[H^+]$ of ammonia is $1.3 \times 10^{-9} 1.3 \times 10^{-9}$ moles per liter. Find the value of hydrogen ion concentration of ammonia and determine its acidity or alkalinity." (LM #2)
Contextualized Activities • "Problem-solving activity (*Sample item from LM #1)* The intensity of the sound of a jet during takeoff is 100 watts m2. a. What is the corresponding sound intensity in decibels? b. How much more intense is this sound than the least audible sound a human can hear?

Table 5 presents some of the contextualized items utilized on the materials on 'logarithmic functions.' Contextualized items such as problems and activities were observed in both learning materials. Notably, most items were related to the scientific applications of logarithmic functions such as determining the pH scale of a solution and the intensity of a sound. These items were considered contextualized since they exhibited real-life applications of the concept.

Contextualization was evident in both sets of teacher-made learning materials on 'functions and their graphs.' The result aligned with the K-12 curriculum's mandate to make learning meaningful and relevant by incorporating real-life settings into the lessons. The findings also showed that the teacher-respondents employed localization as a way to contextualize. The materials connected the lesson's content to the learners' local knowledge and experiences. Most of the information used included local places, objects, familiar events/activities, and problems encountered by students in their personal lives and the community. On the contrary, indigenization, the other form of contextualization, was not evident. None of the materials incorporated the socio-cultural, bio-geographic, and historical context of the learners' community into the lessons.

Additionally, the learning materials used different essential forms of learning based on the REACT strategy to contextualize. The most utilized forms of learning were relating, applying, and transferring. There were a few items identified that promoted collaborative learning. Meanwhile, the experiencing strategy to contextualize was rarely used. Only one activity used this form of learning, notably LM # 2's 'Fold-and-Cut activity' on exponential functions. The findings indicated that some forms of contextual learning were hardly utilized in the teacher-made learning materials. Thus, contextualization based on REACT was not perfectly implemented.

2. Extent of Contextualization and Alignment of the Materials to Learning Competencies

Table 6. Extent of Contextualization of the Teacher-made Learning Materials Per Competency

Topics	Most Essential Learning Competency (MELC)	Mean Rating	Interpretation	Rank
Key Concepts of Functions	Represents real-life situations using functions, including piecewise functions	3.35	Satisfactory	3
	Solves problems involving functions.	3.42	Satisfactory	1
Rational Functions	Represents real-life situations using rational functions.	3.21	Satisfactory	6
	Solves problems involving rational functions, equations, and inequalities	3.33	Satisfactory	4
One-to-one and Inverse Functions	Represents real-life situations using one-to-one function	3.24	Satisfactory	5
	Solves problems involving inverse functions.	3.36	Satisfactory	2
Exponential Functions	Represents real-life situations using exponential functions.	3.06	Satisfactory	8
	Solves problems involving exponential functions, equations, and inequalities.	3.08	Satisfactory	7
Logarithmic Functions	Represents real-life situations using logarithmic functions.	2.47	Poor	9
	Solves problems involving logarithmic functions, equations, and inequalities	2.42	Poor	10

Descriptive equivalents: 1.00-1.49 (Not Satisfactory), 1.50-2.49 (Poor), 2.50-3.49 (Satisfactory), 3.50-4.00 (Very Satisfactory)

As shown in Table 6, the learning materials on the selected MELCs under key concepts of functions, rational, one-to-one and inverse, and exponential functions were satisfactorily contextualized, while the learning materials on the selected MELCs under logarithmic functions were poorly contextualized.

It was agreed by the evaluators that all of the evaluated teacher-made learning materials have placed topics in real-life (outside of the classroom) situations and experiences that the students are familiar with by using materials, facts, and information observable in their community. This is consistent with the conclusion of Reyes et al. (2019) which stated that teachers had two approaches to contextualization which were: relating lessons to students' lives and employing local materials and knowledge. The results imply that teachers are aware that making connections between the local environment and the lesson is essential in contextualization. As stipulated in RA 10533: "the curriculum shall be flexible enough to enable and allow schools to localize, indigenize and enhance the same based on their respective educational and social contexts…" (Official Gazette, 2013). The mandate prompted teachers to align their instructions to what information was present in the students' current environment and setting.

The materials also obtained a high rating in the indicators stating that the material "includes realistic & believable problem-solving situations that students can relate to in their current or future life" and "includes activities that require students to apply mathematics concepts in real life in the context of their application in their community." The results conformed to the suggestion of Buan et al. (2021) and Ulandari et al. (2019) who found that learning materials with contextual problems could improve students' problem-solving and self-efficacy abilities. The use of authentic and practical problem-solving situations also helped students understand when and how to connect and apply a mathematical concept to real-world problems (Loi et al., 2020; Panaoura et al., 2016; Sawalha, 2018).

Furthermore, the teacher-made learning materials also employed few collaborative learning activities while instructions that promoted experiential learning were extremely limited. This is somewhat similar to the conclusion of Bueno and San Agustin (2019) who found that teachers contextualized their lessons on functions by relating them to students' lives and by using collaborative learning strategies, but they least employed experiential learning

strategies. The experiencing and cooperating strategies were among the essential forms of learning enumerated in the REACT strategy of contextualization. However, instructions or activities that employed the two strategies were not adequately observed on the evaluated learning materials.

Table 7. Frequency and Percent of Aligned MELCS and Teacher-made Learning Materials

Topics	No. of MELCS	No. of aligned MELCS & teacher-made learning materials				Mean	Mean percent
		(LM 1) PPT materials		(LM 2) Learning modules			
		F	%	F	%		
Key concepts of functions	4	4	100	4	100	4	100
Rational functions	7	7	100	7	100	7	100
One-to-one & inverse functions	5	4	80	5	100	4.5	90
Exponential functions	7	6	85.7	5	71.4	5.5	78.6
Logarithmic functions	7	6	85.7	4	57.1	5	71.4

Table 7 displays the frequency and percentage distribution of the aligned materials and learning competencies on the unit of 'functions and their graphs.' The teacher-made materials were assessed regarding their contents' alignment to the prescribed learning competencies outlined in the DepEd's Adoption of the BE-LCP or known as the MELCs.

Results revealed that the learning materials on key concepts of functions and rational functions had the highest mean percent of alignment (100%), while the materials on logarithmic functions had the least percent of aligned learning competencies, with a mean percent of 71.4%. The majority of the MELCs were covered on both sets of materials indicating a high degree of alignment between the materials' instructions and learning competencies. However, some misalignments were determined as neither set of teacher-made materials covered all of the unit's target competencies. The few misalignments may suggest that the instructions in the learning materials are insufficient to facilitate students in mastering all learning competencies throughout the unit of "functions and their graphs." As a result, students may find it challenging to learn competencies in higher mathematics that require the concepts of functions, such as calculus. The findings and conclusion of Urbano (2020) supported this assumption as he concluded that misalignment could explain some of the teachers' difficulties during their lessons, such as the students' undeveloped math skills and abilities. Additionally, Mamolo (2019) asserted that students' least learned competencies (LLCs) were topics that were too difficult and not taught or covered during their teachers' instruction. Alfauzan and Tarchouna (2017) reiterated in their study that an aligned curriculum reinforced students' successful attainment of the intended learning outcomes. Thus, teachers should thoroughly review the contents of their learning materials following the list of learning competencies outlined in the curriculum guide to ensure that students will demonstrate a greater understanding of and ability to perform the targeted learning competencies.

3. Problems Encountered by Teachers in Preparing Contextualized Learning Materials

Classroom teachers were vital in the implementation of the curriculum. The conditions that they experienced while planning for their instruction needed to be explored as they contributed to the decision of teachers whether to contextualize or not. The teacher-respondents revealed that limited time for instructional preparation hindered them from contextualizing their materials. Bose (2018) complemented this finding as he also found that many paper works and voluminous tasks left the teachers with limited time for material preparation. The teachers also have limited knowledge about contextualization. They revealed that they had not yet attended any training/seminar on the strategy and that opportunities to attend such programs were also limited. This agreed with the study of Nangpuhan (2019) which stated that teachers had few opportunities to attend contextualization training and seminars, and when they did, only a few teachers were invited. Moreover, the teachers also found it challenging to contextualize some learning competencies, especially those concepts that were too analytical. A similar problem arose in the study of Reyes et al. (2019) where they found that JHS teachers also struggled in contextualizing some learning competencies in mathematics. These findings were supported by the statement enclosed in the Framework for Philippine Mathematics Teacher Education which stated that not all learning competencies in mathematics had an apparent connection in real life but were still necessary to be taught (SEI-DOST & MATHTED, 2011). Lastly, one teacher-respondent revealed

that students' diversity posed a problem in preparing contextualized materials. As discussed by Domingo (2017), CLMs were deemed necessary to support students' learning from different backgrounds, abilities, and styles. Thus, teachers must have knowledge and understanding of their students' differences (Espiritu & Ogerio, 2020).

4. Preparation of Contextualized Learning Materials (CLMs)

Contextualized learning materials (CLMs) in the form of self-learning modules (SLMs) on the least contextualized lessons were prepared as an output of this study. SLM was an interactive, self-contained, self-instructional, and compact material focusing on the development of one or several related MELCs prescribed by the DepEd as the primary learning resource during distance learning. The least contextualized competencies were determined based on the ranking of the ratings in the contextualization of the teacher-made material as shown in Table 6. The least contextualized competencies were in the topic of logarithmic functions, namely: 'represents real-life situations using logarithmic functions' and 'solves problems involving logarithmic functions, equations, and inequalities which were ranked 9 and 10, respectively. Thus, two CLMs were developed. Table 8 shows the list of the learning objectives and contextualized contents employed on the CLMs.

Table 8. Contextualized Features/Contents of the Researcher-made CLMs

MELCs	Learning Objectives	Contextualized Contents
Represents real-life situations using logarithmic functions.	• Define logarithmic functions; • Convert exponential function to logarithmic function or vice versa; • Evaluate logarithmic expression; and • Represent real-life situations using logarithmic function	• Actual data of earthquakes recorded in the municipality of Alicia and province of Isabela, Philippines • Objects familiar to students, such as vacuum cleaners and laundry detergent. • Usual food, beverages, and condiments, like milk, coke soda, tomato, calamansi juice, and *sukang basi* (a traditional vinegar native to the Ilocano). • Comics illustrating the growth of members in a networking business over time. • Usual activities/practices of the locals, like managing a *sari-sari* store, taking an afternoon nap, online selling, and saving money in banks. • Events held/observed in the municipality, like band concerts, fireworks displays, traffic situations near Robinson's supermarket, and *Pagay Festival* (the cultural town fiesta in Alicia) • An activity where students gather data about their personal food consumption's pH level and create their digital posters. • A collaborative activity on solving real-life problems (students ask questions, exchange ideas, and evaluate their solutions).
Solves problems involving logarithmic functions, equations, and inequalities	• Recall how to solve logarithmic equations and inequalities; and • Solve problems involving logarithmic functions, equations, and inequalities	• Local places/landmarks near or in Alicia, such as PNB Alicia, Santiago City, Motor trade Alicia branch, Pag-Ibig Cauayan branch, Alicia commercial center, and Pan de Zab bakery. • Common foods and beverages, such as coffee, coke, mango juice, milk, ice cream, porridge, banana, and "buko-roll." • Common objects familiar or found in the students' surroundings, like door handles, smartphones, laptops, earphones, and ten-peso bills. • Usual activities/practices of the locals like farming, selling meat, investing money in a local farmers'

	cooperative or in banks, applying for a motorcycle loan, and saving money. • Name of famous local personality like "*Baso Musikero*" • Cultural song of the Ilocano group, "*Manang Biday"* • Historical background of the town of Alicia • Actual data on the population growth of Isabela, of Alicia and its barangays. • An activity where students gather actual data on the population of their respective barangays. • A collaborative activity on solving real-life problems (students ask questions, exchange ideas, and evaluate their solutions).

The CLMs contained real-world concepts and problems featuring the municipality of Alicia, Isabela, Philippines, and some indigenous content such as the community's historical background and cultural knowledge from the town's most dominant cultural group, the Ilocano group. The REACT strategy was also employed in designing the materials' instructions.

Some of the local concepts integrated into the two CLMs included everyday objects seen in the locality, typical foods and beverages, familiar places and establishments, usual activities of the residents, and local town events. Furthermore, realistic and practical problem-solving situations were also employed in the CLMs. They also contained word problems that incorporated indigenized content such as the historical background of the town, cultural events (Pagay festival), native products (sukang basi), and a cultural song (Manang Biday). The prepared CLMs employed both localization and indigenization techniques to contextualize.

Conclusion

Contextualization was evident in the teacher-made learning materials on 'functions and their graphs,' where the teachers mainly utilized localization as a technique. Notably, the most employed form of learning from the REACT strategy on contextualization were relating, applying, and transferring. Moreover, the teacher-respondents contextualized their learning materials to varying degrees ranging from poor to satisfactory extent while aligning their contents with the prescribed most essential learning competencies (MELCs). The study also found that teachers encountered problems in developing contextualized learning materials. They were hindered by the lack of time allotted for preparing contextualized materials, limited knowledge of contextualization, difficulty connecting the competencies to the context of real life, and, finally, the students' diverse differences and interests. As an output of this study, contextualized SLMs on the least contextualized competencies, which were on logarithmic functions were prepared. The materials contained features of the real-life contexts of Alicia, Isabela, Philippines.

The overall findings suggest that teachers should integrate more relevant information and engaging activities such as those that foster experiential and collaborative learning into their materials to make them more contextualized, most especially on the learning competencies with a low extent of contextualization. Relevant training and workshops on contextualization focusing both on localization and indigenization must be held so that teachers can expand their knowledge and skills on contextualization and apply them in preparing for their learning materials in mathematics. It was also recommended that the workloads given to each teacher may be lessened so they have more time for material preparation, attend development programs relevant to the topic, and think of more engaging activities appropriate to the learning competencies and suitable to different kinds of learners. Additionally, the prepared CLMs in this study were recommended for expert validation and pilot testing to determine their effectiveness in improving students' learning outcomes in mathematics. Future researchers may also conduct a similar study considering a more extensive scope of materials and respondents to examine further the implementation of contextualized SHS mathematics curriculum.

Acknowledgement

The researcher would like to express her heartfelt gratitude to the Department of Science and Technology-Science Education Institute (DOST-SEI) for supporting her financially in the completion of this study through the Capacity Building Program in Science and Mathematics Education (CBPSME) Scholarship; to Saint Mary's University School of Graduate Studies (SMU-SOGS) for their unwavering support and assistance in pursuing this study; to her thesis adviser, Ms. Rowena A. Rivera, MST, for her dedication to sharing her knowledge and expertise throughout the study's completion; to her parents, Mr. Jaime S. Gayo and Mrs. Melita A. Gayo, and her brother, Christian A. Gayo, for their unconditional love and priceless moral, spiritual, and emotional support; and above all, to The Almighty God for giving her the courage and faith to overcome all of the fears and challenges throughout her thesis writing journey.

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