

Development and validation of contextualized learning material in mathematics (Bikol Central) for kindergarten

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Abstract

The K-12 curriculum promotes the use of learners' mother tongue as a medium of instruction in Kindergarten through Grade 3. This study aimed to develop a Mathematics learning material in Bikol Central, incorporating essential features and assessing its curricular and statistical validity. Descriptive, evaluative, and developmental research methods were employed to achieve these objectives. 25 kindergarten learners utilized the LM and ten expert-validators evaluated the material using the DepEd Evaluation Tool for Language. The results indicate that the developed learning material excels in activities and exercises under the Evaluation for Language, particularly in coherence and clarity of thought (Factor I), grammar and syntax (Factor II), spelling and punctuation (Factor III), and stylistic consistency (Factor IV). The LM also significantly manifested compliance in all of the Factors under the Evaluation for Content such in Intellectual property rights (Factor I), Learning Competencies (Factor II), Instructional Design and Organization (Factor III), Instructional Quality (Factor IV), Assessment (Factor V), and Readability (Factor VI). The use of Bikol Central in the learning material and its contextualized activities significantly improved learners' performance between pre-test and post-test phases, with p-value of less than 0.05 (p-value- 6.86124E-17), reflecting its effectiveness in relating to the respondents' experiences. Moreover, the material's distinctive features, including contextualized learning activities, enhanced students' understanding and appreciation of the lessons, fostering awareness of gender and development concepts. Further studies are recommended to explore additional factors that may enhance academic performance.

Keywords: mathematics, learning material, kindergarten, mother tongue, contextualized

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1. Introduction

The importance of education cannot be overestimated, as it is the key to a bright and successful future. Education is key to the healthy development of people and their nation. Providing this to the children will ensure their future generations will have the opportunity to look towards a brighter future. Also, education develops critical thinking. This is vital in teaching a person how to use logic when making decisions and interacting with people (e.g., boosting creativity, enhancing time management). However, each individual has different ways in learning. In order for the children to attain their goal, the educator should focus on the individual learner. Through this, the educators will cater the needs of their learners for quality education they deserve (SDG No.4).

CBSUA is an institution of higher learning which strongly advocates gender equality and women empowerment (SDG No. 5). It envisions to lead in steering development efforts towards these advocacies as manifested by their various programs and projects such as in the conduct of research undertakings and community engagements. Moreover, as a Regional GAD Resource Center, the university is committed to lead and influence other Higher Education Institutions of its gender mainstreaming practices. One of which is the development and validation of gender-responsive instructional resources towards the establishment of GAD center resources for gender mainstreaming.

MTB MLE is the government's banner program for education as a salient part of the implementation of the K to 12 Basic Education Curriculum. Learners' mother tongue and additional languages are used in the classroom. Learners begin their education in the language they understand best- their mother tongue and develop a strong foundation in their mother language before adding additional languages. Research stresses that children with a solid foundation in their mother tongue develop stronger literacy abilities in the school language. Hence, this study will be focusing on the development and validation of contextualized Learning Material for elementary learners specifically in Mathematics for Kindergarten learners. The book will be written in Bikol Central in accordance to the K to 12 Basic Education Curriculum requirement that the first language or mother tongue of the learners will be utilized in the instruction, activities, and work exercises. Moreover, the material will also be contextualized or localized for learner's immediate comprehension of concepts since topics are within their knowledge and experiences. The gender-sensitivity of activities is also integrated in the activities. As a result, this specially designed learning material will assist the elementary educators, parents/ guardians, learners, and other professionals as an additional resource in Mathematics for Kindergarten learners.

Objective of the Study - The main objective of the study to develop and validate the contextualized learning materials in Mathematics in order to supplement the learning tasks and be able to support the development of competencies among the Kindergarten learners. The LM was written in Bikol Central and contain contextualized learning activities and integrates gender- awareness concepts. More specifically, Develop contextualized learning materials in Mathematics for Kindergarten learners written in Bikol Central. Determine the curricular validity (validation process) of the learning materials in Mathematics for Kindergarten learners; Determine the statistical validity of the learning materials in Mathematics for Kindergarten learners; and Describe the features of the learning materials.

2. Research highlights

Descriptive, evaluative, and developmental methods of research were used. Descriptive was used to describe the features of the learning material in Mathematics (Bikol Central). Evaluative method was employed to measure the statistical and curricular validity of the developed learning material. Developmental method was

Development and validation of contextualized learning material in mathematics (Bikol Central) for kindergarten used in making the Mathematics learning material written in Bikol Central.

As presented in Table 1, the following were the distribution of the respondents of the study.

Table 1
Distribution of the respondents of the study

Respondents	Number
Teacher-Validators	10
Learners	25
TOTAL	35

Validators. Include the purposely selected master teachers, kindergarten and primary level teachers from Milaor district. The validation process of the LM contents and activities covering the first up to fourth quarter was done with use of Evaluation tool for Language, a DepEd-Developed Learning Resources tool.

Learners. These are the 25 kindergarten learners enrolled in Milaor Central School. Pre-test was administered to the respondents before utilizing the LM. At the end of the fourth quarter, respondents underwent a post test to determine if there was a significant difference in their performance.

There were two (2) instruments used, the (1) pre and post teacher-made test and (2) Evaluation tool for Language, a DepEd-Developed Learning Resources tool. **Pre and Post Teacher-Made Test.** Composed of 15-item questions aligned to the topics and competencies in Mathematics specifically in logic, number and number sense, measurement, geometry, and statistics and probability. The results of these tests will determine the statistical validity of the LM. **Evaluation Tool for Language.** This tool was comprised of standards indicated in the criterion items under the five (5) factors, namely: Factor I. Coherence and clarity of thought, Factor II. Grammar and syntax, Factor III. Spelling and Punctuation and Factor IV. Consistency in style. **Evaluation Tool for Content.** This tool was composed of standards indicated in the criterion items under the six (6) factors which are to be complied, namely: Factor I- Intellectual Property Rights Compliance, Factor II- Learning Competencies, Factor III- Instructional Design and Organization, Factor IV- Instructional Quality, Factor V- Assessment, and Factor VI-Readability.

To facilitate the analysis of data, the following statistical treatment were used: Descriptive statistics which include the frequency count, percentage technique, mean and standard deviation were employed to determine the curricular validity of the Mathematics learning material particularly in terms of its lesson and activities. T test was used to compute the statistical validity of the developed LM using the result of the pre-test and post tests.

Theoretical Framework - This research study is anchored on the following theories: Reinforcement Theory, Instructional Aid Theory and Theory in the Use of Instructional Materials, and Gender Theory. Reinforcement Theory (BF Skinner, 2008) is a limited effects media model applicable within the realm of communication. The theory generally states that people seek out and remember information that provides cognitive support for their pre-existing attitudes and beliefs. Instructional Aid Theory (Seuferts and Brunken, 2006) states that human brain and the memory function during the communicative process. There is general agreement about certain theoretical factors that seem pertinent to understanding the use of instructional aid. The use of instructional aid must be planned, based on ability to support a specific point in a lesson.

Theory on the Use of Instructional Materials (Adekunle, 2008) states that teaching at any level requires that the students be exposed to some form of simulation. When the students are given the chance to learn through more senses than one, they can learn faster and easier. The use of instructional materials provides the teacher with interesting and compelling platforms for conveying information since they motivate learners to learn more.

Gender theory (Jule, 2014) is the study of what is understood as masculine and/or feminine and/or queer behavior in any given context, community, society, or field of study including but not limited to literature, history, sociology, education, applied linguistics, religion, health sciences, philosophy, cultural studies. Gender refers to the categories of social expectations, roles, and behaviors, feminine and masculine, i.e., what is nurtured. In this

study, the LM developed was used to enhance the gender-neutrality and awareness among the Kindergarten and Primary level learners and teachers.



Figure 1. Theoretical Framework

3. Result

Develop contextualized learning material in Mathematics for Kindergarten learners written in Bikol Central - The learning material was developed ensuring that it was engaging, relevant, and effective for young learners particularly to the kindergarten learners. This was developed and designed contextually, incorporating local customs, traditions, and daily activities familiar to the children. Short situational math problems and stories were set in familiar environments and involve characters that children can relate to. Berns and Erickson, 2001 adhere that one of the goals and effects of a contextualization is to capture the students' attention by illustrating the relevance of the learning experience. Contextualized Learning Material (CLM) helps students find and create meaning through experience, drawing from prior knowledge in order to build upon existing knowledge.

The native language of the children, that is Bicol Central as the medium of instruction for Kindergarten mathematics was used. This had several significant advantages that could enhance learning, cultural relevance, and overall educational outcomes. Children were more likely to understand concepts when taught in their native

language. Bikol Central allows for clear and direct communication, reducing language barriers. Learners also feel more comfortable and confident participating in class when instruction is in their native language. This could lead to increased engagement and enthusiasm for learning. Further, using the Bikol Central helps preserve and promote the local culture and traditions. It allows children to see their own experiences and environment reflected in their education. Moreover, the learning material ensured its curriculum alignment. The contents adhered to the educational standards set by the Department of Education, that was based from K to 12 Curriculum Guide for Kindergarten mathematics. Topics covered were from first quarter to fourth quarter which were composed of: Chapter I. Logic, Chapter II. Number and Number Sense, Chapter III. Measurement, Chapter IV. Geometry, and Chapter V. Statistics and Probability.

Gender and Development (GAD) concepts were integrated into the contents and lesson activities. This was essential to promote gender equality and inclusivity from an early age. Gender-neutral terms were used and avoided the use of stereotypes in the language and examples used in the material. Characters in the contents performed a variety of roles and activities, showcasing that all genders can engage in all types of work and play. This concept was in support to Gumba (2013); Hernandez and Cudiamat (2017), that the integration of gender-sensitive teaching strategy remains to be a challenge among educators. This social issue requires more in-depth exploration especially in the classroom to promote its significance and its applicability and effectiveness.

Curricular validity of the learning material in Mathematics for Kindergarten learners - Ensuring the curricular validity of learning material in Mathematics involved a rigorous validation process. This process confirmed that the material was aligned with educational standards, effective, age-appropriate, and culturally-relevant. A need assessment was conducted to understand the specific requirements of kindergarten learners, teachers, and the educational context. Inputs from educators, parents, and curriculum experts were gathered. The DepEd's K to 12 Curriculum Guide was used to ensure curricular alignment.

Evaluation for Language

Panels of experts composed of master teachers, school heads, kindergarten and primary level teachers were assembled to review the material. Expert evaluated the material using the DepEd's Evaluation Tool for Language which was composed of five factors, each was comprised of standards or criterion items; Factor I – Coherence and Clarity of Thought was composed of nine (9) criterion items. At least 7 criterion items must be marked yes to indicate compliance to this factor. Factor II was Grammar and Syntax, composed of 7 criterion items and requires at least 5 items to be marked yes to achieve compliance to this factor. Factor III was about the Spelling and Punctuation which requires 2 out of 3 criterion items to attain compliance and Factor IV covers the Consistency in Style that requires 4 out of 5 criteria to be complied.

a. Factor I- Coherence and clarity of thoughts

Table 2 shows the results of evaluation for Factor I- Coherence and clarity of thoughts. From among the ten (10) panel of evaluators, eight (8) of them agreed that the statements from the materials make sense, sentences in the paragraph contribute to one idea, thoughts or ideas were logically sequenced, conjunctions and transitional phrases were used to link sentences or paragraphs, the choice of words or expressions were appropriate, language used was appropriate for the target learners, and headings or titles were appropriate to the content. Seven (7) out of nine (9) of the criterion items were generally marked with Yes responses. The validation process under this factor yielded highly positive results, indicating strong compliance with key criteria. The two criteria items that did not achieve full agreement might indicate minor areas for improvement, but the overall positive responses suggested that these were not significant enough to undermine the effectiveness of the material.

Table 2 presents the Evaluation results based on Factor I- Coherence and Clarity of Thought. The high level of agreement among the evaluators on the clarity and coherence of the material implied that Kindergarten learners will likely find the content easy to understand. This was crucial for foundational learning, where

comprehension is key to further cognitive development. Also, the logical sequencing and the use of transitional phrases ensure that the learning process is smooth and structured. This helps young learners make connections between concepts, enhancing their ability to grasp and retain mathematical ideas. Moreover, using the language and expressions appropriate for Kindergarten learners ensures that the materials were accessible. This fosters a positive learning experiences, reducing frustration and encouraging engagement with the content.

Table 2
Evaluation results based on Factor I- Coherence and Clarity of Thought.

Standards/ Criterion Items	Yes	No
Factor I- Coherence and Clarity of Thought		
1. Do the statements/phrases make sense?	10	
2. Do the sentences in the paragraph contribute to one idea?	10	
3. Are the thoughts / ideas logically sequenced?	10	
4. Are conjunctions and transitional phrases used to link sentences or paragraphs?	10	
5. Is the choice of words / expressions appropriate?	10	
6. Is the length of sentences appropriate to the target learners?	9	1
7. Is the language appropriate for the target learners?	10	
8. Are the headings or titles appropriate to the content?	10	
9. Is there proportional or equal treatment of topics of the same importance?	9	1
MEAN	9.78	
STATUS- 7 out of 9	Complied	

Further, given that the materials were in Bicol Central, the appropriateness of language and expressions also signifies cultural relevance. This helps in building a strong cultural identity and pride among young learners, making education a more relatable and enriching experience. Rodriguez & Thompson (2010) argues the need for teachers to consider the importance of learning as a linguistic milieu especially when teaching science in context. When teaching and learning in contextually, competent communication must include adequate, genuine, clear and relevant amounts of information.

b. Factor II- Grammar and syntax

Table 3 presents the results of Factor II, the Grammar and syntax. Data revealed that six (6) out of seven (7) criteria received that yes mark, thus making this factor in a compliant status. Evaluators affirmed that the learning material have correct subject-verb agreement, clear antecedents, correct parallel construction, no split infinitives, no overused words, and no redundancies.

Table 3
Evaluation results based on Factor II- Grammar and Syntax

Factor II. Grammar and Syntax	Yes	No
1. Does the developed learning resource have correct subject - verb agreement?	10	
2. Does the developed learning resource have correct placement of modifiers?	9	1
3. Does the developed learning resource have clear antecedents?	10	
4. Does the developed learning resource have correct parallel construction?	10	
5. Does the developed learning resource have no split infinitives?	10	
6. Does the developed learning resource have no overused words?	10	
7. Does the developed learning resource have no redundancies?	10	
MEAN	9.85	
STATUS- 6 out of 7	Complied	

The compliance with these grammatical and syntactical standards ensures that the LM were clear and easy to understand. This is particularly important for Kindergarten learners who were still developing their language skills. Also, by adhering to correct grammatical conventions, the material provides good language models for young learners. This helps in developing their own language skills, which were foundational for all future learning. Moreover, the use of varied vocabulary and the elimination of redundancies make the materials more engaging. Young children were more likely to stay interested in content that was well-written and concise.

c. Factor III- Spelling and punctuation

Table 4 presents the panel of members’ assessment along Factor III- Spelling and Punctuation. The evaluation results for Factor III indicates full compliance. Each criterion within this factor received unanimous approval from all evaluators. This is crucial for ensuring the materials are accurate, clear, and professionally presented.

Table 4
Evaluation results based on Factor III- Spelling and Punctuation

Factor III- Spelling and Punctuation	Yes	No
1. Are words, whether local or foreign, correctly spelled?	10	
2. Are the right punctuation in the right places?	10	
3. Is the use of the serial comma (comma before <i>and</i> and <i>or</i>) observed?	10	
MEAN	10	
STATUS- 3 out of 3	Complied	

This implied that correct spelling is fundamental for readability and understanding. For Kindergarten learners, encountering correctly spelled words helps in building early literacy skills and prevents the formation of incorrect spelling habits. Young learners can more easily follow the text, improving their comprehension and learning experience. This is particularly important in the foundational stages of education, where clear and precise language is key to effective learning.

d. Factor IV- Consistency in Style

Full compliance in Factor IV, which focuses on consistency in style was observed. Each criterion within this factor received unanimous approval from all evaluators. This is crucial for ensuring the material is professional, cohesive, and easy to follow. The result enhances the overall quality and usability of the content.

Table 5
Evaluation results based on Factor IV- Consistency in Style

Factor IV- Consistency in Style	Yes	No
1. Where alternative spellings are permitted, was a choice made and used consistently throughout the materials?	10	
2. Are main heads, subheads, sections, and subsections consistently classified?	10	
3. Is the need for the same tense or person observed?	10	
4. Are the rules on capitalization, hyphenation, setting off in italics or boldface followed?	10	
5. Is there consistence in phraseology of titles, presentation or introduction of new chapters or units?	10	
MEAN	10	
STATUS- 5 out of 5	Complied	

The results implied that full compliance in consistency in style contributes to the readability and comprehension of the materials. Young learners benefit from a structured and predictable format, which helps in understanding and retaining information. The consistent use of language conventions and formatting rules provides model for young learners. This helps in instilling good writing habits and attention to detail from an early age.

Evaluation for Content - Content evaluation of the learning material was conducted to evaluate the learning resource for compliance to standards indicated in the criterion items under the six (6) factors, namely; a. Factor I- Intellectual Property Rights Compliance, b. Factor II- Learning Competencies, c. Factor III- Instructional Design and Organization, d. Factor IV- Instructional Quality, e. Factor V- Assessment, and f. Factor VI- Readability. At least 3 criterion items must be marked yes to indicate compliance to Factor I while for Factor II with single item must be marked yes to indicate compliance. At least eight criterion items are being required in Factor III to indicate compliance to this factor and 5 items for Factor IV, V, and VI.

a. Factor I- Intellectual Property Rights Compliance

Table 6 presents the evaluation results for Factor I- Intellectual Property Rights Compliance. With full compliance (4 out of 4) to the criterion items shows that the learning resource or learning material supports a high-quality, legally compliant, and ethically sound educational environment, benefitting both teaching and learning processes. It ensures that the educational institution avoids legal repercussions associated with copyright infringement. It also upholds ethical standards by respecting the intellectual property rights of creators. Proper citation and accurate references enhance the credibility and reliability of the learning material, making them more trustworthy for students and educators.

Table 6

Evaluation results along Factor I- Intellectual Property Rights Compliance

Standards/ Criterion Items: Factor I- Intellectual Property Rights Compliance	Yes	No
1. The learning resource has no copyright violations.	10	
2. The copyrighted texts and visuals used in the LP are cited.	10	
3. The copy righted materials used in the LP are accurately cited.	10	
4. The references are properly cited in the Bibliography.	10	
STATUS- 4 out of 4	Complied	

b. Factor II- Learning Competencies

The overall status shows the full compliance (1 out of 1) in the criterion which means that the content meets the specified standard. Learning competencies contained in the LM was based from the curriculum guide for Mathematics of the Kindergarten learners. When content aligns with learning competencies, teachers can spend less time searching for appropriate materials and more time focusing on teaching. This ensures that teaching is focused on the skills and knowledge that students need to acquire at each grade level, thus teachers can plan lessons more effectively, knowing that their teaching materials support the required learning outcomes. The compliance with the targeted DepEd Learning Competencies ensures that the educational content provided in the LM meets national standards, supports effective teaching, and enhances student learning outcomes. By adhering to these competencies, the institution demonstrates a commitment to delivering high-quality education that prepares students for academic success and future opportunities.

Table 7

Evaluation results along Factor II- Learning Competencies

Standards/ Criterion Items: Factor II- Learning Competencies	Yes	No
1. Content is consistent with the targeted DepEd Learning Competencies (LCs) intended for the learning area and grade level.	10	
STATUS- 1 out of 1	Complied	

c. Factor III- Instructional Design and Organization

Effective instructional design and organization lead to better educational outcomes and a more positive learning experience. Along with this, the learning materials being utilized plays a pivotal role in achieving these goals. Table 8 shows that the LM in Mathematics is compliant of criteria items in Factor III with 8 out of 11 items marked yes.

Table 8

Evaluation results along Factor III- Instructional Design and Organization

Standards/ Criterion Items: Factor III- Instructional Design and Organization	Yes	No
1. The LR contributes to the achievement of specific objectives of the learning area and grade level for which it is intended.	10	
2. Sequencing of contents and activities within each lesson facilitates achievement of objectives.	10	
3. Content is suitable to the target learner's level of development, needs, experience.	10	
4. Content reinforces, enriches, and / or leads to the mastery of the targeted learning competencies intended for the learning area and grade level.	10	
5. Content is logically developed and organized throughout the material. (Lessons/activities are arranged from simple to complex, from observable to abstract).	10	
6. The LR contains useful introductions, reviews, summaries, and other devices that facilitate smooth progression from one lesson to another.	7	
7. Development of lessons allows for review, comparison & integration w/ previous lessons.	9	
8. Motivational strategies (e.g., overviews, advance organizers, puzzles, games, etc.) are provided.	8	
9. The LR uses various teaching and learning strategies to meet individual differences/ learning styles. (if applicable)	10	
10. The LR develops higher cognitive skills (e.g., critical thinking skills, creativity, learning by doing, problem solving) and 21st century skills.	10	
11. The LR enhances the development of desirable values and traits.	10	
STATUS- 8 out of 11	Complied	

Developed LM was perceived to contribute to the achievement of objectives of Mathematics for Kindergarten with the appropriateness of activities and exercises indicated thereof. Contents facilitate the acquisition of learners’ level of development, needs, and experiences, reinforces the mastery of learning competencies, and was logically developed and organized from simple to complex. The results implied that LM would be an instrument to enhance learning. Well-structured lessons help learners to understand and retain information more effectively. Organized and thoughtfully designed instruction and best choice of LM for utilization keeps learners to be engaged and motivated. Streamlined content and clear objectives also save time and make teaching more efficient. It also allows for the accommodation of diverse learning styles and needs.

d. Factor IV- Instructional Quality

Under this factor, the LM was evaluated to be compliant of the 6 out of 6 criterion items (Table 9) indicating a high standard of quality. Ten (10) expert-validators agreed that LM in Mathematics have accurate and up-to-date content and information. The LM is free from any social content violations, factual errors, computational errors, and grammatical errors. Accuracy in content ensures that learners are learning correct

information which is essential for understanding and knowledge development. Keeping content current is also important so that learners are learning the most recent and relevant material, preparing them better for contemporary applications. Moreover, the LM does not contain any material that could be considered socially inappropriate, biased, or discriminatory, thus ensuring LM to be respectful and inclusive of all learners' backgrounds and identities. Validators have cross-checked and validated the contents and found out to be free from factual and grammatical errors, thus maintained the credibility and reliability of the LM.

Table 9

Results of evaluation along Factor IV- Instructional Quality

Standards/ Criterion Items: Factor IV- Instructional Quality	Yes	No
1. Content and information are accurate.	10	
2. Content and information are up-to-date.	10	
3. The LR is free from any social content violations.	10	
4. LR is free from factual errors.	10	
5. LR is free from Computational errors (if applicable).	10	
6. LR is free from grammatical errors.		
STATUS- 6 out of 6	Complied	

The LM's compliance with all the 6 criteria under Factor IV signifies a comprehensive accuracy across various dimensions such as content accuracy, currency, social appropriateness, factual correctness, computational correctness, and grammatical precision. This implied that the LM is reliable, effective, and respectful. This thoroughness would help create a conducive learning environment where learners can trust the material and focus on learning.

e. Factor V- Assessment

Assessment (Factor V) evaluates the efficacy of the LM in providing valuable measures and information to help teachers assess learners' progress. As shown in Table 10, the expert-validators believed that the LM in Mathematics complied with the standards required for Factor V- Assessment as the LM obtained 5 out of 6 criteria. This manifested a strong alignment of the learning material with effective assessment practices, though there may be one area that needs further improvement. The LM provides useful measures and information that would help the teacher evaluate learners' progress in mastering the target competencies. Assessments are aligned with the specific objectives and content, provides variety of assessment types, have clear examples and instructions to serve as guide on how these would be used, and various activities were utilized to ensure active engagement of the learners. Thus, by using assessments aligned with learning objectives and providing clear instructions and rubrics, teachers can ensure that learners understand what is expected of them and how to achieve it, leading to better learning outcomes.

Table 10

Results of evaluation along Factor V- Assessment

Standards/ Criterion Items: Factor V- Assessment	Yes	No
1. The LR provides useful measures and information that help the teacher evaluate learner's progress in mastering the target competencies.	10	
2. Assessments are aligned with the specific objectives and content.	10	
3. The LR provides "self-checks," ready-made achievement tests &/or review activities.	7	
4. The LR provides variety of assessment types.	10	
5. Assessments have clear demonstration / examples, instructions, and/or rubrics to serve as guide on how these will be used.	10	
6. Variety of activities within the LR are utilized to ensure active engagement of the learners to ensure active engagement of the learners.	10	
STATUS- 5 out of 6	Complied	

f. Factor VI- Readability

Readability evaluates how well the LM was adapted to the comprehension levels and reading abilities of the target users. Table 11 reveals the results of evaluation along Factor VI- Readability. Data shows that LM in Mathematics is compliant with the standards with 5 out of 6 criteria. This elicits the LM was generally well-adapted to the readability needs of the Kindergarten learners, though one might require further attention.

Table 11*Results of evaluation along Factor VI- Readability*

Standards/ Criterion Items: Factor VI- Readability	Yes	No
1. Vocabulary level is adapted to target users' experience and understanding.	10	
2. Length of sentences is suited to the comprehension level of the target user.	10	
3. Sentences and paragraph structures are varied and appropriate to the target user.	10	
4. There is logical and smooth flow of ideas within a lesson and from lesson to lesson.	10	
5. There is consistently good use of transition devices to focus on the main topics and signal a change of topic.	10	
6. Lessons, instructions, exercises, questions, and activities are clear to the target user.	8	
STATUS- 5 out of 6	Complied	

The results implied that LM might cause improvement in the comprehension level of the learners. When vocabulary, sentence length, and structures were suited to learners' levels, comprehension improves. Learners could understand and retain information better, leading to more effective learning outcomes.

Statistical validity of the learning material in Mathematics**Table 12***Result of the t- test for statistical validity of the Mathematics learning material*

	n	Mean	Standard Deviation	t	Two-Tailed (df=24, a = 0.05)	
					Critical Value (CV)	p-value
Pre-test	25	1.8	0.9574	-20.86	+/-2.06	6.86124E-17***
Post -test	25	12.04	2.5259			

Note: ***p < 0.001; **p < 0.01; *p < 0.05; ^{ns}p > 0.05

Table 12 revealed the results of the t-test to find out the statistical validity of the LM in Mathematics using the pre-test and post-test administered to the learners. The results from the pre-test ($M = 1.8$, $SD = 0.9574$) and post - test ($M = 12.04$, $SD = 2.5259$) scores before and after the utilization of the learning material in Mathematics shows an increase of scores. The mean score increased significantly from the Pre-test to the Post test, indicating that on average, learners performed much better after the utilization of the LM. This difference is very highly significant, $t(24) = -20.86, 0.05$. The p -value is extremely low, essentially zero, far below the common significance level, $\alpha = 0.05$. This indicates that the observed difference in means is highly statistically significant.

The significant increase in scores from the pre-test to the post rest suggests that the learners experienced substantial improvement. One of its causes could be attributed to the effective use of the learning material. According to Tety (2016), instructional materials are considered important in teaching and learning in all levels of education because textbooks and other resource materials are basic tools. Absence or inadequacy makes teachers handle subjects in an abstract manner, portraying it as dry and non-exciting (Eshiwani, 1984). For example, textbooks, charts, maps, audiovisual and electronic instructional materials such as radio, tape recorder, television and video tape recorder contribute much in making learning more interesting (Atkinson, 2000). The importance of instructional materials is also evident in the performance of students (Adeogun, 2001).

Features of the Mathematics learning material - Effective learning is facilitated when learners engage with materials that resonate with their learning needs and are contextualized to their cultural and educational backgrounds. The Mathematics learning material in this study incorporates several key features:

- **Preface.** Introduces the material titled “MATHEMATICS: Kontekstuwalisado asin Dyender Nyutral na Materyal sa Pag-adal para sa mga Kaakian” in Bikol Central, outlining its purpose and scope, and emphasizing Gender and Development (GAD) concepts to promote awareness of gender equality and empowerment.
- **Table of Contents.** Organizes lessons and activities systematically, providing easy access with page references.
- **Lessons.** Structured into chapters covering I- Logic, II- Number and Number Sense, III- Measurement, IV- Geometry, and V-Statistics and Probability, aligned with the curriculum guidelines.
- **Activities/Exercises.** Contextualizes learning with real-world applications tailored to learners’ experiences, enhancing relevance and understanding.
- **References.** Includes comprehensive citations for further reading and research.
- **Bikol Central Language.** Supports Mother Tongue-Based Multilingual Education (MTB-MLE) under Republic Act No. 10533, fostering literacy and academic success among Bikolano learners.
- **Gender and Development (GAD) Concepts.** Integrates GAD principles into lessons to challenge gender stereotypes and promote equitable treatment in education, following UNESCO’s recommendations for gender-sensitive pedagogy.
- **Contextualized Contents.** Utilizes familiar contexts and examples that resonate with learners’ daily lives, facilitating active engagement and skill development.

4. Conclusions and recommendations

Following a comprehensive analysis, it is evident that the developed Mathematics learning material exhibits strong curricular validity in language and content. However, there were several aspects in the language and contents of the LM which requires attention such as in terms of Factor V- assessment which should provide "self-checks," ready-made achievement tests &/or review activities, Factor III- Instructional design and organization that LM should contain useful introductions, reviews, summaries, and other devices that facilitate smooth progression from one lesson to another. Moreover, the utilization of Bikol Central language and the integration of contextualized activities based on real-life experiences have significantly contributed to enhanced learner performance. These findings are underscored by the statistical validity of the learning material’s impact on student outcomes. The distinctive features of this learning material, particularly its contextualized learning activities, have proven instrumental in fostering student engagement and understanding. Furthermore, these activities have served as a platform for developing awareness of gender and development concepts among learners.

It could be considered to include "self-checks," ready-made achievement tests &/or review activities and introductions, reviews, summaries in the LM. It is also essential to recognize that while the developed learning material in Mathematics has contributed to improved learner achievement, it is not the sole factor. The enhanced performance can also be attributed to factors such as the innate intellectual abilities of the learners and the effectiveness of teachers’ instructional methods. Therefore, future studies should explore these additional factors to further enhance students’ learning skills.

During the course of this study, the researcher encountered some minor challenges, such as financial constraints in acquiring the necessary materials for producing the learning material. Additionally, there were

Development and validation of contextualized learning material in mathematics (Bikol Central) for kindergarten budgetary limitations for travel expenses during the distribution and monitoring phases of the study. These issues were resolved with the invaluable assistance of personnel stationed at the researcher's campus, who provided the essential materials for the LM. Therefore, it is strongly recommended that future research endeavors be adequately supported with sufficient budget allocations.

5. References

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