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Development of MATH-erials for Teaching Numeracy in Early Childhood

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A B S T R A C T

The Philippines ranked at second overall lowest out of 79 participating nations worldwide as regards to Mathematical literacy which was according to the Programme for International Student Assessment (PISA), in 2018 (Layug et al., 2021). In the PISA International Report (2019), Filipino children's average score in Mathematical literacy was 353 points, significantly lower than the Organization for Economic Cooperation and Development (OECD) average of 489 points, indicating a below Level 1 proficiency (Mullis & Martin, 2019). Data like these were necessary to deal with the problem of students' confidence in Mathematics and develop effective strategies to enhance Mathematics education in the Philippines. The study recommended that consideration be given to teaching Mathematics using a multivariable approach. This aims to develop instructional manipulative materials called "MATH-erials," in enhancing Numeracy skills among Kindergarteners. The study has its focus on creating and utilizing materials that are age-appropriate which were linked in learning preferences and developmental needs of learners. Quantitative approach was used through a descriptive-developmental method. The participants for this study were from LRMS, Early Childhood experts, Kindergarten teachers, and 30 Kindergarteners. The study was conducted at Perez Elementary School, CMIS- Catmon, and Pulilan Central School. The data had shown that MATH-erials helps the learners to be engaged and active in learning Numeracy. With this, the results could influence the creation of curriculum, ways of instruction, and programs for the professional development of teachers that support early Mathematical learning, thus provide a solid basis for future academic achievement. The MATH-erials have the potential to improve children's attitudes toward Mathematics and their long-term Mathematical achievement by creating a joyful and stimulating Mathematical experience in Kindergarten. The learners are interested in using the MATH-erials because it has ignited their logical thinking skills and kept them interested.

Keywords: Numeracy, Manipulatives, Kindergarten, Curriculum Guide, Development

INTRODUCTION

The Philippines ranked at second overall lowest out of 79 participating nations worldwide as regards to Mathematical literacy which was according to the Programme for International Student Assessment (PISA), in 2018 (Layug et al., 2021). In the PISA International Report (2019), Filipino children's average score in Mathematical literacy was 353 points, significantly lower than the Organization for Economic Cooperation and Development (OECD) average of 489 points, indicating a below Level 1 proficiency. The Philippines also scored 297 in Math in the 2019 Trends in International Mathematics and Science Study (TIMSS) by the International Association for the Evaluation of Educational Achievement (Mullis & Martin, 2019). Data like these were necessary to deal with the problem of students' confidence in Mathematics and develop effective strategies to enhance Mathematics education in the Philippines.

In accordance to Candelaria (2020), instructional materials are a vital part of the teaching and learning process in Mathematics education. It directly affects the learning abilities of the learners', including their capacity for learning, their attitudes toward learning, and their ability to use effective study and performance tactics. In this, it was necessary to deal with the problem of learners' skills and abilities in Mathematics and develop effective strategies to enhance Mathematics education in the Philippines. To achieve this, teachers must be equipped and knowledgeable to teach Mathematics in early childhood. And in teaching Mathematics especially in young learners, it is important to provide manipulatives. As stated by Artigas (2023), it is recommended that manipulatives should be used as much as possible to better the Mathematics performance of pupils in primary school. This points to the fact that conceptual knowledge founded in a direct relationship of the Mathematical process with necessary manipulatives has the essential to build appropriate hands-on experiences to apply learning to new contexts. The study found significant relevance quoting to Tjandra (2021), "The use of manipulatives in Mathematics education has proven effective in increasing learners' understanding of Mathematical concepts and involvement in the learning process."

As researchers and future educators, developing instructional materials such as manipulatives, real objects are one way that researchers seek to address these problems. The design of manipulatives that the researchers had developed was inclined with the domains of Mathematics in standard competencies for Kindergarten. The instructional materials consist of activities in numbers, colors, shapes, number operations, measurement, and pattern. According to

the study of Artigas (2023), "Providing students with differentiated learning resources aids in their success. Achievement in acquiring Numeracy abilities. When teaching these abilities through manipulative learning resources, a simple comprehension of the idea is anticipated. Consequently, the purpose of this investigation is to assess how well the Math learning resource package performed in terms of Numeracy abilities of Kindergarteners."

The study aimed to develop a MATH-erials for Numeracy subject of Early Childhood education. It is a manipulative instructional material that can be used by the educator to make interactive teaching for the learners. The output must be consisted of Mathematical domains that are patterned in the Standard Competencies for Five-Year-Old Filipino, and organized by the researchers to make sure that it will be effective materials to teach Numeracy in Kindergarten to target all the concepts and areas. Finally, the teachers and the students will be given enough time to experience and use the MATH-erials.

FRAMEWORK

The context describes the learning areas targeted in the instruction materials. Then the input discusses the materials to be used to develop the MATH-erials. While the Process shows the step-by-step procedure to develop the instructional materials. Lastly, the output talks about the overview of the MATH-erials.

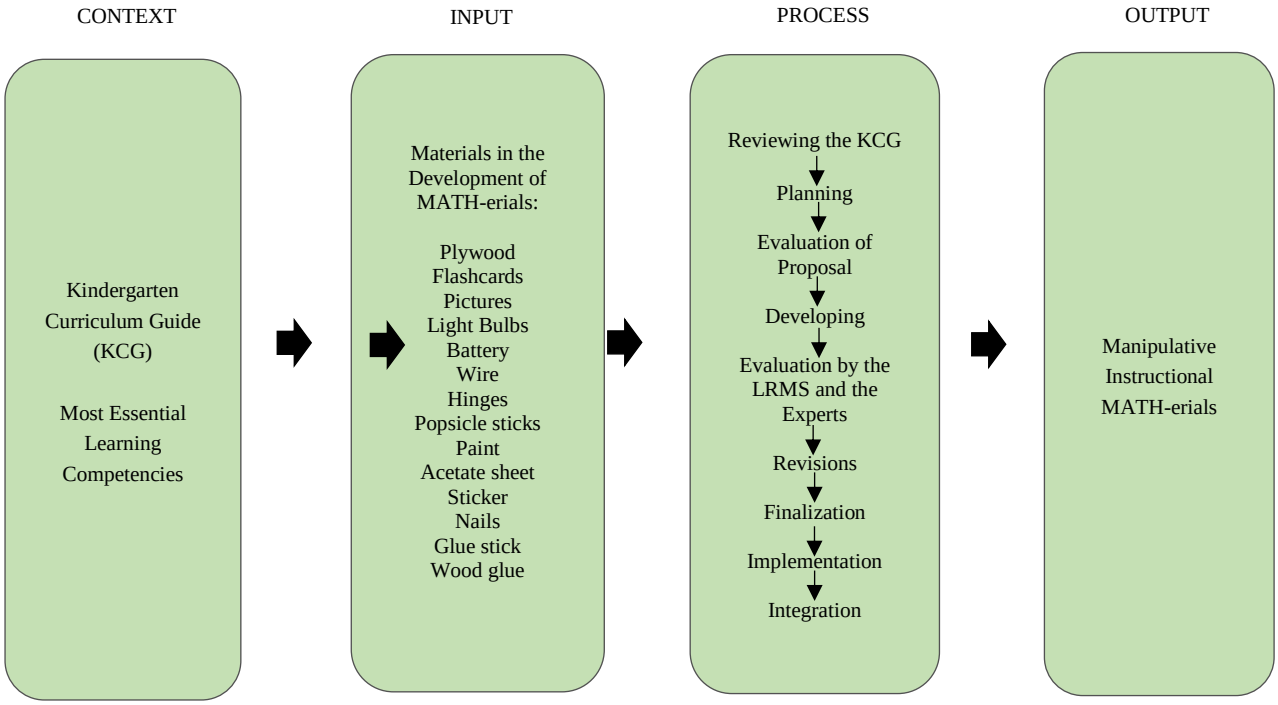


Fig. 1- Conceptual Framework

Context. The context within the MATH-erials in teaching Numeracy was designed primarily consisting of the Standard Competencies for Five-Year-Old Filipino Children and Most Essential Learning Competencies. The researchers considered and made use of the Kindergarten Curriculum Guide and Most Essential Learning Competencies to cater various materials on the four domains in Mathematics which are Sorting and Classifying, Counting, Numbers in Algebra and Thinking, and Measurement. Actions related to context were subjected to provide the needs of Kindergarten learners and to contribute to the quality of education.

Input. The input frame included the different materials that were used in developing MATH-erials. It was consisted of the following: plywood, flashcards, pictures, light bulbs, battery, wire, hinges, popsicle sticks, paint, acetate sheet, sticker, nails, glue stick, and wood glue. This part was essential in creating the MATH-erials and providing quality instructional materials.

Process. The frame that illustrated the process was consisted of developing instructional manipulative materials aimed at enhancing Kindergarten Numeracy. Initially, the researchers conducted a review of the Standard Competencies for Five-Year-Old Filipino Children, focusing on four key areas within the Numeracy domain: Sorting and Classifying, Counting, Number and Algebraic Thinking, and Measurement. Subsequently, researchers formulated activities to incorporate into the materials. The MATH-erials underwent evaluation by LRMS Coordinators, who provided feedback for revision, emphasizing the need for a thorough written explanation and ensuring high quality. Following these recommendations, the researchers proceeded the development process, enlisting the assistance of a carpenter to construct the MATH-erials, a task lasting approximately two weeks. The MATH-erials were then assembled, printed, cut, and laminated, with the entire production phase taking around three weeks. Validation was then sought from Early Childhood Education experts and LRMS coordinators, leading to revisions based on identified areas for improvement. The revised MATH-erials were subsequently re-evaluated by the same experts and coordinators. Participation in the study extended to teachers from Perez Elementary School, City of

Malolos Integrated School-Catmon, and Pulilan Central School. Finally, after a four-week process encompassing planning, revisions, and data collection, the researchers finalized the MATH-erials for utilization in the schools.

Output. The output was achieved to be appropriate, valid, and adaptable materials in teaching Mathematics. Objectively, the output become an instructional material that the Kindergarten grade must have, filled with Mathematical concepts and have lots of activities that facilitate different learning, and skills of the learners. These materials may be used by the teachers and learners in their daily classroom activities.

RESEARCH OBJECTIVES

The main objective of the study was to develop instructional material called MATH-erials that is useful for teaching Numeracy among Kindergarten learners.

RESEARCH DESIGN

This study utilized a quantitative approach through a descriptive-developmental method employing the survey questionnaire as the main instrument for gathering data. The descriptive-developmental method of research involves the collection of data to describe the level of utilization and the process of developing MATH-erials as instructional material in teaching Numeracy in Early Childhood.

RESEARCH METHODS AND PROCEDURE

The methods focused primarily on the description, comparison, analysis, and interpretation of existing data. This method was appropriate for this study since the researchers determined that the process used was suitable for developing the MATH-erials. Hence, the instructional material as believed to be useful for teaching numeracy in early childhood.

The materials and process of developing MATH-erials was evaluated by the 3 experts using the Learning Resources Management System (LRMS) evaluation rating sheet. After the evaluation and revision of materials coming from the experts, the researchers proceed with the utilization of the materials as supporting evidence to check the acceptability of the MATH-erials. The teachers observed and evaluated the materials and procedure of MATH-erials using the standardized questionnaire about acceptability.

The researchers asked permission to conduct the study in selected Elementary Schools in Bulacan (Perez Elementary School in Meycauayan, Bulacan, Pulilan Central School in Pulilan, Bulacan, and City of Malolos Integrated School-Catmon in Malolos, Bulacan). The researchers sought permission from the school administration and Kindergarten teachers to evaluate the instructional materials that will be developed by the researchers. The MATH-erials were presented to the LRMS coordinators, and Early Childhood education experts evaluated the materials using the LRMS evaluation rating sheet. After that, the researchers utilized the MATH-erials to Kindergarten classrooms. The teachers evaluated the MATH-erials based on its acceptability. In the process of data collection, time and ethical issues were carefully considered. Then, the Kindergarten learners evaluated the instructional materials based on their perception. Through the LRMS evaluation rating sheet and adopted-modified questionnaire, the researchers collected the data and interpreted it.

The data collected will be discussed in three parts, starting of the LRMS evaluation rating sheet was treated using statistical treatment, specifically mean and standard deviation. The statistical treatments were utilized to describe the data that was collected from the respondents in terms of content of the manipulatives, other findings, and additional requirements for manipulatives. The second questionnaire was about the acceptability of the MATH-erials that was also treated using descriptive statistics. Then, last questionnaire was about the perception of the learners to support the acceptability of the materials, also had used the descriptive statistics.

DATA ANALYSIS AND STATISTICAL TREATMENT

Data regarding the content, findings, and extra needs of the manipulatives obtained in the first questionnaire. Given to LRMS coordinators and experts in early childhood education, the gathered data were described using statistical analysis, which included statistical treatment, specifically mean and standard deviation. Thus, the numerical value must be interpreted accordingly, based on this equivalence scale:

1-1.5	Strongly Disagree	Not Satisfactory
1.5-2	Disagree	Poor
2.5-3	Agree	Satisfactory
3-4	Strongly Agree	Very Satisfactory

1-1.5	Strongly Disagree	Poor Do Not Evaluate Further
1.5-2	Disagree	Present & Requires Major Redevelopment
2.5-3	Agree	Present but very minor & must be fixed

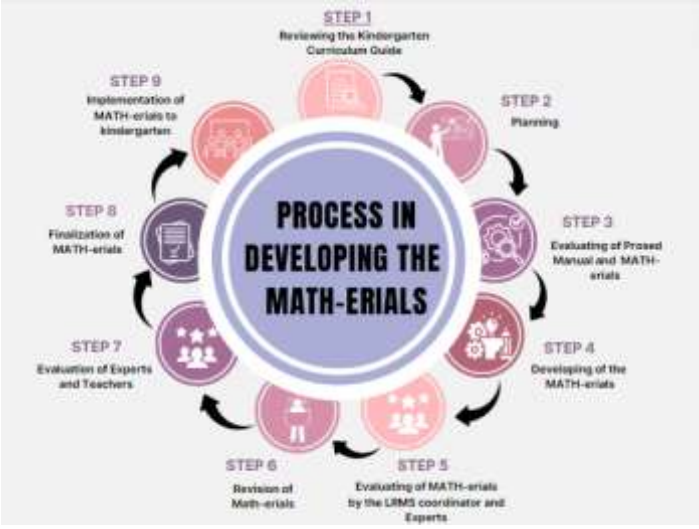
3-4	Strongly Agree	Not Present

The second questionnaire evaluated the acceptability of the MATH-erials in classroom environments and was given to kindergarten teachers. Responses on a Likert scale, from 1 to 4, are used to determine how acceptable it is to teach numeracy. With this, the interpretation will be based on this scale, to which:

1-1.79	Strongly Disagree	Very Not Acceptable
1.8-2.59	Disagree	Not Acceptable
2.6-3.39	Neutral	Neutral
3.4-4.19	Agree	Acceptable
4.2-5	Strongly Agree	Very Acceptable

Kindergarten students who filled out the third questionnaire could open an investigation how they view the materials. This questionnaire, which was taken and modified from a prior study, used a different approach for answering questions: a thumb-up signified agreement with statements and a thumb-down denotes disagreement.

RESULTS AND DISCUSSION



1. How the MATH-erials developed for improvement of Kindergarten Numeracy based on Kindergarten Curriculum Guide? The process of developing the materials followed different steps. It started with reviewing the kindergarten curriculum guide. Then, proceeded to the planning of the MATH-erials and then sought advice from 3 LRMS coordinators. Following the advice, the researchers started to develop the MATH-erials. After that, the researchers moved on in evaluating the physical model of the MATH-erials through the LRMS coordinators and early childhood education experts. The MATH-erials made progress once again as the researchers followed all the recommendations and suggestions from the LRMS coordinators and Early Childhood education experts. Later on, the revised MATH-erials were evaluated by the experts and Kindergarten teachers. Through that the researchers were able to finalize the MATH-erials and began utilizing it in the Kindergarten classroom.

Table 1 – Descriptive Measures of Evaluation of MATH-erials in terms of Content.

Indicators	Ave Rating	SD	Descriptive Interpretation
1. Content reinforces, enriches, and / or leads to the mastery of certain learning competencies for the level and subject it was intended	4.00	0.00	Strongly Agree
2. Material has the potential to arouse interest of the target users.	4.00	0.00	Strongly Agree
3. Facts are accurate.	4.00	0.00	Strongly Agree
4. Information provided is up-to-date.	4.00	0.00	Strongly Agree
5. Visuals are relevant to the text.	3.86	0.38	Strongly Agree
6. Visuals are suitable to the age level and interests of the target user.	3.71	0.49	Strongly Agree
7. Visuals are clear and adequately convey the message of the subject or topic.	3.71	0.49	Strongly Agree
8. Typographic layout / design facilitates understanding of concepts presented.	3.86	0.39	Strongly Agree
9. Size of the material is appropriate for use in school.	3.71	0.49	Strongly Agree
10. Material is easy to use and durable.	3.83	0.41	Strongly Agree
Overall	**3.87**	**0.26**	**Strongly Agree**

SD-Standard Deviation

2.1. Content. Table 1 shown that all indicators were rated Very Satisfactory in verbal interpretation. The indicators had included that the content reinforces, enriches, and/or leads to the mastery of certain learning competencies for the level and subject it was intended, Material has the potential to arouse interest of the target users, Facts are accurate, Information provided is up-to-date, all of which got the same highest mean of 4.00. While visuals are relevant to the text and Typographic layout/design facilitates understanding of concepts presented, it has the same mean of 3.86. On the other hand, the statement material is easy to use and durable only has a mean of 3.83. Other following indicators got lowest mean of 3.71, these are the: Visuals are suitable to the age level and interests of the target user, Visuals are clear and adequately convey the message of the subject or topic, and Size of the material is appropriate for use in school. The overall mean of content of MATH-erials is 3.87 illustrated Strongly Agree in Verbal Description, with the Standard Deviation of 0.26 which meant that all of the participants were most likely close to each other's results. The findings reflected in the study of Kwon and Capraro (2018), it was necessary for teachers to mindfully plan and structure activities that were appropriate and align in the learning objectives based on the curriculum.

Table 2 – Descriptive Measures of Evaluation of MATH-erials in terms of Other Findings.

Descriptors	Ave.	SD	Descriptive Interpretation
1. Conceptual errors.	3.86	0.38	Strongly Agree
2. Factual errors.	3.86	0.38	Strongly Agree
3. Grammatical and/or typographical errors.	4.00	0.00	Strongly Agree
4. Other errors (i.e., computational errors, obsolete information, errors in the visuals, etc.)	3.71	0.49	Strongly Agree
Overall	**3.86**	**0.31**	**Strongly Agree**

SD-Standard Deviation

2.2. Other Findings. Table 2 indicated that Grammatical and/or typographical errors got the highest mean of 4.00, while Conceptual and Factual errors had the same mean of 3.86 and Other errors like computational, obsolete information and errors in the visual respectively got the lowest mean of 3.71. However, the descriptors were still interpreted as Very Satisfactory in verbal interpretation. Remarkably, the MATH-erials in Early Numeracy were rated as error-free. The overall mean of Other Findings of MATH-erials was 3.86 interpreted as Strongly Agree in Verbal Description. The perception of the participants was most likely related having its standard deviation of 0.31. Based on the study of Artigas (2023), wherein it suggested that learners must be provided with different learning materials to foster basic understanding of concepts to be successful in Numeracy skills. According to Tagupa and Arnado (2023), the overall weighted mean score of 4.57 indicates that the materials have exceedingly met the criterion on usability/content in terms of these other factors. This implies that the MMLMs are designed to be inclusive, supportive, and effective in promoting a positive learning experience for pupils/learners. Upon analyzing the findings, there was visibility in this part that the materials must have minimal errors to be able to achieve the success of skills among Kindergarten.

Table 3 – Descriptive Measures of Evaluation of MATH-erials in terms of Additional Requirements.

Descriptors	Ave.	SD	Descriptive Interpretation
1. Adequate support material is provided.	4.00	0.00	Strongly Agree
2. Activities are summarised; extension activities are provided.	3.71	0.76	Strongly Agree
3. Suggested activities support innovative pedagogy.	3.71	0.77	Strongly Agree
4. Manipulative is safe to use.	3.71	0.49	Strongly Agree
5. Size and composition of manipulative is appropriate for intended audience.	3.86	0.39	Strongly Agree
6. Suggested manual tasks within the activities are compatible with the motor skills of the intended users	3.57	1.13	Strongly Agree
Overall	**3.76**	**0.58**	**Strongly Agree**

SD-Standard Deviation

2.3. Additional Requirements. Table 3 represented that the descriptor which stated Adequate support material is provided, obtained the highest mean of 4.00. On the other hand, the descriptor on size and composition of manipulative is appropriate for the intended audience was seen as second with a mean of 3.86. Meanwhile, the following indicators with the same mean of 3.71 which were: Activities are summarised; extension activities are provided, Suggested activities support innovative pedagogy, Manipulative is safe to use. Then, the Suggested manual tasks within the activities are compatible with the motor skills of the intended users obtained lowest mean of 3.57. Overall, these indicators were all interpreted as Very Satisfactory in verbal interpretation. The overall mean of the Additional Requirement of the MATH-erials is 3.86 placed Strongly Agree in Verbal Description. With its Standard Deviation of 0.58, the findings meant that the participants were not that near with each other's insight. In connection with previous study, it was

recommended that instructional materials must be built with validity, practicality, and efficacy in mind. (Hasibuan et al., 2018). Additionally, according to Tagupa and Arnado (2023), it sheds light on the potential advantages of including engaging and hands-on materials in Mathematics lesson.

Table 4 – Summary of Evaluation of MATH-erials.

No.	Components	Mean	SD	Verbal Description
1.	Content	3.82	0.26	Very Satisfactory
2.	Other Findings	3.86	0.31	Very Satisfactory
3.	Additional Requirements for Manipulatives	3.76	0.58	Very Satisfactory
	Overall	**3.83**	**0.39**	**Very Satisfactory**

SD-Standard Deviation

2.4. Summary of Findings. Table 4 presented the summary of evaluation of the MATH-erials in teaching numeracy. Among the components, Content obtained mean of 3.82 with a Standard Deviation of 0.26 were interpreted as Very satisfactory. While, Other requirement got highest mean of 3.86 and 0.31 as its Standard Deviation were interpreted as Very Satisfactory. Finally, Additional Requirements for manipulatives obtained the lowest mean of 3.76 with a Standard Deviation of 0.58 but still interpreted as Very satisfactory. Generally, the findings were seen to be Very Satisfactory relating to this quoted idea, "Every teacher wants to give the best by providing high quality Math instruction for the learners. Math manipulatives play a vital role in the learning, understanding, and mindset of learners." (Gerahty, 2019). Upon developing the MATH-erials, the researchers made sure that all the indicators in the LRMS evaluation rating sheet had been taken into account. The Overall mean of the summary of the LRMS Evaluation Rating Sheet was 3.83 resulted as Very Satisfactory in Verbal Description. As strengthened by the Standard Deviation of 0.39, the findings were achieving that the overall perception of the participants relates to each other. To sum up the results in Early Childhood Experts and LRMS, the supervisors advocate the implementation of policies to include the use of manipulatives in Mathematics to further improve the curriculum. (Muhammad et al., 2020). This claim is supported by Tagupa and Arnado (2023), who stated that the content validity of MMLMs in terms of language arts content can be assessed by evaluating the quality and organization of the materials, as well as their alignment with the relevant learning objectives and standards.

Table 5 – Acceptability of MATH-erials by teachers.

	INDICATORS	Mean	SD	Description
3. How the MATH-erials	1. Math-erials make learning more fun as it unlocks a learning difficulty among learners.	5.00	0.00	Very Satisfactory
	2. MATH-erials help children understand basic math concepts.	5.00	0.00	Very Satisfactory
	3. MATH-erials serves as manipulatives that help learners make physical representation of abstract ideas.	5.00	0.00	Very Satisfactory
	4. MATH-erials is easy to use.	5.00	0.00	Very Satisfactory
	5. MATH-erials is easy appropriate to the level of the learners.	5.00	0.00	Very Satisfactory
	6. MATH-erials promote active participation.	5.00	0.00	Very Satisfactory
	7. MATH-erials consist of various functions in teaching numeracy and they are well Integrated.	5.00	0.00	Very Satisfactory
	8. MATH-erials can be used every day in teaching numeracy.	5.00	0.00	Very Satisfactory
	9. I would recommend this MATH-erials to my co-teachers to use for teaching numeracy.	5.00	0.00	Very Satisfactory
	10. MATH-erials consist of student-centered activities.	5.00	0.00	Very Satisfactory
	Overall	**5.00**	**0.00**	**Very Satisfactory**

SD-Standard Deviation

evaluated based on its acceptability by the teachers? The table 5 has shown the acceptability of MATH-erials evaluated by the teachers. Indicator 1

shown that MATH-erials makes learning more fun as it unlocks the learning difficulty in the learners. The indicator 2 represented that MATH-erials can help the learners in understanding the basic Math concepts. Then, the indicator 3 revealed that MATH-erials serves as manipulatives that help learners make physical representation of abstract ideas. As for the indicator 5, it appeared that MATH-erials is easy to use. And indicator 5 expressed that MATH-erials is easy appropriate to the level of the learners. While indicator 6 displayed that the MATH-erials promote active participation. The MATH-erials consist of various functions in teaching numeracy and they are well Integrated have been presented in the indicator 7. And for indicator 8 it signified that MATH-erials can be used every day in teaching numeracy. Then indicator 9 has proven that teachers would like to recommend the MATH-erials to their colleagues. Lastly indicator 10 declared that MATH-erials were consist of learner-centered activities. To summarize, all of the 15 teachers-respondents rated the MATH-erials perfectly, as it exhibited the average rating of the indicators was 5.00 with the standard deviation of 0.00. This only proved that according to the perception of the Kindergarten teachers MATH-erials is highly accepted in the Kindergarten as an instructional material in teaching Numeracy in Early Childhood.

The findings were aligned to Hidayah (2021) that highlighted providing learners tangible manipulatives can help them understand various Mathematical concepts and foster the development of their Higher Order Thinking Abilities. Moreover, TAM method was used to measure the acceptability of manipulatives and the results showed that using manipulatives may influence the learners' attitudes towards it. With their study's result of 87%, this meant that they are highly prevalent. Teachers provide feedback and comments regarding the MATH-erials. They are overwhelmed about the structure and organization of the activities. They are also happy about the activities that the researchers included in the MATH-erials. They also suggested that these materials can be proposed in the Department of Education because they see how the materials can help the teacher as a supplementary material as an interactive and enjoyable strategy to teach Kindergarten in Numeracy.

Table 6 – Learners Perception on the MATH-erials.

Questions	Agree	Disagree
1. Are you satisfied with the use of MATH-erials?	100%	0%
2. Did you recognize the numbers from 1-10 using the MATH-erials?	100%	0%
3. Did you learn about addition using the MATH-erials?	100%	0
4. Did you learn subtraction using the MATH-erials?	93%	7%
5. Were you able to write the numbers using the MATH-erials	93%	7%
6. Is it enjoyable to use the color game with the MATH-erials?	100%	0%
7. Did you identify the shapes using the MATH-erials?	97%	3
8. Is it fun to use the MATH-erials for measuring objects	93%	7%
9. Did you enjoy doing patterns using the MATH-erials?	100%	0%
10. Is it easy to use the MATH-erials even when you're alone?	83%	17%

4. How the MATH-erials evaluated based on the perception of the learners as supporting evidence in its acceptability? The table 6 presented the frequency on the perception of the learners in accordance with the utilization of the MATH-erials in Kindergarten classroom. The indicator 1 showed that all learners expressed their satisfaction with using MATH-erials, with a unanimous agreement of 100%. As for the indicator 2, each learner recognized numbers from 1-10 using the MATH-erials, resulting in a 100% agreement rate. While indicator 3 appeared that all learners learned addition through MATH-erials, achieving a full agreement rate of 100%. Then regarding the indicator 4 that talked about subtraction, 93% of learners agreed that they learned it with the use of MATH-erials, while the remaining 7% disagreed. Also, indicator 5 indicates that 93% of learners specified that they were able to write numbers using MATH-erials, while 7% encountered difficulties in doing so. For indicator 6, a unanimous 100% of learners enjoyed using the color game in the MATH-erials. While, indicator 7 presented that when it comes to identifying shapes using MATH-erials, 97% of learners agreed with the statement, while 3% disagreed. Following, indicator 8 showed that 93% of learners had fun measuring objects, while 7% did not enjoy it. The indicator 9 conveyed that all learners expressed enjoyment in doing patterns using MATH-erials, with a full agreement rate of 100%. Finally, the indicator 10 appeared that 83% of learners stated that they can use the MATH-erials alone, while the remaining 17% required assistance in using them. The findings exhibited that some learners have difficult time using the MATH-erials. Having that result, the MATH-erials is more appropriate to use with the guidance of teachers. With the objective that MATH-erials is specifically designed as instructional material helping the teachers to teach Numeracy among Kindergarten learners. The findings presented connection to Lange (2021), to quote, "Manipulatives can provide numerous ways of learning and engagement in the content area. Results revealed that if manipulatives are used effectively, it has a major impact on learners' Numerical skills."

CONCLUSION

Based on the study's result and interpretation, the manipulatives' applications spark learners' curiosity and encourage active participation during the utilization. Apparently, when learners are at the center of the learning process, they can make new connections between the things they have learned, and their own understanding develops. A systematic process is the main foundation of the development of MATH-erials whereas having enough time in the planning period is helpful as it will allow to have a concrete foundation of ideas. In that way, the activities must be associated with the Kindergarten Curriculum Guide. Through this, the materials will be timely, relevant, and factual. In conclusion, the findings presented valuable insights ensuring that the recently developed materials are exciting to use for teaching the learners Numerical skills. Aside from this, the perception of experts is needed as it gives more appropriate activities or methods. By then, proper utilization of instructional materials must be followed. By this, it will provide more suggestions and recommendations coming from experts and learners that will better develop the MATH-erials. Thereafter, the learners are interested in using the MATH-erials because it ignites their logical thinking skills and it makes them interested in doing activities. Finally, MATH-erials also promoted scaffolding into the learners as the teacher facilitated only the learners and let them do it. Through the use of MATH-erials, it helps the learners to be engaged and active in learning Numeracy.

RECOMMENDATIONS

In order to highlight the importance of the study and its findings the following recommendations are included:

1. First, a comprehensive development of materials to improve Kindergarten Numeracy. Developing manipulative is a long process and having sufficient time is important. The manipulatives must be associated with the Kindergarten Curriculum Guide. Seeking for other experts in terms of development of materials is highly recommended.
2. The LRMS must have time to visit Kindergarten classrooms and check the availability of materials for teaching not only Numeracy but even with other subjects. For Early Childhood education experts, there should be a regular assessment upon the content, accuracy and acceptability of manipulatives. It is also recommended that each Kindergarten teachers should have one MATH-erials in their classroom.
3. Various instructional manipulative materials are needed for teaching Kindergarten. Teachers must create a manipulative-rich classroom notably in Early Childhood. It is commended that there is parents' participation in developing instructional materials in classrooms.
4. Upon implementing the MATH-erials to the Kindergarten classrooms, the study found out that the instructional materials can be made for individual use. Moreover, it must ensure the age appropriateness, sizes of materials are appreciated and it is easy and safe to use.
5. It is recommended that future researches pursue to develop this kind of Manipulative material, which will be aligned with other subjects and grade levels. In developing instructional materials, the use of recycled materials is urged. At the end, the instructional materials must be composed with different activities in order to target the domains in Curriculum Guide.

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APPENDICES

Appendix A. Questionnaire for Early Childhood Experts and LRMS

Evaluation Rating Sheet for Charts, Posters, Drill/Flashcards and Manipulatives

1.1 Evaluation Rating Sheet for Charts, Posters, Drill / Flash Cards and Manipulatives.

Title:

Type:

Intended for: Grade/Year level(s): Subject area(s):

Author(s):

Publisher Distributor / Supplier:

Copyright Year: No. of Pages:

Instructions: Examine the material carefully and for each evaluation criterion consider the extent to which the resource meets the criteria. Check the appropriate number [with **4** being *Very Satisfactory (VS)*; **3** - *Satisfactory (S)*; **2** - *Poor*; and **1** – *Not Satisfactory*]. For a rating below 4, write your comments/justifications on each evaluation criterion. If an evaluation criterion is ***Not Applicable (NA)*,** the material is rated **3** on said criterion. (Not Applicable means that the criteria is not relevant to the resource being evaluated. It is given the score of 3 so that the evaluation score for each factor reflects only the performance against criteria that are relevant to the nature of the resource being evaluated). Attach extra sheets if necessary. Your report may be completed in soft or hardcopy. Please write legibly if completing in hardcopy

Factor A. Content	**V S** **4**	**S/NA** **3**	**Poor** **2**	**Not Satisfactory** **1**
1. Content reinforces, enriches, and / or leads to the mastery of certain learning competencies for the level and subject it was intended.				

2. Material has the potential to arouse interest of the target users.				
3 Facts are accurate.				
4. Information provided is up-to-date.				
5. Visuals are relevant to the text.				
6. Visuals are suitable to the age level and interests of the target user.				
7. Visuals are clear and adequately convey the message of the subject or topic.				
8. Typographic layout / design facilitates understanding of concepts presented.				
9. Size of the material is appropriate for use in school.				
10. Material is easy to use and durable.				
Total Points				
Note: Resource must score **at least 30 points** out of a maximum **40 points** to pass this criterion. Please put a check mark on the appropriate box		**Passed**		
	□	**Failed**□		

Factor B. Other Findings **Note down observations about the information contained in the material, citing specific pages where the following errors are found:**	**Not Present** **4**	**Present but very minor & must be fixed** **3**	**Present & requires major redevelopment** **2**	**Poor Do not evaluate further** **1**
1. Conceptual errors.				
2. Factual errors.				
3. Grammatical and/or typographical errors.				
4. Other errors (i.e., computational errors, obsolete information, errors in the visuals, etc.)				
Total Points				
Note: Resource must score **at least 16 points** out of a maximum **16 points** to **pass** this criterion. Please put a check mark on the appropriate box		**Passed**		
	□	**Failed. (All issues must be documented in the Comments □section)**		

Manipulative

Complete Evaluation for Factor A and B above as well as Factor C

Factor C. Additional requirements for Manipulative	**V S** **4**	**S/NA** **3**	**Poor** **2**	**Not Satisfactory** **1**
Instructional Design 1. Adequate support material is provided.				
2. Activities are summarised; extension activities are provided.				
3 Suggested activities support innovative pedagogy.				
Technical Design 4. Manipulative is safe to use.				
5. Size and composition of manipulative is appropriate for intended audience.				
6. Suggested manual tasks within the activities are compatible with the motor skills of the intended users.				
Total Points				
Note: Resource must score **at least 18 points** out of a maximum **24 points** to pass this criterion. Please put a check mark on the appropriate box		**Passed**		
	□	**Failed**□		

Other Comments

Recommendation

Note: Any material that fails Factor B must not be recommended for use in public schools until the identified issues have been fixed.

(Please put a check mark (□) in the appropriate box.)

i. □ I / We recommend the approval of this material for possible use in public schools provided that the corrections / revisions included in this report are made. (For commercial resources (non-DepED owned resources) the Publisher must implement all recommended corrections / revisions in their next printing or provide errata.)

ii. □ I / We do not recommend the approval of this material for possible use in public schools for the reasons stated below and/or cited in this evaluation report. (Please use separate sheet if necessary.)

(Please sign below and at the back of each page.)

I/We certify that this evaluation report and recommendation are my / our own and have been made without any undue influence from others.

Evaluator(s):_____Signature(s):_____

(Please print your full name)

Date: _____

Appendix B. Questionnaire for Kindergarten Teachers

Name (Optional): _____

Position/Designation: _____

Affiliation/ School: _____

Instrument #2. Acceptability of Materials ***(Adopted and modified from the study of Couture, 2012)***

Statements	**5 Strongly Agree**	**4 Agree**	**3 Neutral**	**2 Disagree**	**1 Strongly Disagree**
1. MATH-erials make learning more fun as it unlocks a learning difficulty among learners.					
2. MATH-erials help children understand basic math concepts.					
3. MATH-erials serves as manipulatives that help learners make physical representation of abstract ideas.					
4. MATH-erials is easy to use.					
5. MATH-erials is easy appropriate to the level of the learners.					
6. MATH-erials promote active participation.					
7. MATH-erials consist of various functions in teaching numeracy and they are well integrated.					
8. MATH-erials can be used everyday in teaching numeracy.					
9. I would recommend this MATH-erials to my co-teachers to use for teaching numeracy.					
10. MATH-erials consist of student-centered activities.					

Appendix C. Questionnaire for Kindergarten Learners

Instrument #3. Acceptability of Materials ***(Adopted and modified from the study of Couture, 2012)***

Name (Optional): _____

School: _____

Directions: Color the thumbs up if you agree to the statement, and then thumbs down if not.

1. Are you satisfied with the use of MATH-erials?		
2. Did you recognize the numbers from 1-10 using the MATH-erials?		
3. Did you learn about addition using the MATH-erials?		

4. Did you learn subtraction using the MATH-erials?	👍	👎
5. Were you able to write the numbers using the MATH-erials?	👍	👎
6. Is it enjoyable to use the color game with the MATH-erials?	👍	👎
7. Did you identify the shapes using the MATH-erials?	👍	👎
8. Is it fun to use the MATH-erials for measuring objects?	👍	👎
9. Did you enjoy doing patterns using the MATH-erials?	👍	👎
10. Is it easy to use the MATH-erials even when you're alone?	👍	👎

Appendix D. MATH-erials