Developmentally-Appropriate Practices in Teaching Early Numeracy in Grade 1: Basis for Supplemental Learning Materials

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Abstract

This study assessed Developmentally-Appropriate Practices (DAP) among Mercedes District teachers for teaching early numeracy to grade one learner, focusing on the development and evaluation of DAP-based supplemental learning materials. Using a descriptive-developmental evaluative method, 248 grade one learner, 45 teachers, and 5 Master Teachers, an Education Program Supervisor, and Division LRMS coordinator participated. Findings revealed a frustration level in early numeracy skills before exposure to DAP interventions, with common least mastered competencies including visualization of numbers and understanding inverse functions. Teachers demonstrated developmentally-appropriate practices, employing pedagogies connecting early numeracy to real-life scenarios, utilizing visual aids, facilitating manipulative-based activities, and emphasizing manipulative-based assessments. The study produced DAP-based materials aligned with curriculum competencies, adhering to DepED standards, significantly enhancing learners' post-intervention performance. A notable improvement in early numeracy skills affirmed the effectiveness of DAP-based materials. Recommendations included developing digital versions, involving parents, and proposing separate DAP-based materials for each identified least mastered competency in early numeracy.

Keywords: Teachers DAP; early numeracy; intervention; supplemental learning material

1. Introduction

In a global scale beginning or basic numeracy has been recognized by different schools world-wide as one of the fundamental literacy skills that is expected to be evident among school-age children in as early as in the preparatory and primary levels of education (Bennet,2019). Well-established early numeracy skills enable the young learners to respond and cope well with the early mathematical demands of education and life. Children with good early numeracy skills are more likely to have a promising literacy development and academic achievement. Rosendo (2019) posited that, there is a good array of personal and academic benefits and learning gains that can be provided to children with sufficient level of early numeracy skills.

In a national context, Deloso (2020) stated that the Department of Education currently implements a

program called Developmentally- Appropriate Program (DAP). DAP serves a reinforcement program that is supportive of a more comprehensive program which is the Early Language, Literacy and Numeracy Program (ELLN). Both of these programs aim to motivate teachers to implement and apply developmentally-appropriate practices in teaching and provision of instruction for the learners. These practices include the development and production of developmentally-appropriate instructional materials or teaching-learning tools. Thus, Mendes (2020) stressed that, the integration of the Developmentally-Appropriate Program (DAP) is highly promoted to be integrated in the teachers' efforts to utilize teaching-learning resources in providing instructions for the learners.

However, according to the local study conducted by Rivero (2019), the major problems and issues associated with the implementation of DAP include the teachers' perceptions and observations on the wide, complex and very comprehensive scope of the context of developmentally-appropriates. Teachers are typically challenged by the multiplicity of developmentally-appropriate practices that they need to consider, meet and integrate along diverse domains, aspects and areas based on the learning needs and demands of their learners. These areas include pedagogical methods, educational resources, instructional activities and other forms of academic services for the learners.

Thus, in relation to the cited discussions and challenges cited by the previous studies, the researcher found interest and motivation to conduct a study that will delve on the different developmentally-appropriate practices (DAP) implemented and utilized by the teachers in Mercedes District in teaching early numeracy to the grade one learners. Being a grade teacher herself, it is highly important for the researcher to determine and analyze how her fellow grade one teachers align, adapt and match the contents and over-all approach to early numeracy instruction to the actual learning needs and status of the grade one learners using the DAP. Thus, through this study, the researcher was able to come up with a concrete and specific body of research-based data and information that will reflect the actual and practical DAP utilized by the grade one teachers that can be formally tackled in teacher-training programs and collaborative faculty education. Moreover, the study is also guided by the objective and motivation of designing and developing DAP-based supplemental learning materials in early numeracy skills and competencies that will be aligned to the results of the learning assessment and surveys to be conducted in this research. Furthermore, it was in the need to come up with validated instructional material anchored with DAP principles in early numeracy through the evaluation of the experts, that this study was hereby conducted.

2. Methods

This study made use of the Descriptive-Developmental Evaluation method as its research design. The Descriptive method of research was applied in the discussion of the focal concepts of the study as to the level of the early numeracy skills of the learners prior to the implementation of Developmentally-Appropriate Practices (DAP) in grade one, the early numeracy difficulties encountered by the grade one learners, the developmentally-appropriate practices in teaching early numeracy in grade one and the and examining the level of early numeracy skills of the learners after the utilization of DAP-based supplemental learning materials. The Developmental method was incorporated in this study in support of the researcher's endeavor of designing DAP-based supplemental learning materials that can be developed for the grade one learners. Meanwhile, the Evaluative method was applied in analyzing the evaluation results of the experts in the developed DAP-based learning materials in early numeracy 1.

The respondents of the study were the selected 248 grade one pupils, 45 grade one teacher, 5 Master Teachers of Mercedes District, the Education Program Supervisor and Division LRMS coordinator.

For the purpose of data collection, teacher-made pre-test and post-test in early numeracy, survey-questionnaires and rubrics were utilized as research instruments. The teacher-made pre-test served to gather data about the level of early numeracy skills of the learners prior to the implementation of Developmentally-

Appropriate Practices (DAP). Meanwhile, post-test served to acquire data about the level of improvements in the early numeracy skills of the learners after the implementation of DAP. The pre-test and post-test were rated, computed and analyzed using percentage and simple mean method. Survey-Questionnaires helped to acquire data and responses about the developmentally-appropriate practices that can be integrated in the development of learners' materials in early numeracy and the DAP-based learners' materials that can be developed. Rubrics was used in the evaluation of the experts in the developed DAP-based supplemental learning materials in terms of contents, format, presentation and organization and accuracy and up-to-datedness of information. These rubrics were specifically sourced and anchored with LRMDS evaluation rating sheet.

Frequency count, percentage and weighted mean technique were use for data treatment and analysis under each objective of the study.

3. Results and Discussion

3.1. Level of the Early Numeracy Skills of the Learners Prior to the Implementation of Developmentally-Appropriate Practices (DAP) in Grade One.

It was found that performance level (PL) of the Mercedes District schools in the pre-learning assessment was generally low or in the frustration level prior to the learners' exposure to developmentally-appropriate practices in DAP.

It was shown in the data that the highest performance level of 73.8 in early numeracy during the pre-intervention was attained by one section of learners from Mercedes Elementary School and at the same time the lowest performance of 21.7 was also recorded in one section of learners from this school. The highest PL can be justified by the sufficiency of instructional support services in early numeracy provided to the top section of learners and most of all, the general higher level of cognitive skills of this high ability group. Meanwhile, the least PL can be attributed to the generally lower level of cognitive skills and existing learning gaps among the last section or the low ability group.

Table 1. Pre-test Results of Grade One Learners Prior to DAP

Schools	Total Score	No. of learners Tested	Mean	PL	SD
Gaboc Elementary School	264	20	13.2	44.0	3.54
Manguisoc Elementary School	402	38	10.6	35.3	3.21
Mercedes Elementary School	664	30	22.1	73.8	4.63
	470	30	15.7	52.2	3.89
	195	30	6.5	21.7	2.51
	283	30	9.4	31.4	3.02
San Roque Elementary School	471	40	11.8	39.3	3.39
Tagongtong Elementary School	232	30	7.7	25.8	2.73

n = 248

These findings only imply that the prior knowledge in early numeracy of the learners is generally requiring for attention, interventions and developmentally-responsive practices. This lower level of prior knowledge of the learners can be attested and reflected in their least mastered competencies, low test scores and mean scores and unsatisfactory performance level (PL) in early numeracy skills. It can simply be justified by the scenario that the developmentally-appropriate practices (DAP) were not yet exposed or provided to the learners during the pre-intervention period.

3.2. The Early Numeracy Difficulties Encountered by the Grade One Learners.

Based from the assessment results, the unmastered learning competencies in early numeracy constituted the learning difficulties of the learners. Results showed that the most difficult early numeracy skills for the learners are visualizing, representing and counting numbers from 0 to 100 using a variety of materials and methods with its least obtained correct responses, interpreted as unmastered. This was followed by the illustrating that addition and subtraction are inverse operations, interpreted as unmastered. The third most difficult early numeracy skills for the learners were telling and writing time by hour, half-hour and quarter-hour using analog clock, also interpreted as unmastered.

These specific learning difficulties in early numeracy skills were identified and specified during the pre-intervention period of the study. Thus, the extent of the learning difficulties of the learners can be justified by the fact that the developmentally-appropriate practices (DAP) in early numeracy were not yet mainstreamed and incorporated in the instruction during the pre-intervention phase of the study. It implied that in the pre-intervention stage of the research, the interventions to address the least mastered skills and prior knowledge are not yet fully operationalized.

Table 2. Grade One Learners' Specific Learning Difficulties in Early Numeracy

Least Mastered Skills	No. of Correct Response	% of Correct Response	Mastery Level
Visualizing, representing and counting numbers from 0 to 100 using a variety of materials and methods	28	11	Unmastered
Illustrating that addition and subtraction are inverse operations	57	23	Unmastered
Telling and writing time by hour, half-hour and quarter-hour using analog clock	75	30	Unmastered
Telling the days in a week, months in a year in the right order	84	34	Unmastered
Comparing two sets using expressions less than, more than and as many as	98	40	Unmastered
Renaming numbers into tens and ones	101	41	Unmastered
Telling the days in a week, months in a year in the right order	103	42	Unmastered
Visualizing and drawing the whole region or set given its ½	104	42	Unmastered
Visualizing, representing, dividing a whole into halves and fourths and identifies 1/2 of a whole object	106	42	Unmastered
Identifying and creating patters to compose and decompose using addition	109	44	Unmastered

Legend:
0-54 Unmastered
55-74 Near Mastery
75-100 Mastered

3.3. Pedagogies. Level of the Early Numeracy Skills of the Learners Prior to the Implementation of Developmentally- Appropriate Practices (DAP) in Grade One.

It was also found that in terms of DAP along with pedagogies in early numeracy, the leading practices was in terms of promoting real life connections by providing opportunities for children to apply math concepts to real-life situations, such as counting objects in the classroom or dividing objects into halves, which obtained the highest mean of 4.68 or very highly implemented.

The least DAP, however in terms of pedagogies was the use of differentiated instruction by using small group instruction, flexible grouping, and other strategies to provide differentiated instruction in early numeracy, with the lowest mean of 4.26, but still interpreted as highly implemented. This was the least practice, although it was still assessed in this study as highly implemented because differentiated instruction is typically reliant or based on the learning situations and learning needs and performance level of the learners.

Table 3. Developmentally-Appropriate Practices in terms of Pedagogies

Indicators	Weighted Mean	Interpretation
1. Using *play-based learning* that allow my learners to explore, manipulate, and experiment with different materials and concepts. With the use of games, puzzles, and other hands-on activities to help my learner understand numbers and basic math concepts.	4.31	Highly Implemented
2. *Multisensory approach* - Incorporating visual aids, manipulatives, and other sensory materials to help children with different learning style understand numbers and mathematical concepts.	4.36	Highly Implemented
3. *Differentiated instruction.* Using small group instruction, flexible grouping, and other strategies to provide differentiated instruction in early numeracy.	4.26	Highly Implemented
4. *Real-life connections.* Providing opportunities for children to apply math concepts to real-life situations, such as counting objects in the classroom or dividing objects into halves.	4.68	Very Highly Implemented
5. *Active engagement*- Using strategies such as questioning, discussions, and problem-solving activities to engage children in the learning process and help them develop their math skills	4.57	Very Highly Implemented
Grand Mean	4.43	Highly Implemented

N=45
Legend:
4.50-5.00- Very Highly Implemented
3.50-4.49-Highly Implemented
2.50-3.49-Sufficiently Implemented
1.50-2.49-Poorly Implemented
1.00-1.49-Very Poorly Implemented

Instructional Materials. In terms of instructional materials, the data showed that in general, the developmentally-appropriate practices in teaching early numeracy were highly implemented, with a grand mean of 4.37. The results also showed that in terms of DAP along instructional materials, the leading practice was the use of visual aids by way of using pictures, posters, charts, and diagrams that help their learners understand mathematical concepts and procedures, with the highest mean of 4.73, interpreted as highly implemented.

However, the least identified DAP in terms of instructional materials was the use of whiteboards and markers by way to practice writing numbers, drawing shapes, and solving basic arithmetic problems and for group activities, where students can collaborate on solving problems and sharing ideas which obtained the lowest mean of 4.15, but still interpreted as highly implemented. This was the least practice in DAP in terms of instructional materials due to the scenario of the financial considerations and allocations for the provision of these tools.

Table 4. Developmentally-Appropriate Practices in terms of Materials

Indicators	Weighted Mean	Interpretation
1. Manipulatives- Using blocks, counters, geometric shapes, and other materials that allow students to physically manipulate objects to help them understand concepts such as counting, addition, and subtraction.	4.42	Highly Implemented
2. Games and puzzles-Using games and puzzles can be used to reinforce concepts and skills learned in class and engaging my learners in learning while making it fun.	4.26	Highly Implemented
3. Visual Aids-Using pictures, posters, charts, and diagrams that help my learners understand mathematical concepts and procedures.	4.73	Very Highly Implemented
4. Using Whiteboards and Markers- To practice writing numbers, drawing shapes, and solving basic arithmetic problems and for group activities, where students can collaborate on solving problems and sharing ideas.	4.15	Highly Implemented
5. Picture Books- Using colorful and engaging books that teach basic numeracy concepts like counting, sorting, and geometry and to introduce new concepts and to reinforce learning objectives in a fun and engaging way.	4.31	Highly Implemented
Grand Mean	4.37	Highly Implemented

N=45
Legend:
4.50-5.00- Very Highly Implemented
3.50-4.49-Highly Implemented
2.50-3.49-Sufficiently Implemented
1.50-2.49-Poorly Implemented
1.00-1.49-Very Poorly Implemented

Learning Activities. It was found that in general, the developmentally-appropriate practices in terms of learning activities in the locale were highly implemented with a grand mean of 4.27. It was revealed that in terms of DAP along with learning activities, the leading identified practice was the use of concrete materials to make sense of numbers and counting. I use objects like blocks, buttons, or counters to teach children basic concepts such as one-to-one correspondence, counting, and comparing quantities, which acquired the highest mean of 4.57, interpreted as highly implemented.

The least practice however, were the use of music and movement by incorporating music and movement into math instruction to engage and help learners remember math concepts and use of songs, dances, and physical activities to teach counting, skip counting, and other math skills and the use of math literature by way of reading stories that involve counting, patterns, or shapes and have students discuss and analyze the math concepts in the story, which both obtained the lowest mean of 4.05, but still interpreted as highly implemented.

Table 5. Developmentally-Appropriate Practices in terms of Learning Activities

Indicator	Weighted Mean	Interpretation
1.Games -Using games like bingo, matching, and memory games to teach number recognition, addition, subtraction, and other math skills.	4.36	Highly Implemented
2. Problem-solving - Presenting pupil with problems that require them to use math skills to find a solution.	4.36	Highly Implemented
3. Music and movement Incorporating music and movement into math instruction to engage and help learners remember math concepts. I use songs, dances, and physical activities to teach counting, skip counting, and other math skills.	4.05	Highly Implemented
4. Math literature Reading stories that involve counting, patterns, or shapes and have students discuss and analyze the math concepts in the story.	4.05	Highly Implemented
5. Using concrete materials to make sense of numbers and counting. I use objects like blocks, buttons, or counters to teach children basic concepts such as one-to-one correspondence, counting, and comparing quantities.	4.57	Very Highly Implemented
Grand Mean	4.27	Highly Implemented

N=45
Legend:
4.50-5.00- Very Highly Implemented
3.50-4.49-Highly Implemented
2.50-3.49-Sufficiently Implemented
1.50-2.49-Poorly Implemented
1.00-1.49-Very Poorly Implemented

Learning Assessment. In terms of learning assessment, the results showed that the developmentally-appropriate practices were highly implemented with an obtained grand mean of 4.44. The findings also suggest that the highest implemented DAP in terms of learning assessment in early numeracy include using pictures or manipulatives to assess early numeracy concepts than written tests and using performance-based assessments which allows learners to demonstrate their understanding and skills in a practical way, which both obtained the highest mean of 4.52, interpreted as very highly implemented.

It was also revealed that the least implemented practice was encouraging student self-assessment through reflection activities or self-checks, with the lowest mean of 4.26, but still interpreted as highly implemented. Although, it was also highly implemented in the district, it can also be gleaned and understood that reflective learning during assessment is highly challenging and difficult for as young as grade one learners.

Table 6. Developmentally-Appropriate Practices in terms of Learning Assessment

Indicators	Weighted Mean	Interpretation
1. Using informal assessments, such as questioning and interviewing students, to gain insight into their thinking and understanding.	4.47	Highly Implemented
2. Using pictures or manipulatives to assess early numeracy concepts than written tests.	4.52	Very Highly Implemented
3. Using authentic assessments that are designed to reflect real-life situations.	4.47	Highly Implemented
4. Using performance-based assessments which allows learners to demonstrate their understanding and skills in a practical way.	4.52	Very Highly Implemented
5. Encouraging student self-assessment through reflection activities or self-checks	4.26	Highly Implemented
Grand Mean	4.44	Highly Implemented

N=45
Legend:
4.50-5.00- Very Highly Implemented
3.50-4.49-Highly Implemented

2.50-3.49-Sufficiently Implemented
1.50-2.49-Poorly Implemented
1.00-1.49-Very Poorly Implemented

3.4. The DAP-Based Supplemental Learning Materials Developed for the Grade One Learners.

Contents and Competencies. The materials focus on the identified learning difficulties of the learners in early mathematical skills such as visualizing, representing and counting numbers from 0 to 100, illustrating that addition and subtraction are inverse operations and telling the days in a week and months in a year in the right order. Moreover, the other integral learning contents and competencies that are least mastered by the majority of grade one learners covered in the materials are comparing two sets using expressions less than, more than and as many as, renaming numbers into tens and ones, visualizing and drawing the whole region or set given its ½, visualizing, representing, dividing a whole into halves and identifying and creating patterns to compose and decompose using addition.

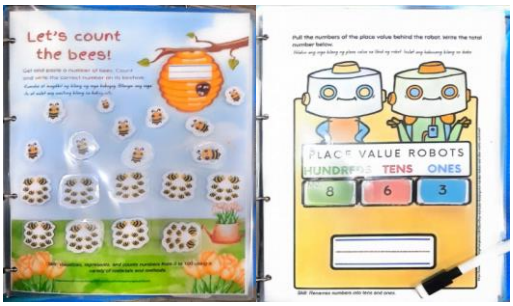

Fig.1(a)counting numbers from 0 to 100; (b)renaming numbers into tens and ones

Learning Activities. These materials highlighted interactive activities, stimulating exercises, simulations and educational games that are used together with the printed materials as reinforcements. The developmentally-appropriate nature and functions of these learning tools were also reflected in its application of adaptive learning activities that are designed and intended to engage the grade one learners in more personalized and independent learning engagements in early numeracy.

Fig.2(a)interactive activities; (b)simulations

Mechanics. In terms of mechanics of utilization, the medium of instruction of the DAP-based supplemental learning materials includes Tagalog and English to make its contents more comprehensible for the learners. The fonts used in the materials are also clear, visible and readable for the learners. The cover of the materials is made of plastic, transparent materials that cannot be easily damaged when spilled with water. The materials inside are also visible. It also has a handle and sling that makes it handy and portable.

Moreover, these materials also have a zipper bag to make it secure. These DAP-based learning tools also highlight soft felt and laminated (250 microns) materials for durability. The sharp edges are also fixed to

ensure learners' safety during its utilization. In addition, the size of the materials and manipulatives are also accurate and can easily be grasped by children. The DAP tools also feature colorful pages and contents in order to elicit and stimulate learners' visual attention and interest towards the materials. Furthermore, the targeted learning skills and competencies are also indicated at the bottom page for teachers' reference.

Fig.3(a) zipper bag; (b)transparent, plastic laminated materials

Learning Assessment**.** These materials contain sections that provide for the assessment of learners' knowledge and mastery of specific early numeracy skills. The evaluative exercises and activities are also directed towards measuring learners' understanding and ability to apply numeracy skills in real life. These materials also integrate learning assessment exercises that promote independent learning and enable learners to gauge their own mastery and understanding of content knowledge and competencies.

Fig.4 (a) assessment ofknowledge of specific numeracy skill; (b) measuring learner's understanding to apply numeracy in real life

3.5. Policy Evaluation of the Experts in the Developed DAP-Based Learning Materials in Early Numeracy

Content. It was found that developed DAP-based learning materials in early numeracy obtained total points of 28 out of maximum of 28 points in terms of contents. Therefore, the developed DAP-based learning materials passed the criteria and standards of contents as evaluated by the Master Teachers of Mercedes District.

It therefore implies that the DAP-based supplemental learning materials were able to meet the standards of contents in educational materials particularly in terms of suitability to learners' developmental levels, capacity to contribute to the attainment of specific learning objectives in a learning area, provision of opportunities to develop learners' higher order learning skills, freedom from all forms of biases and fostering values formation among the learners, and motivational appeal of the material.

Table 7. Evaluation Results as to Content

Factor 2: Content	4 -VS	3 –S/NA	2 –Poor	1 –NS
1. Content is suitable to the student's level of development.	4	0	0	0
2. Material contributes to the achievement of specific objectives of the subject area and grade level for which it is intended.	4	0	0	0
3. Material provides for the development of higher cognitive skills such as critical thinking, creativity, learning by doing, inquiry, problem solving, etc.	4	0	0	0
4. Material is free of ideological, cultural, religious, racial, and gender biases and prejudices.	4	0	0	0
5. Material Enhances the development of desirable values and traits. 6. Material has a potential to arouse interest of target reader.	4	0	0	0
7. Adequate warning /cautionary notes are provided in topics and activities where safety and health are of concern.	4	0	0	0
Total Points	**28**			
Note: Resource must score at least 21 points out of maximum 28 points to pass this criterion. Please put a check on the appropriate box.	**/**	**Passed**		

Format. The results showed that the developed DAP-based learning materials in early numeracy obtained total points of 68 out of maximum of 72 points in terms of format. Therefore, the developed DAP-based learning materials passed the standards of format as evaluated by the experts and instructional leaders. These results only imply that developed materials oriented are properly formatted to comply to the principle of curriculum alignment in terms of teaching-learning resources as mandated by the education department.

Table 8. Evaluation Results as to Format

Factor 3: Format	4 -VS	3 –S/NA	2 –Poor	1 –NS
1. Prints				
1.1 Size of letters is appropriate to the intended user	4	0	0	0
1.2 Spaces between letters and words facilitate reading	4	0	0	0
1.3 Font is easy to read	4	0	0	0
1.4 Printing is good quality (i.e., no broken letters, even density correct alignment, properly placed screen registration).	4	0	0	0
2. Illustrations				
2.1 Simple and easily recognizable	4	0	0	0
2.2 Clarify and supplement the text	4	0	0	0
2.3 Properly labelled or captioned (if applicable)	4	0	0	0
2.4 Realistic and appropriate colors	4	0	0	0
2.5 Attractive and appealing ss	4	0	0	0
2.6 Culturally relevant	4	0	0	0
3. Design and Layout				
3.1 Attractive and pleasing to look at	4	0	0	0
3.2 Simple (i.e., does not distract the attention of the reader	4	0	0	0
3.3 Adequate illustration in relation to text	4	0	0	0
3.4 Harmonious blending of elements (i.e., illustrations and text)	4	0	0	0
4. Paper and Binding				
4.1 Paper used contributes to easy reading	4	0	0	0
4.2 Durability binding to withstand frequent use	4	0	0	0
5. Size and Weight Resource				
5.1 Easy to handle	4	0	0	0
5.2 Relatively light	4	0	0	0
Total Points	**68**			
Note: Resources must score at least 54 points out of a maximum 72 points to pass this criterion. Please put a check mark on the appropriate.	**/**	**Passed**		

Presentation and Organization. The developed DAP-based learning materials got total points of 20 out of 20 points in terms of presentation and organization. Thus, it was shown that the developed DAP-based learning materials passed the criteria of presentation and organization as validated by the expert teachers of Mercedes District. It implies that the material passed the standards of validity and accuracy in presentation and organization due to its engaging and comprehensible presentation, logical and smooth flow of ideas, accuracy and alignment of vocabulary to learners' comprehension level, suitability of sentence structures to learners' comprehension and variety of sentence and paragraph structures.

Table 9. Evaluation Results as to Format

	Factor 4: Presentation and Organization	**4 –VS**	**3 – S/NA**	**2 – Poor**	**1 – NS**
1.	Presentation is engaging, interesting, and understandable	4	0	0	0
2.	There is logical and smooth flow of ideas	4	0	0	0
3.	Vocabulary level is adapted to target reader's likely experience and level of understanding	4	0	0	0
4.	Length of sentences is suited to the comprehension level of the target reader	4	0	0	0
5.	Sentences and paragraph structures are varied	4	0	0	0
	Total Points	**20**			
	Note: Resources must score at least 15 points out of a maximum 20 points to pass this criterion. Please put a check mark on the appropriate.	**/**	**Passed**		

Accuracy and up-to-datedness of information. It was shown that the developed DAP-based learning materials in early numeracy attained a total score of 24 out of maximum score of 24 in terms of accuracy and up-to-datedness of information. Thus, it was shown the developed output pass the standards of accuracy and up-to-datedness of information. It only implies that the developed material is free from any forms of errors. The researcher was able to comply with the standards of accuracy and up-to-datedness of information in terms of contents and inputs of this material primarily by consulting the instructional leaders and experts in Mathematics and by subjecting the materials to the validation by the experts in LRMDS.

Table 10. Evaluation Results as to Accuracy and Up-to-datedness of Information

Factor 5: Accuracy and Up-to-datedness of Information Note down observations about the information contained in the material, citing specific pages where the following errors are found**.**	**4- Not present**	**3- Present but very minor & must be fixed**	**2- Present requires major redevelopment**	**1-Poor do not evaluate further**
1.Conceptual errors	4	0	0	0
2. Factual errors	4	0	0	0
3.Grammatical errors	4	0	0	0
4.Computation errors	4	0	0	0
5.Obsolete information	4	0	0	0
6.Typographical and other minor errors (e.g., inappropriate, or unclear illustrations, missing labels, wrong captions, etc.)	4	0	0	0
Total Points		**24**		
Note: Resource must score 24 out of a maximum 24 points to pass this criterion. Please put a check mark on appropriate box		**/**	**Passed**	

3.6. Academic Performance of the Learners in Early Numeracy after the Utilization of DAP-Based Supplemental Learning Materials.

The performance level (PL) of the pupil-respondents significantly improved in the post-intervention compared to the PL in the pre-intervention phase. Therefore, it implies that the implemented and applied developmentally-appropriate practices (DAP) in early numeracy were effective in fostering improvement in the early numeracy skills of the grade one learners.

Table 11. Post- Test Results of Grade One Learners Prior to DAP

Schools	Total Score	No. of learners Tested	Mean	PL	SD
Gaboc Elementary School	456	20	22.8	76.0	4.65
Manguisoc Elementary School	865	38	22.8	75.9	4.71
Mercedes Elementary School	691	30	23.0	76.8	4.72
	671	30	22.4	74.6	4.65
	695	30	23.2	77.2	4.73
	608	30	20.3	67.6	4.43
San Roque Elementary School	930	40	23.3	77.5	4.76
Tagongtong Elementary School	721	30	24	80.1	4.82

N=248

3.7. Academic Performance of Learners before and after the Utilization of DAP-Based Supplemental Learning Material.

The results indicated a significant difference between math test scores before and after the introduction of the intervention. For Gaboc Elementary School, a significant difference was established with [$t(30) = 5.969$, $p < .000$]. A significant difference was also noted for scores of learners in Manguisoc Elementary School with [$t(38) = 12.567$, $p < .000$]. A significant difference was obtained as well for the three groups of Mercedes Elementary School learners with [$t(30) = 20.928$, $p < .000$], [$t(30) = 18.545$, $p < .000$ [$t(30) = 7.334$, $p < .000$], respectively. A significant difference was also reflected for San Roque Elementary School and Tagontong Elementary School with [$t(40) = 12.850$, $p < .000$], and [$t(30) = 17.599$, $p < .000$], respectively. The overall score for the eight groups of learners accounts for a significant difference of [$t(8) = 5.346$, $p < .001$].

The computed P value of .001 denotes the decision of rejecting the hypothesis of the study and attesting the significant difference in the academic performance of the learners before and after the utilization of DAP-based supplemental materials. It only implies that the significant difference between the pre-test and post-test performance of the learners was attested to the considerable improvement in the level of early numeracy skills of the grade one learners with the aid of the DAP-based learning materials.

Table 12. Test for the Significant Difference in the Academic Performance of Learners before and after the Utilization of DAP-Based Supplemental Learning Materials

School	Mean	N	df	t	Sig	Conclusion
Gaboc ES	9.6	20	19	5.969	.000	Significant
Manguisoc ES	12.184	38	37	12.567	.000	Significant
Mercedes ES	.9	30	2309	.865	.394	Not Significant
	14.967	30	29	20.928	.000	Significant
	16.667	30	29	18.545	.000	Significant
	10.833	30	29	7.334	.000	Significant
San Roque ES	11.475	40	39	12.850	.000	Significant
Tagongtong ES	16.300	30	29	17.599	.000	Significant
Overall Score	332.000	8	7	5.346	.001	Significant

Legend: $\alpha = 0.05$

3.8. Recommendations Advised by the Experts for the Enhancement of DAP-Based Supplemental Learning Materials in Early Numeracy.

The focal recommendations include presenting a computer-aided, digital version of the DAP-based learning materials, developing a localized version of the DAP-based learning materials, ensuring that the DAP materials can be adapted to home-based learning, training and orienting the parents on the proper use of the DAP materials and developing an instructional plan or guide also for the parents in case the DAP materials would be used at home learning and mentoring sessions for their children in early numeracy.

The first recommendation only implies that the digital version of the DAP-materials is one way of serving the needs of visually-oriented learners. Evidently, majority of young learners nowadays are attributed with visual orientation, digital literacy and technological cognizance.

Meanwhile, the second recommendation as to localizing the instruction of the materials only imply that the experts recognize the role of making early numeracy instruction more relevant and realistic for the learners. It implies that through localization and contextualization of the DAP-based learning materials, learners are provided with better access to opportunities to engage in more authentic, realistic and life-relevant learning and instruction in early numeracy.

On the other hand, the researcher also recognizes the value of adhering to the third to fifth recommendations as to the need for developing a localized version of the DAP-based learning materials, ensuring that the DAP materials can be adapted to home-based learning, training and orienting the parents on the proper use of the DAP materials, developing an instructional plan or guide also for the parents in case the DAP materials would be used at home learning and mentoring sessions for their children in early numeracy. These only imply that the experts recognize the practical roles and functions of parents and families in extending support systems to the early numeracy education of the children.

Table 13. Test for the Significant Difference in the Academic Performance of Learners before and after the Utilization of DAP-Based Supplemental Learning Materials

1. Present a computer-aided, digital version of the DAP-based learning materials.
2. Develop a localized version of the DAP-based learning materials.
3. Ensure that the DAP materials can be adapted to home-based learning.
4. Train and orient the parents on the proper use of the DAP materials.
5. Develop an instructional plan or guide also for the parents in case the DAP materials would be used at home learning and mentoring sessions for their children in early numeracy.

4. Conclusions

Based from the findings, the following salient conclusions were drawn:

1. Generally, the grade one learners have a frustration level of early numeracy skills prior to their exposure to the developmentally-appropriate interventions.
2. The common least mastered competencies of the grade one learners in early numeracy were visualization of numbers, understanding the inverse functions of basic operations and recognizing basic concepts of time.
3. The developmentally-appropriate practices in teaching early numeracy in grade one were mostly exemplified by the teachers in terms of using pedagogies that help learners understand real-life connections of early numeracy skills, use of instructional materials like visual aids and tools that can help learners visualize and comprehend early numeracy concepts, facilitating learning activities that develop learners' ability to manipulate concrete learning materials in early numeracy and administering learning assessment which is more on the use of manipulatives than written assessment.
4. As the major research output, the researcher designed and developed a set of DAP-based learning materials that are attributed with curriculum-aligned competencies with focus on the least mastered skills, colorful visuals and features, interactive learning activities adapted to each major early numeracy skill and functional learning assessment that is responsive to learners' needs.
5. The developed DAP-based supplemental learning materials passed and adhered to the salient DepED standards and guidelines of contents, format, presentation and organization and accuracy and up-to-datedness of information with its competency-based contents, accurate layout and design, systematic integration of content knowledge and validity of instructional contents and inputs in early numeracy skills.
6. The practicality, usefulness and functionality of the DAP-based learning materials were attested and reflected in this study through the significant improvement in the performance of the grade one learners in early numeracy skills in the post-intervention stage.
7. A significant distinction between the level of early numeracy skills and competencies of the grade one learners before and after their exposure to the utilization of DAP-based learning materials was established in this study, thereby, affirming the effectiveness of the developed intervention tools or output in improving the performance of learners.

8. In order to foster enhancement in the quality, utilization and mechanics of the DAP-based learning materials, the evaluators suggested to make a digital and localized version of the learning tools and to involve and train the parents in the utilization of the materials in mentoring and guiding their children along the learning of early numeracy skills.

5. Recommendations

In light of the findings of the study, the following recommendations were hereby proposed:

1. Design and develop a set of pre-learning assessment that is especially intended for specific classes or ability groups of grade one learners in early numeracy.
2. Develop and produce a set of DAP-based learning materials separately for each identified least mastered competency in early numeracy.
3. Discover and explore other forms of developmentally-appropriate practices in teaching early numeracy that can be adapted to both classroom-based learning and home-based learning systems.
4. Make an interactive format or version of the DAP-based learning materials such as a computer-aided, PowerPoint-presented or hybrid learning version of the tools to adapt to the visually-oriented learning nature of the grade one learners.

5. Subject the developed DAP-based learning materials in early numeracy to the evaluation of the other grade one teachers from other districts and even by the parents of the grade one learners.

6. Produce a set of enrichment DAP-based learning materials to maintain or even enhance the performance of the grade one learners along the identified mastered skills and competencies in early numeracy.

7. Conduct a separate action research that will delve on the other relevant factors that affect the performance level of the grade one learners in early numeracy before and after the utilization of DAP-based learning tools.

8. Distribute copies of the DAP-based learning materials to the other grade one teachers and ask for their further suggestions or feedback on how to enhance the quality of the output.

6. Acknowledgement

I would like to express my deepest gratitude to the following individuals and groups who have been instrumental in the completion of this thesis:

First and foremost, I extend my heartfelt thanks to the Almighty God for His unwavering guidance and blessings throughout this journey. His divine grace has been the cornerstone of my strength and perseverance.

I am profoundly thankful for the invaluable support and encouragement of my family, whose love and unwavering belief in my abilities have sustained me through the challenges of this undertaking. Your belief in me and your unwavering support have been a constant source of strength and inspiration. This achievement would not have been possible without your love and understanding.

I am indebted to my research adviser and statistician, Dr. Ela N. Regondola, for her invaluable guidance, expertise, insights, and unwavering support. Her mentorship, feedback, patience and encouragement have been instrumental in shaping this research into its final form.

I am also thankful to the members of the thesis Advisory committee, Dr. Erlinda J. Porcincula, Dr. Alexy Gene Castillo, Dr. Anicia S. Madarang and Dean of Graduate School Dr. Sonia S. Carbonell for their valuable insights, constructive feedback, and rigorous evaluation, which have contributed significantly to the quality of this research.

My heartfelt appreciation goes to my TAGESTA family for their unwavering help, support, motivation, and encouragement throughout this endeavor. Your collective efforts have made a significant impact on the completion of this thesis.

Finally, I acknowledge the countless unnamed individuals whose contributions, whether direct or indirect, have played a significant role in the completion of this thesis. Their collective efforts have contributed to its fruition.

Thank you all for being a part of this remarkable journey and for your unwavering support every step of the way.

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