JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

Development and Validation of Strategic Worksheet in Mathematics 3

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Abstract

The study determined the proficiency level before and after using the developed and validated strategic worksheet in Mathematics 3 in Maycatmon Elementary School, Milaor District, Division of Camarines Sur, School Year 2024 – 2025. The study employed descriptive-comparative and research & development methods. Thirty-eight grade 3 learners were the main respondents and five experts in Mathematics were the validators of the developed strategic worksheet. The data gathering tools used were teacher-made tests and evaluation checklist. Statistical analysis involved weighted mean, standard deviation, performance level, t-test for dependent samples, and Cohen's D. A significant difference between the learners' performance before and after using the worksheet was noted after using the Cohen's D test. This means that using a tool such as strategic worksheet was effective in enhancing the numeracy skills of the learners.

Keywords: Proficiency Level, Whole Number Sense, Addition of Whole Numbers, Subtraction of Whole Numbers, Worksheet

Introduction

Numeracy skills are essential in our everyday lives, as it enable us to understand and work with numbers effectively and efficiently. This skill involves the ability to perform basic calculations, interpret numerical information, and make informed decisions based on numerical data. Individuals with solid numeracy skills can

navigate financial matters, interpret statistical data, and analyze quantitative information, making them better equipped to engage with various aspects of daily life and professional responsibilities. Learners in the elementary grade level can perform basic operations and apply it to real life situations through the mastery of numeracy skill.

In Mathematics subject, numeracy skills are incorporated from kindergarten up to college level in which it is expected to be mastered by the learners with the help of teachers. In primary level, basic concepts of numeracy are being taught to the young learners. A solid understanding of numbers, operations, and mathematical concepts is essential for tackling more advanced topics. However, developing strong numeracy skills is crucial for success in mathematics and its applications in various fields. It is often a gradual process that involves practice, critical thinking, and a solid understanding of foundational concepts.

In addition, Bonz Magsombol in Rappler (December 2023) reported the Philippines ranked 77th out of 81 countries globally in the student assessment conducted by the Organization for Economic Cooperation and Development (OECD) for 15-year-old learners. In the 2022 student assessment, the country scored approximately 120 points lower than the average scores, with scores of 355 in math, 347 in reading, and 373 in science. Berediana (2023) mentioned in her study that former DepEd Secretary Briones stated civilization can only move forward through innovation and that we should start innovation in the universities and at the basic education level.

Learning remediation and intervention are some of the key outcomes of the DepEd recovery planning and success in ensuring that learning gaps are identified and addressed among all learners. Numeracy intervention is one of the key initiatives which aims to enhance numeracy skills of learners. Through this, it’s expected that learners can re-learn the difficulties experienced in classroom discussions.

Additionally, the innovation that can be made is to develop a worksheet that will surely supplement the learning difficulty of the learners. Worksheet aid in enhancing numeracy skills of learners who are struggling in Mathematics learning area. Developing a worksheet will also lessen the time of teachers in preparing materials for remediation. In this case, both learners and teachers will benefit. Also, an interactive and friendly worksheet for learners will catch attention and interest among learners using it.

Hence, validation of the developed worksheet is necessary to ensure accuracy, prevent errors and promote deeper understanding of the concepts. It should be checked to make sure as well that the lessons are aligned to the objectives in the subject area's content. Also, it means ensuring that educators provide learners with quality learning experience that fosters learning and success. Thus, validation with the use of survey checklist is needed to promote validity and cohesiveness of the resource made.

Hence, the developed strategic worksheet tool for intervention contributed to the attainment of United Nations fourth sustainable development goal which is good quality education. Meanwhile, to further enhance the numeracy skill of learners, DepEd Order No. 013 s.2023, also known as Adoption of the National Learning Recovery Program in the Department of Education, states that:

> *…National Mathematics Program (NMP) aims to drive collaborative action to promote better numeracy and mathematics learning in schools across all grade levels. Specifically, efforts under the NMP shall be geared towards (i) improving shared understanding of numeracy and its critical connections with mathematics and the real-world; (ii)increasing system-wide capacity to implement key principles in developing numeracy and mathematics skills; (iii) increasing the availability of broad and reliable data on numeracy and mathematics progress and achievement.*

Moreover, the creation of additional materials like worksheets will add more fun yet meaningful learning experience to the learners. This will not just help learners but the teachers as well for they will not make repetitive effort in giving interventions or activities to the learners. In addition, the researcher is motivated to develop a Strategic Mathematical Worksheet. Specifically, for Grade 3 learners at Maycatmon Elementary School, Milaor District, Division of Camarines Sur. Henceforward, this would help to improve the numeracy skill of the grade 3 learners.

Apparently, many studies on development of worksheet or skill book on Mathematics and validation were found. The subject matter was undertaken by Atiksari et al. (2023), Romiyate et al. (2023), Doblon (2022), Gustiningsi at al. (2022), Pahrudin et al. (2020), Insorio & Macandog (2022), Safitri et al. (2023), Enrique et al. (2018), Hervas (2022), and Sabando (2022). They also investigated the proficiency level of learners in Mathematics. They revealed that achievement of the learners in Mathematics had a significant difference on the use of strategic tools such as worksheet.

Worksheet in Mathematics

Worksheets serve as an additional tool to support a meaningful learning experience to learners. It is used for additional learning activities that aid the teachers in assessing student engagement, especially in mathematics. This also provides an avenue for the teachers to become more productive when it comes to the teaching and learning process. By utilizing different instructional materials like worksheets, teachers and learners will create a meaningful teaching and learning environment inside the classroom.

According to Atiksari et al. (2023), digital worksheets can train creative thinking skills and can be used as a learning guide. Used by teachers and students in the learning process as a medium for creative and innovative teaching materials, it can improve understanding and attention. It can attract students' interest in learning. Digital worksheets are easy to use and easy to access via various devices such as telephones and computers. Teachers can develop digital worksheets further by focusing on integrating digital worksheets with other digital learning platforms and using these digital worksheets to practice other thinking skills strongly associated with the linguistic achievement of students with highly educated parents. This means that parental involvement helped in honing the pupils' achievement. Thus, school head`s leadership will also help in strong parental involvement towards school endeavors. Meanwhile, teachers' dedication and effort in creating worksheet in mathematics can be helpful in numeracy.

Meanwhile, Romiyate et al. (2023) ventured on the Development of Mathematical Student Worksheets Based on Scientific Approaches and PQ4R Learning Strategies on Associated Materials. The process of developing student worksheets that have been carried out is followed by the validation stage carried out by material experts, obtaining a score of 95 in the "Good" category and design experts obtaining a score of 43 in the "Very Good" category. The individual trial phase scored 68 in the "Very Good" category. In addition, this means that the worksheet is valid, practical, and effective for learning mathematics in junior high schools, especially in learning sets.

However, Doblon (2022) steered on Supplementary worksheets in Mathematics 2 for Modular Learning in Naga City. The researcher used Research and Development design in the study. The study discovered that proficiency of pupils varies based on the subject or topic. In her study, pupils' proficiency in division of the whole number,

fractions, geometry and patterns were insufficient and did not meet the 75% passing standard. Meanwhile, development of supplementary worksheet is needed to help the students addressed their needs.

Additionally, Gustiningsi et al. (2022) found out that student worksheets are declared valid in terms of content, construct, and language. The results of this study show that the student worksheet is valid and practical. The student worksheet is in accordance with the HOTS level in the taxonomy of Bloom and the PISA framework, in accordance with the curriculum and the material for eight grades, and in accordance with the General Guidelines for Indonesian Spelling (PUEBI) and did not cause multiple interpretations. Then, the students understand the instructions or questions in the student worksheet, and it can be used by students.

Likewise, Pahrudin et al. (2020) found out that integration of approaches between science, technology, engineering, and mathematics (STEM) in education is one of the solutions to achieve learning objectives. By applying the STEM approach to Student Math-worksheets (SMw) supported by picture models, it is expected to be an alternative source of learning that is more effective in guiding learning with supported pictures that help participants develop imagination and connect the lesson with the circumstances. The study found out the effective/successful scale of the use of Student Math-worksheets. The result is that the Student Worksheets used are quite effective, and there are significant differences in the effectiveness and analysis of high-scale effect size tests.

Proficiency Level in Mathematics

Numeracy Skill in mathematics equips learners with problem-solving skills, analytical abilities, and lifelong learning skills, altogether contribute to the improvement in various aspects of life which includes future careers like engineering and health. There are factors like knowledge, resources, and attitudes towards the subject can affect proficiency in mathematics. Knowing and mastering basic knowledge in mathematics plays a vital role in developing critical thinking of learners at all levels. If there is a problem, improving proficiency in basic knowledge such as whole number sense, adding whole numbers and subtracting whole numbers not only equip learners with essential tools for higher education but also foster a deeper appreciation for the necessity and usage of mathematics.

Hence, Insorio & Macandog (2022) revealed that video lessons help the students understand Mathematics concepts complementing lessons on the modules. Moreover, they enjoyed watching the teacher-made videos since they see the teacher explaining the lesson. However, the students suggested having regular posting of videos with more examples and explanations having clear and loud voice of the teacher. Hence, the teacher`s guidance must be still there to guide the students.

However, Safitri et al. (2023) mentioned in the result of their paper a review of 40 articles related to learning activities that use multiple intelligence-based approaches, media, and learning models, published from 2011 to 2021. The multiple intelligences theory was put forward by Howard Gardner, an expert in education and psychology. There are nine types of intelligence based on Gardner's theory, namely: verbal-linguistic intelligence, visual-spatial intelligence, musical intelligence, logical-mathematics intelligence, interpersonal intelligence, intrapersonal intelligence, bodily-kinesthetic intelligence, naturalist intelligence, and existential intelligence, which have different characteristics. The method used in this study is a systematic literature review with the following stages: determining research questions; determining criteria; generating a framework for articles; searching, filtering, and selecting; analyzing and interpreting the content of each reviewed article; article writing, and publishing.

While Enrique et al. (2018) revealed that the students improved in their mathematics performance in all the four quarterly exams administered during the school year. Their attitudes toward mathematics improved, and they perceived the intervention program as very effective. Themes gathered from the interviews include (1) usefulness of mathematics in one's daily life, (2) motivation in learning and teaching mathematics, (3) ease in understanding mathematics, (4) improvement in math performance, (5) teaching mathematics as a learning experience, (6) training as beneficial for math teachers, and (7) Mathdali Intervention Program to be continued in the classroom. The program has been strongly recommended by the teacher and the learners having been proven effective in their mathematics classes. This shows that student behaviors towards math is important in learning mathematics concepts.

According to Hervas (2022) who showed in his study that the 3Cs (Copy-Cover-Compare) intervention has contributed a small effect on the mathematical fundamental operations skills of the respondents. Thus, the intervention needs to be improved. The author recommended enhancing the study by proposing other options for improving the Mathematics Fundamental Operations skills of Elementary Pupils. This will surely help Elementary pupils to have the full potential of learning and improve their mathematical skills in fundamental operations. It shows that additional worksheet for intervention in numeracy is also vital in improving knowledge in numbers.

While Sabando (2022) found out that the teachers strongly agreed that they used Repetition in helping their pupils learn better. A significant difference was also noted in the use of Repetition and Timed testing as intervention strategies specifically in terms of sex. Meanwhile, Male and female teachers differ in their use of two strategies although there was no significant difference in all other strategies under study. Moreover, the teachers did not exhibit any significant difference on the perceived level of effectiveness of the intervention strategies based on the selected demographic profile. Also, a significant relationship between the intervention strategies and their perceived level of effectiveness in enhancing learners' performance was evident in the study. The author concluded that teachers perceived the intervention strategies as effective in enhancing their learners' performance. Thus, strategic worksheet in mathematics for intervention is also a necessity to address future problems in numeracy.

Methodology

This research utilized descriptive-comparative and research and development (R&D) methods to achieve the purpose of the study. Descriptive method was used to determine the proficiency level of the students before and after using the worksheets. Likewise, it was also utilized to describe the design of the Competency-Based Learning worksheet along with different components, namely, a) intended learning outcomes, b) contents, c) experiences, and d) assessments. Relatively, the descriptive method is used in determining the curricular validity of the developed worksheets in terms of face, content and construct.

On the other hand, comparative method was used to test if there is a significant difference before and after using the strategic worksheet in Mathematics 3. Further, it was also used in determining the effectiveness of the strategic worksheets in enhancing the Mathematics proficiency of the learners. Moreover, the research and development method was used in crafting the worksheet in enhancing the proficiency level of the learners.

The respondents of this study consisted of two groups. The first group was composed of 38 learners who were officially enrolled at Maycatmon Elementary School, Milaor District, Division of Camarines Sur. The second group consisted of master teachers from Milaor District who validated the developed strategic worksheet. The researcher used purposive sampling and total enumeration. Hence, no sampling method was applied.

Results and Discussion

The status of proficiency level in Mathematics of the Grade 3 learners (Table 1), showed that the computed overall average proficiency level of 38.767 with an interpretation of Did Not Meet Expectation. The data implied that there is a need for intervention to improve learners' skills in whole number sense, addition and subtraction. Like what mentioned in the study of Atiksari et al. (2023) that digital worksheet can train creative thinking skills and can be used as learning guide. Hence, the use of worksheet is beneficial in the learning process of learners.

In Tables 2a, 2b, and 2c, it was found out that the developed strategic worksheet in Mathematics 3 obtained an average weighted mean of 4.00 in terms of face, content and construct validity. The computed valued implied that the worksheet is highly valid in terms of usability, the content was arranged according to the skills needed to be mastered as well as its logical arrangement of the topics. In table 2d, it showed the summary of curricular validity of the worksheet with a computed value of 4.00 as well and an interpretation of highly valid. It revealed that the language used, format and grammar in the material was appropriate to the learners. Parallel to the study of Romiyate et al. (2023) who ventured on the Development of Mathematical Student Worksheets based on Scientific Approaches that went to validation stage and with Good category under material experts, Very Good category under design experts and very Good category under individual trial phase.

In table 3, it revealed the level of learners' proficiency level after the use of the developed strategic worksheet. The data showed that the proficiency of Grade 3 learners appeared that there is a notable improvement in proficiency level along addition of whole numbers, number sense and subtraction of whole numbers. The use of developed strategic worksheet allowed learners to grasp foundational mathematical skills more effective. Parallel to the study of Enrique et al. (2018) who revealed that students improved in their Mathematics performance in

all the four quarterly exams administered during the school year. From that result, additional tool is effective in enhancing the skills in numeracy of learners.

The table 4 showed that there is a significant difference in the proficiency levels of Grade 3 learners before and after the use of developed strategic worksheet in Mathematics 3. It was noted that there is an increase in statistical value in the significance level. Therefore, developing worksheets enhance and level up the proficiency level of the learners in Mathematics 3. Additionally, Sabando (2022) found out that teachers strongly agreed that they used repetition in helping their pupils learn better. Hence, repetitive exercises in the worksheet is also helpful in learning different concepts in Mathematics subject.

Meanwhile in table 5, it revealed the effectiveness of the developed strategic worksheet in Mathematics 3. A computed Cohen's d value of 3.495 fell on the interpretation of large effect. Thus, application of worksheet in enhancing mathematical skills have positive effect towards learning the skills needed. Likewise, Hervas (2022) showed that 3C's (Copy-Cover-Compare) intervention has contributed a small effect on the mathematical fundamental operations skill of the students.

Table 1. Status of Learners' Proficiency Level in Mathematics

Aspects	NI	Average Weighted Mean	SD	PL	Interpretation
Addition of Whole Numbers	10	4.68	1.56	46.8	DNME
Whole Number Sense	10	4.24	1.5	42.4	DNME
Subtraction of Whole Numbers	10	2.71	1.35	27.1	DNME
Overall Average Weighted Mean	**30**	**11.63**	**4.41**	**38.767**	**DNME**

Table 2a. Curricular Validity of The Developed Strategic Worksheet in Mathematics in Terms of Face Validity

Indicators	Weighted Mean	Interpretation	Rank
The language used is clear and easy to understand	4.00	Highly Valid	3
The format and style of the worksheet exercises are appropriate to the target level	4.00	Highly Valid	3
The Illustration provides concrete visual clues	4.00	Highly Valid	3
The language in terms of vocabulary is clear and comprehensive	4.00	Highly Valid	3
The grammar and construction are correct	4.00	Highly Valid	3
Average Weighted Mean	**4.00**	**Highly Valid**	

Table 2b. Curricular Validity of The Developed Strategic Worksheet in Mathematics in Terms of Content Validity

Indicators	Weighted Mean	Interpretation	Rank
The intended outcomes are relevant to the topics covered in Mathematics 3	4.00	Highly Valid	3
The worksheet exercises give insights and ideas what the activity is all about	4.00	Highly Valid	3
The worksheet exercises Provides background of concepts and information about the topic to be solved	4.00	Highly Valid	3
The worksheet exercises are relevant to objectives and appropriate to pupils' abilities	4.00	Highly Valid	3
The worksheet l exercises are adequate to develop pupils' mathematical knowledge and skills	4.00	Highly Valid	3
Average Weighted Mean	**4.00**	**Highly Valid**	

Table 2c. Curricular Validity of The Developed Strategic Worksheet in Mathematics in Terms of Construct Validity

Indicators	Weighted Mean	Interpretation	Rank
Topics are sequence according to Most Essential Learning Competencies	4.00	Highly Valid	3
Learning activities are adapted to the student's level of comprehension	4.00	Highly Valid	3
Assessment is adequate and enough to determine student's mastery level	4.00	Highly Valid	3

Directions are clear and easy to follow	4.00	Highly Valid	3
Concepts for each activity are arranged logically to ensure that there is no duplication	4.00	Highly Valid	3
Average Weighted Mean	**4.00**	**Highly Valid**	

Table 2d. Summary of Curricular Validity of The Developed Strategic Worksheet in Mathematics 3

Aspect	Average Weighted Mean	Interpretation	Rank
Content	4.00	Highly Valid	2
Face	4.00	Highly Valid	2
Construct	4.00	Highly Valid	2
Overall Average Weighted Mean	**4.00**	**Highly Valid**	

Table 3. Level of Learners' Proficiency in Mathematics after the use of Worksheet

Aspects	NI	Weighted Mean	SD	PL	Interpretation
Whole Number Sense	10	6.05	1.64	60.5	FS
Addition of Whole Numbers	10	6.45	1.64	64.5	FS
Subtraction of Whole Numbers	10	4.58	1.52	45.8	DNME
Overall Ave. Weighted Mean	**30**	**17.08**	**4.8**	**56.933**	**DNME**

Table 4. Test on Significant Difference between Learners' Proficiency Levels

Statistical Measures	Statistical Value
t-Stat	13.79
p-value	0.000
Interpretation	**Significant**

Table 5. Test on Significant Difference between Learners' Proficiency Levels

Domain	d – value	Interpretation
Cohen's d	3.495	Large effect

Conclusions

The major conclusions were: (1) the over-all proficiency level of the learners was in the Did Not Meet Expectation level; (2) the developed worksheet in Mathematics 3 was aligned with learning outcome, learning content, learning activities and learning assessment for grade 3 learners; (3) the overall curricular validity of the developed worksheet was interpreted with highly valid level; (4) the overall proficiency level of students was interpreted under the beginning level with an increased post-test result; (5) there is a significant difference between the learners' performance before and after using the worksheet; and (6) the strategic worksheet was effective in improving learners' proficiency level of learners in whole number sense, addition of whole numbers and subtraction of whole numbers.

Recommendations

The study recommends that a proposal to devise an intervention providing a clearer path forward for improvement using developed worksheet in Mathematics 3. This would also add comfort to the teachers for the succeeding school years due to the availability of the devised worksheet. Likewise, it is recommended to use the worksheet as an intervention tool in mathematics 3. As well as investigate which topic in the worksheet learners have difficulty. This could mean providing additional support for students who find the worksheet activities challenging or more advanced activities for those who clutch the concepts quickly.

Furthermore, it is suggested to conduct learner usability testing to identify possible areas where the worksheet could be made more visually appealing, user-friendly, or easier to navigate. Worksheets are effectively promoting learning outcomes. It is also recommended to consider offering additional support resources or differentiated

instruction for subtraction since it has the lowest statistical increase in proficiency level. Similarly, continuously monitor student performance in whole number sense and addition and adapt the worksheet based on on-going data and feedback from learners and teachers.

In addition, this study suggested that since it is effective to the grade 3 learners during the first quarter of school year 2024 – 2025, the researcher should continue developing worksheet for intervention in the second quarter of school year 2024-2025.

Acknowledgment

The research is thanking the Grade 3 learners of Maycatmon Elementary School for their cooperation in being participants of the study as well as the 5 Master Teachers of Milaor District for evaluating the developed Strategic Worksheet in Mathematics 3. Similarly, he is thankful to the principal of the school and the Schools Division Superintendent of the DepEd Camarines Sur for the permission granted to him to undertake the study.

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