IMPROVING GRADE 2 LEARNERS' PROBLEM-SOLVING SKILLS BY CHUNKING WORD PROBLEMS INTO MODEL, LANGUAGE AND SYMBOL

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APPROVAL SHEET

This research entitled "**Improving the Mathematics Performance of Grade 10 Integrity Students of Bal-ason National High School Through Project RAY-MATHTINIK**" prepared and submitted by **RENATO M. ESCOLANO, LORINA M. BRIONES and MARY IRINE ROSE J. MACEDA** to the Schools Division Research Committee of DepEd-Gingoog City has been examined and is recommended for presentation to the Regional Office X as BERF-funded research.

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Abstract

The study aimed to investigate the effectiveness of chunking word problems into model, language, and symbol components in enhancing the problem-solving skills of 26 Grade 2 learners. The intervention was integrated into the solving, presenting, and discussing (concept development) phase of the lesson, following a problem-solving approach in teaching mathematics. It involved a comprehensive data analysis process, including assessments conducted before, during, and after the lesson. Descriptive statistics, such as frequency, and percentage mean, were utilized to assess the learners' performance before and after the intervention, while a paired sample t-test was employed to evaluate significant improvements. Additionally, the study explored the relationship between problem-solving, discussing, and presenting phases within the concept development process with the assessment result through correlation analysis. The results of the paired sample t-test demonstrated a significant difference between pretest and post-test scores. The calculated t-statistic values indicated substantial mean differences, with corresponding p-values of 0.002 and 0.000, respectively, confirming the statistical significance of the observed improvements. A correlation analysis was also conducted whether the variations in the solving, presenting and discussing phases(concept development) are statistically associated with the variations in the assessment scores. The study found a positive correlation, which strongly explains the interconnectedness between the concept development and assessment results.

Keywords: problem-solving skills, chunking, model, language, symbol, teaching math through problem-solving

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Introduction

Problem solving and critical thinking skills are the two main goals of teaching Mathematics as stipulated in the framework of K to 12 Basic Education Curriculum. This was also clearly translated into the Department of Education’s MATATAG agenda which considered problem solving as a goal, as a process, and as a basic skill. It stated that processes involved in solving mathematical problems, from recognizing and understanding a problem, to modelling the problem through different representations, to planning a solution, to executing the solution, and to finally checking whether the problem has been solved, demonstrate that problem solving is a very important life skill for 21st-century citizens to possess. The curriculum goal further emphasized the importance of nurturing the learners’ abilities to create innovative solutions to real-world problems to help them meet the challenges of the 21st century.

According to Altun (2015), problem solving is defined as "deciding what to do when what to do is not known." When faced with a problem that is not understood, it is nearly impossible to come up with a solution, develop a strategy, or choose a method for the solution. It is safe to say that problem solving is crucial for this reason (Altun, 2015).

National Council of Teachers of Mathematics (NCTM) published a document named Curriculum and Evaluation Standards for School Mathematics in 1989 (NCTM, 1989). NCTM (1989) described problem solving as “the central focal point of the mathematics curriculum”.

According to Diamond, L. (2018) problem solving is recognized as a critical component to becoming a self-determined individual. The development of this skill should be fostered in the early years using age-appropriate direct and embedded activities.

The Department of Education (DepEd) was mandated by the Philippine government, by virtue of the Republic Act 9155, otherwise known as the Governance of Basic Education Act of 2001. It is responsible for achieving quality, equitable, and accessible formal and nonformal education in the country and is mainly tasked with supervising basic education—from kindergarten to Grade 12— at elementary and secondary levels in both public and private schools.

Based on Republic Act 10533, Section 15, Commitment to International Benchmarks and DepEd Order No. 29, s. 2017 on Policy Guidelines on System Assessment in the K to 12 Basic Education Program, the Department of Education's participation in TIMSS 2019 provided the department with an additional tool to measure the effectiveness of the enhanced basic education curriculum and its delivery systems. Further, the results of TIMSS informed and supported education policy decision making; identified weaknesses in the education system; and served as benchmark to measure school effectiveness and determined the alignment of national standards with international standards. Magno & Piosang (2016) stressed out that levels of assessment should include participation in international benchmarking of competencies to embark on educational reform. Ültanır & Ültanır (2018) also cited that Trends in International Mathematics and Science Study (TIMSS) results should be included as educational achievement indicators.

Almost contradicting to its goal and purpose, the 2019 edition of the Trends in International Mathematics and Science Study (TIMSS) published by TIMSS & PIRLS International Study Center, Lynch School of Education and Human Development, Boston College, and International Association for the Evaluation of Educational Achievement (IEA) gave the Philippines scores of 297 and 249 in mathematics and science, respectively - the lowest among the 58 countries involved in the study. The study found out that only one percent of Filipino students reached the high benchmark in mathematics, which means "students apply conceptual understanding to solve problems. In the said test, grade 4 pupils of Don Restituto Baol central School were among the test takers thus significantly represented the level of proficiency in Mathematics.

Congruent to the result of this international standard, Department of Education revealed through the result of the National Achievement Test (NAT) – which gravitated towards the low proficiency levels" especially in Science, Math and English. NAT is administered for Grade 6, Grade 10 and Grade 12 students.

Moreover, result of the Division Achievement Test showed that Mathematics was one of the least learned subjects which hit lower than mastery level of 75%.

Furthermore, result of the first and second quarter exam in grade 2 section parrot showed low performance in Mathematics specifically on solving word problems. Result showed that only an average of 4 out of 33 or 12.21% were able answer in solving word problems (items 20,26,27,28,29,30 in first quarter and items 5, 13, 26,30 in second quarter).

As teachers, we were also concerned on the responses of learners when given word problems to solve. The learners have difficulty grasping the abstract content of the word problem first because they focused on word recognition while reading the problem instead of understanding the context. This variable affecting problem solving was supported by Belet and Yasar (2007 cited in Güner & Erbay, 2021) who stated that the cognitive variable that affects solving word problem is about reading comprehension skills like identifying the main idea and auxiliary ideas of the text, finding the cause-effect relations in the text, and predicting the meanings of the unknown words in the text.

With our desire to improve the performance of grade 2 learners in solving word problems we have developed a strategy which is chunking word problem into models, language and symbols specifically on solving routine and non-routine problems involving division of Numbers by 2, 3, 4, 5, and 10, solving problem involving time, solving routine and non-routine problems involving length and solving routine and non-routine problems involving mass.

Intervention, Innovation, and Strategy

This strategy was anchored to the Rathmell Triangle Model (Payne & *Rathmell*, 1975) which presented a versatile framework for teaching mathematics. It stated that relationships must be discussed between and among real-life situations, materials, language, and symbols to develop strong mathematical ideas.

The study of Budano et al. (2021) also supported this study by proving that visualizing and representing were among the effective strategies to imp rove problem solving skills of grade 2 learners.

Rumack and Huinker (2019) stated that chunking the reading was a more detailed way of approaching problem solving. Breaking long strips of information into bit-sized chunks can help learners understand and remember important details of the scenario.

In this strategy, the teacher posed a word problem related to real life situation as an opener of the lesson. Word problem may be routine or non-routine. Routine problems are mathematical exercises or questions that can be solved using standard procedures, algorithms, or techniques that students have learned in their regular coursework. These problems typically have a clear and well-defined solution path, and students are expected to apply the appropriate formula, algorithm, or method to arrive at the correct answer while non-routine problems, on the other hand, are mathematical challenges that require students to think creatively, apply problem-solving strategies, and often deviate from standard procedures. These problems do not have straightforward, readily available solutions, and they may involve multiple steps, real-world context, or novel mathematical concepts. Non-routine problems are designed to encourage critical thinking, creativity, and the exploration of different problem-solving approaches.

Problem solving was generated in different stages. First without chunking or allowing the learners to read and answer the whole text. Second and next stages was considered re-think stages where pupils were assisted through probing and chunking the word problem.

As an intervention real-life problem was chunked into small details first by making a model or illustration. Word problem was visually translated into picture that represented the context. In this study it was encouraged that learners have to draw or make a model or representation as the answer of the teacher's question or probing. The teacher may also present a concrete material or illustration to clarify concepts and ideas.

It was believed that this part provided a structured approach to solving problems, which helped learners to identify key variables, develop a logical sequence of steps, and test solutions to see if they were valid. It also helped to make sense of complex systems. Modelling helped learners to understand complex systems and phenomena by breaking them down into simpler, more manageable parts. In this strategy modelling was not solely done by the teacher or learners alone. Modelling was scaffolded through probing which is typically in contrast to the traditional approach in teaching which are often characterized as "teacher-directed." – a kind of teaching where teacher takes a more central role in the learning process who y provide information to students in a lecturestyle manner, expecting students to passively receive and absorb the knowledge (Tularam & Machisella 2018).

Success in problem solving and achievement measures were influenced by the degree to which students were supported to gain facility with representations as problem representation is crucial to effective problem solving (Krawec, 2014.)

Language in this strategy referred to the clue words that signaled mathematical operation or concept. It involved defining key terms and variables that are essential to understanding the model. In this study use of simple, clear language including translation and code switching was emphasized since learners are at primary level. Word-problem solving served as a form of text comprehension, and understanding language proves integral to students' mathematics word-problem solving performance Powell et al. (2019)

Furthermore, research evidence suggested students require word-problem specific language comprehension to build a word-problem model above and beyond general language Fuchs et al. (2015) and Fuchs et al. (2018) as cited in Powell (2019).

In this strategy, learners were asked about clue words or usually the actions of the subject that led them to identify clue words like "gihatag", "gikuhaan:", "gibahin" etc.

Translation of language to symbol means proceeding from language identified in the problem to the math operations or concepts such as +, -, x, ÷, =, <, >, and more which was done in the discussion leading to summarizing part of the lesson.

Research Questions

This study sought to answer the following questions:

The main objective of this study was to determine effectiveness of chunking word problem into model, language, and symbol in improving the problem-solving skills of the grade 2 learners.

It sought to answer the following questions:

1. What is the performance in solving word problems of Grade 2 learners before the intervention?
2. What is the performance in solving word problems of Grade 2 learners after the intervention?
3. Is there a significant difference in the problem-solving performance of the pupils before and after the conduct of chunking word problems into model, language, and symbol as strategy?
4. Is there a significant relationship between learners' performance during solving, presenting and discussing phases (concept development) and assessment?

Methods

Participants

This research was conducted on twenty-six (26) Grade 2 learners Section Parrot in Don Restituto Baol Central School third and fourth quarter of school year 2022-2023.

Data Gathering Method

This study examined the effectiveness of chunking Mathematics word problems into models, language, and symbols as teaching strategy to improve the learner's performance in solving word problems in pretest-posttest true-control group design. The study determined how this innovation helped the students to solve real life word problems and master math concepts. More specifically, this study investigated what was significantly different between the pretest and posttest on the implementation of the chunking of word problems into models, language, and symbols as teaching strategy to improve the learner's solving word problems. Using the pretest/post-test tool from the learners' materials, pupils were asked to answer the pretest a day before the lesson implementation and the same test was answered after the lesson as exit task.

Furthermore, problem solving skills was also determined during the above-mentioned parts (solving and presenting phases-concept development) using the rubrics from Great Minds (2015). Pupils' answers were noted in two or more rounds or rethink stages. First without using the intervention and on rethink stages when problem was chunked already to determine evidence of conjecturing, reasoning, and other problem-solving indicators. Pupils' oral responses were also noted since it was expected that pupils cannot express all their ideas in writing since they were still in Grade 2.

V. Data analysis

There were three main steps in the data analysis. First, was the pretest composed of five-word problems given before the lesson. Result of this part informed us about the learners' understanding of the lesson before the instruction. We intentionally conducted this part not just to assess and get the baseline data but also to clarify prerequisite understanding of the learners.

Next was the assessment during the lesson before and after the intervention. Conjecturing, reasoning, and other process skills were generated during the lesson in the solving and presenting/discussing phases (concept development) of problem solving where learners were asked to solve one routine or non-routine word problem. Data was extracted using the rubrics from Eureka Math licensed by Great Minds (2015). When little evidence of reasoning without correct answer was given, it was coded 1 and described as poor, when some evidence of reasoning without a correct answer was generated it was coded 2 and described as fair, when correct answer with evidence of some reasoning was created it was coded 3 and described as satisfactory, and when correct answer with solid reasoning was given it was coded 4 or very satisfactory supported by solution paper to support the comparison of conjectures and reasoning before and after the implementation. This assessment during the lesson, informed us the progress of the learners in relation to the development of learning competency and the effectiveness of the strategy employed.

Lastly, as an assessment of learning, five items post-test using the same questionnaire in the pretest was conducted. This was done not just to determine endline data or see the effectiveness of the strategy, but also to further helped the learners.

Descriptive statistics such as frequency, percentage mean, were used to glean the performance before and after the intervention, paired sample T-test was employed to evaluate significant improvement and scores relationship between solving and presenting phases (concept development) and assessment were investigated through correlation.

Results and Discussion

Problem 1. What is the performance in solving word problem of the grade 2 learners before the intervention?

Table 1 shows the performance of learners before the intervention (assessment).

Table 1
Problem-Solving Results of the Learners Before the Intervention (Assessment)

Range	Description	Frequency	Percentage
4.20-5.00	Exceptional	0	0
3.36-4.19	Very Satisfactory	0	0
2.52-3.35	Satisfactory	0	0
1.68-2.51	Fair	1	3.85
0.84-1.67	Poor	9	34.62
0-.83	No Evidence	16	61.53
Total		26	100

Data above revealed that majority at 61.53% of the learners displayed no evidence in problem solving skill, 34.62% manifested poor skill while only 3.85% showed fair level in the pretest.

Table 2 shows the performance of learners during solving and presenting phases (concept development) before the intervention.

Result showed that more than half of the learners at 61.53% manifested skill that can only solve with little evidence without a correct answer. The rest showed satisfactory level or can possibly solve with some evidence of reasoning without a correct answer.

Table 2

Performance of Learners during Solving and Presenting Phases(Concept Development) Before the Intervention

Point Value	Description	Frequency	Percentage
4	Very Satisfactory	0	0
3	Satisfactory	0	0
2	Fairly Satisfactory	10	38.47
1	Poor	16	61.53
Total		26	100

Legend

1- *Poor (Can solve with little evidence without a correct answer)*
2- *Fairly Satisfactory (Can possibly solve with some evidence of reasoning without a correct answer)*
3- *Satisfactory (Can solve with correct answer with evidence of some reasoning)*
4- *Very Satisfactory (Can solve with correct answer with solid reasoning)*

The presented frequency distribution offered valuable insights into the problem-solving abilities of the learners before the intervention. The result of pretest conducted (table1) revealed majority of the learners displayed no evidence of problem-solving skill as they were tested to answer five-word problems before the lesson.

The result helped us to assess and categorized the problem-solving skills of the learners which offered perceptions into areas of improvement in the next phase of the lesson. It guided us to gauge learning and in planning how to orchestrate the discussion based on the thinking of the learners.

Moreover, this phenomenon was supplemented by the result of pretest during the lesson where pupils were asked to answer one problem as opener of the lesson. The result shown in table 2 revealed that most of the pupils (61.53%) cannot give partial conjecture with reasons and the rest manifested fairly satisfactory level (can possibly solve with some evidence of reasoning without a correct answer). It allowed us to identify reasons behind their difficulties to give answer with reasonable solution. DepEd Order number 8 series of 2015 reiterated the policy guidelines on classroom assessment for the k to 12 basic education programs. The part of the lesson where learners were given problem as opener to answer served as formative assessment for and as learning. It helped the learners to identify the barriers in learning as well as the concepts that they misunderstood. As teacher, result of this part helped us to get information about what the learners know and can do about the lesson, determined misconceptions, and allowed us to identify what hinders learning. In this part some notable observations simmered into one that pupils were challenged to read and grasp long word problem thus hindered their skill to answer the problem. As such, there was a need for us to chunk it into significant details to give the learners enough support and chance to process mathematical concepts.

Basically, the design of the lesson following teaching Math through Problem Solving Approach suggested that if some of the learners don't get started ask individual questions to spark thinking, do not directly give the solution or method. In this phase the teacher's critical role to compose mathematical discussion pertaining to model language and symbol was very important through probing. Fitzsimmons (2011) cited that asking questions is a vital part of student learning. Teachers ask students questions to get their minds working and thinking.

NCTM (2000) stated that a program in mathematics instruction should enable all students to recognize reasoning and proof as fundamental aspects of mathematics.

Astawa et al. (2018) cited mathematical conjecture plays an important role in mathematics instruction.

DepEd K12 Mathematics curriculum also emphasized in its framework conjecturing and proving as important skills to be developed in as early as kindergarten. In the context of grade 2 class, support and well-presented orchestration was very critical to develop conjecturing and proving skill of the learners. As we reflect with the results, we realized that pupils should not be judged based on their right or wrong answer. Our goal as a teacher was to develop them based on their level of thinking not merely based on our standard of correct answer.

Problem 2. What is the level of problem-solving skill of the grade 2 learners after the intervention?

Table 3 shows the performance of learners during solving and presenting phases (concept development) after the intervention.

Table 3

Performance of Learners during Solving and Presenting Phases After the Intervention

Point Value	Description	Frequency	Percentage
4	Very Satisfactory	13	50.00
3	Satisfactory	8	30.75
2	Fairly Satisfactory	4	15.40
1	Poor	1	3.85
Total		26	100

Legend

1- Poor (Can solve with little evidence without a correct answer)
2- Fairly Satisfactory (Can possibly solve with some evidence of reasoning without a correct answer)
3- Satisfactory (Can solve with correct answer with evidence of some reasoning)
4- Very Satisfactory (Can solve with correct answer with solid reasoning)

This result showed the performance shared by the learners in their conjectures and reasoning (table 3) after the intervention during the solving and presenting phases (concept development) where chunking was applied during rethink stages.

Significantly, it manifested positive increase where 50% of the learners showed very satisfactory skills in terms of conjecturing and proving with partial or solid reasoning, 30.75% of the learners solved satisfactorily (solving with correct answer with evidence of some reasoning), 15.40% were categorized as fairly satisfactory (solving with some reasoning without correct answer) and 3.85% poorly solved (solved without correct answer with little evidence of reasoning.

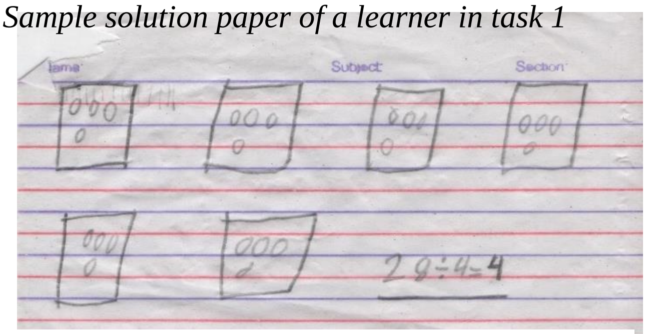
Evidently, correct answer with possible solid reasoning was generated after the intervention.

Sample scenarios:

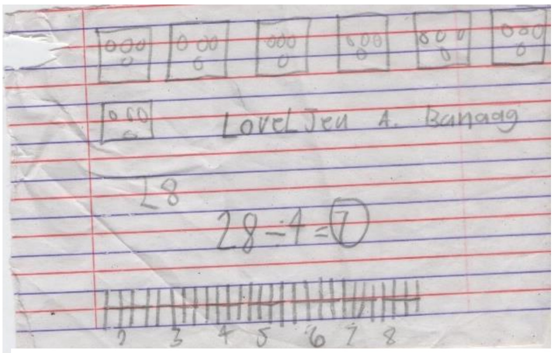
Task 1

Problem: Si JB adunay 7 ka box nga holen. Kada box nay sulod nga tag upat ka holen. Gusto niya bahinon ang iyang mga holen sa iyang 4 ka amigo nga sila Jared, Karl, Mark ug Kent. Tagpila ka holen ang madawat sa iyang kada amigo?

Sample solution paper of a learner in task 1



The figure showed a sample answer from R14 during first stage without applying the intervention. It displayed some reasoning without correct answer.



The figure displayed a revised answer from R14 which showed correct answer with some evidence of reasoning after the intervention

The sample output showed that reasoning and deeper conjectures were generated every time word problem was chunked into meaningful words and phrases emphasizing model, language and symbol in rethink stages.

Other reasoning and communicating skills which allowed backward reasoning were also captured: (translated from vernacular)

Task 4

Problem: Adunay tanom nga mga prutas si Nestor sa ilang balay. Usa niana ka adlaw, nanguha siya ug abokado. Daghan ang iyang nakuha. Iya kining gitimbang ug nahibal-an nga 200g ang gibug-aton sa matag usa . Pila man ka kilograms ang 30 ka abokado nga nakuha ni Nestor?

R7: 6kg (this answer was given during first rethink stage.)

Teacher : Why do you say its 6kg?

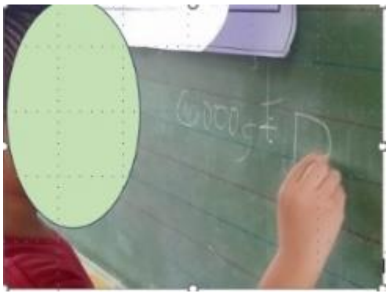
R7: Because 1 kilogram is 1000 grams

Teacher : How did you get 6g kilogram?

R7: I added 1000 kilograms 6 times

R26: Each avocado is 200g, so 5 avocados will make 1 kg.

Teacher : Let us prove if your answers are correct.)



R 7 wanted to prove that the answer is 6 kg

R 26 wanted to prove that 5 avocados is equal to 1 kg.

The teacher further illustrated the conjectures presented by R7 and R26 to assist their ideas leading to the formation of mathematical concepts.

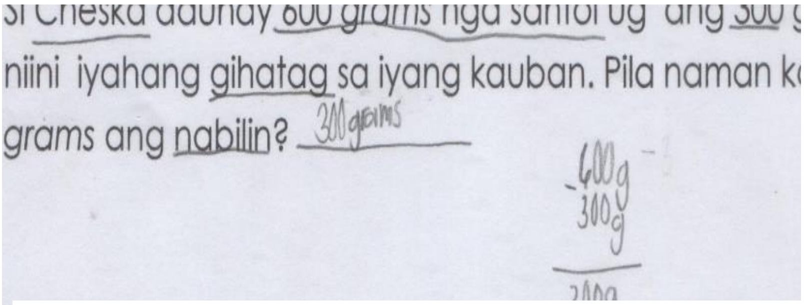
The scenario allowed the teacher to reorchestrate discussion to facilitate backward reasoning based on the given conjectures and reasoning of R7 and in this case the teacher showed illustrations to support the conjectures and partial reasons of R7 and R26.

Analyzing this learners' performance, we may remark that:

R7 has recognized the need to convert grams to kilograms to answer the question.

R 26 supported the idea of R 7 by recognizing the hidden variable (200x5=1000).

Furthermore, some notable evidence in the guided practice part were also noted where learners tried to underline important details of the problem before solving it. This was highly indicative that their minds were trained to understand the problem well by modelling, understanding the language used and associate it with mathematical symbol.



Sample worksheet answered by learner during practice which showed underlines as way of chunking, highlighting significant details of the word problem that help her solve the problem

Table 4

Assessment Results of the Learners After the Intervention (Assessment)

Range	Description	Frequency	Percentage
4.20-5.00	Exceptional	0	0
3.36-4.19	Very Satisfactory	2	7.70
2.52-3.35	Satisfactory	9	34.60
1.68-2.51	Fair	11	42.30
0.84-1.67	Poor	3	11.55
0-.83	No Evidence	1	3.85
Total		26	100

The above phenomenon was clearly supplemented by the result of assessment of learning after the lesson. Results in assessment of learning (table4) presented that substantial portion at 42.30% of the class can solved a problem fairly while 34.60% can solve satisfactorily. 7.70% showed very satisfactory skill, 11.55% poorly solved and 3.85% displayed no evidence to solve a word problem.

Problem 3. Is there a significant difference in the learners' performance in the solving and presenting phases and assessment between pretest and post-test?

The result suggested that there is a statistically significant difference in the performance of learners in the "Solving and Presenting" phases before and after the intervention.

Table 5

Differences in the Learners' Performance in the Solving and Presenting Phases between Pre-test and Post-test

Variables	Mean	T-Value	P-Value
Solving and Presenting (Pre)	**1.40**	**.581**	**.002**
Solving and Presenting (Post)	**3.00**		

The post-test mean score is significantly higher than the pre-test mean score, and the low p-value indicates a high level of confidence in this difference. This is a positive outcome and suggests that the intervention has had a beneficial impact on learners' performance in these phases.

Table 6

Differences in the Learners' Performance in the Assessment Phase between Pre-test and Post-test

Variables	Mean	T-Value	P-Value
Assessment (Pre)	**.77**	**-13.800**	**.000**
Assessment (Post)	**2.36**		

The learners' performance significantly improved from the pre-test (mean score of 0.77) to the post-test (mean score of 2.36). The negative t-value and the very low p-value both indicate a strong statistical significance, suggesting that the improvement in performance is not due to random chance but likely a result of the intervention or teaching that occurred between the pre-test and post-test assessments.

The result of the paired sample t-test both in the solving and presenting/discussing phases (concept development) and assessment of learning both provided strong evidence that there was a significant difference between the pretest and post test scores. The t-statistic value indicated a substantial difference in means, and the p-value was.002 and 0.000 respectively which further confirmed the statistical significance of the difference, thus suggested that there was a meaningful improvement in the performance of grade 2 learners in terms of problem solving using chunking word problem into model, language and symbol.

It has been found to be a successful method for improving problem-solving abilities to break word problems down into three distinct parts: model, language, and symbol. Visualize, represent, and solve problem techniques removed the ambiguity surrounding the concepts and vocabulary related with mathematics and added excitement and enjoyment to mathematics learning (Budano et al., 2021).

Dissecting a word problem into its component models gave the context of the problem a distinct mental representation. We can construct our learners' understanding of the dynamics of the problem using this model as a mental framework. By concentrating on this feature, they gained understanding of the scenario being described in real life, which makes it simpler to identify pertinent data and variables.

Secondly, the language component involved a careful analysis of the way the problem is phrased. It encourages learners to pay close attention to key phrases, such as "gihatag" "nabilin" or "gibahin" "kada or matag" "tanan" which provided crucial clues for selecting appropriate mathematical operations or formulas. This step helped them translate the problem's narrative into a mathematical language, making it amenable to problem-solving techniques.

Finally, the symbol component involved representing the mathematical relationships and equations necessary to solve the problem. This step required them to choose appropriate variables and symbols and construct equations. By focusing on this aspect, we bridge the gap between the real-world scenario (the model) and the mathematical representation, effectively transforming the problem into a solvable form.

Incorporating these three components into developing problem-solving approach not only enhanced the ability of our learners to grasp the complexity of a problem but also equips them with a structured framework for approaching solutions and further develop their thinking skills.

Problem 4. Is there a significant relationship between learners' performance during solving and presenting phases and assessment?

Table

R-Value of the Relationship Between Learners' Performance During Solving and Presenting Phases and Assessment

Variables	R-Value	P-Value
Performance During Solving and Presenting Phases	.810	.01
Assessment Performance		

Relationship between solving and presenting phases (concept development) and assessment can be gleaned above (Table 7) which showed a significant correlation at .01. This entailed that assessment scores was highly dependent to how the teacher process learning or on how teachers facilitate learning.

The highlighted interconnectedness of these components further implied that teachers play a pivotal role in shaping the relationship between these phases. Effective teaching strategies during the solving and presenting phases can directly impact assessment scores. Teachers who guide students through problem-solving, provide clear instructions, and foster a collaborative learning environment are likely to see better assessment outcomes. Conversely, inadequate teacher support can hinder students' ability to perform well in assessments.

Munna, A. S., & Kalam, M. A. (2021) cited that it is a teacher's responsibility to ensure regular interaction between the basic human capabilities of a learner and the culturally invented technologies so that it finally leads to enhancement in their cognitive capabilities. The review further stood that use of visual simulation challenged their learnings and allowed them to become active.

Conclusion and Recommendation

Result of this study supports our notion that we are not only responsible for disseminating information but also for facilitating the interaction between our students' innate abilities and the available stimulus. We can strengthen our students' cognitive abilities and promote a deeper understanding of the ideas we teach by utilizing appropriate teaching strategy wisely.

This reflection reminds us, as grade 2 teachers of the significant influence we have on the growth and development of our students. It served as a reminder that how we teach them during the problem-solving and presentation phases (concept development) has a significant impact on their learning outcomes. The significant outcome of the method chunking word problems into model, language, and symbol recapped the idea to keep raising the bar on our instruction, being aware of the needs of our students, and embracing novel ideas to improve teaching and learning process.

Result of this research will be shared among grade 1 to 3 teachers in DRBCS including other Math teachers in the school, district and division level through LAC session and research congress in different levels.

This also aimed to train teachers to employ Teaching through Problem Solving Approach in teaching Mathematics with Chunking Method in the solving and concept development part to assist Grad 2 learners in developing mathematical concepts.

References

Altun, M. (2015). Ortaokullarda (5, 6, 7 ve 8. sınıflarda) matematik öğretimi (10. Baskı). Bursa: Alfa Akademi Basımevi.

Allen, J. (1985). Inferential comprehension: The effects of text source, decoding ability, and mode, Reading Research Quarterly 20: 603–615 2

Arizmendi, G. D., Li, J., Horn, M. L. V., Petcu, S. D., & Swanson, H. L. (2021). Language-focused interventions on math performance for English learners: A selective meta-analysis of the literature. Learning Disabilities Research & Practice, 36(1), 56–75 https://doi.org/10.1111/ ldrp.1223

Astawa, I.W.P., Budayasa, I.K., & Juniati, D. (2018). Processes of Student's Cognition in Constructing Mathematical Conjecture. Journal on Mathematics Education, 9(1), 15-26.

BELET, Ş & Şefik, YAŞAR. (2007). Effectiveness of Learning Strategies over Reading Comprehension, Writing Skills and Learners' Attitudes towards Turkish Course. Journal of Theory and Practice in Education.

Battista, M. T. (2007). The development of geometric and spatial thinking. In F. K. Lester (Ed.), Second handbook of research on mathematics teaching and learning (pp.843–908). Information Age Publishing

Budaño, Sherine & Joy, Catherine & Ronquillo, C & Ellein, Roma & Yumul, F & Arcanghel, Gabriel & Samosa, Resty & Dominguez, Jessa & Ronquillo, Catherine & Yumul, Roma. (2021). Visualize, Represent and Solve Problem Technique as Teaching Strategy to Improve the Learner's Problem Solving Skill in Mathematics 2. 75-78. 10.13140/RG.2.2.28700.62083.

Capraro, M., & Joffrion, H. (2006). Algebraic equations: Can middle-school students meaningfully translate from words to mathematical symbols? Reading Psychology, 27, 47–164. https:// doi.org/10.1080/0270271060064246

Curtis, A. (1998). A Curriculum for the Pre-School Child: Learning to Learn. London: Routledge.

Department of Education, Department of Science and Technology Science Education Institute, University of the Philippines College of Education, and National Institute for Science and Mathematics Education Development (2007). Trends in International Mathematics and Science Study (TIMSS) 2003 Philippine reports.

DepEd Order No. 55, s. 2016 - Policy guidelines on the national assessment of student learning for the K to 12 Basic Education Program. Retrieved from https://www.deped.gov.ph/2016/06/30/do-55-s-2016-policyguidelines-on-the-national-assessment-of-student-learning-for-the-k-to-12-basic-education-program 4 DepEd Order No. 29, s. 2017 - Policy Guidelines on system assessment in the K to 12 Basic Education Program

Diamond, L. (2018). Problem Solving in the Early Years. *Intervention in School and Clinic*, *53*(4), 220-223. https://doi.org/10.1177/1053451217712957

Lynn Fuchs, Jennifer K. Gilbert, Douglas Fuchs, Pamela M. Seethaler & BrittanyLee N. Martin (2018) Text Comprehension and Oral Language as Predictors of Word-Problem Solving: Insights into Word-Problem Solving as a Form of Text

Comprehension, Scientific Studies of Reading, 22:2, 152-166, DOI: 10.1080/10888438.2017.1398259

Güner, P. & Erbay, H. N. (2021). Metacognitive skills and problem-solving. International Journal of Research in Education and Science (IJRES), 7(3), 715-734. https://doi.org/10.46328/ijres.1594

Jordan, N. C., Levine, S. C., & Huttenlocher, J. (1995). Calculation abilities in young children with different patterns of cognitive functioning. Journal of Learning Disabilities, 28(1), 53–64

Karp, KS., Bush, S., & Dougherty, S. (2019). "Avoiding the Ineffective Keyword Strategy." Teaching Children Mathematics 25, no. 7 (May): 428–35.

Krawec, J. L. (2014). Problem representation and mathematical problem solving of students of varying Math ability. Journal of Learning Disabilities, 47(2), 103–115. https://doi.org/10.1177/0022219412436976

Magno, C. & Piosang, T. (2016). Assessment Schemes in the Senior High School in the Philippine Basic Education. Educational Measurement and Evaluation Review, 7(1).

McKeown, RG., & Gentilucci, J. (2007). "Think-Aloud Strategy: Metacognitive Development and Monitoring Comprehension in the Middle School Second-Language Classroom." Journal of Adolescent and Adult Literacy 51, no. 2 (October): 136–47.

Munna, A. S., & Kalam, M. A. (2021). Teaching and learning process to enhance teaching effectiveness: a literature review. *International Journal of Humanities and Innovation (IJHI)*, *4*(1), 1–4. https://doi.org/10.33750/ijhi.v4i1.102

National Council of Teachers of Mathematics. (1989). Curriculum and evaluation standards for school mathematics. Reston, Va: NCTM.

Ozturk, M., Akkan, Y., & Kaplan, A. (2020) Reading comprehension, mathematics self-efficacy perception, and mathematics attitude as correlates of students‟ non-routine mathematics problem-solving skills in Turkey. International Journal of Mathematical Education in Science and Technology, 51(7), 1042- 1058.

Pólya, G. (1945). How to Solve It. Garden City, NY: Doubleday. Ray-Riek, Max. 2013. Powerful Problem Solving: Activities for Sense Making with the Mathematical Practices. Portsmouth, NH: Heinemann.

Powell, S. R., Stevens, E. A., & Berry, K. A. (2019). Effects of a word-problem intervention on word-problem language features for third-grade students with mathematics difficulty. Learning Disabilities: A Multidisciplinary Journal, 24(2), 1–14. https://doi.org/10.18666/LDMJ-2019-V24-I2-9835

Putman, H. and Walsh, K. (2021). State of the States: Teacher Preparation Policy (Washington, DC: National Council on Teacher Quality, 2021)

Rumack, A., and Huinker, D. (2019). "Capturing Mathematical Curiosity with Notice and Wonder." Mathematics Teaching in the Middle School 24, no. 7 (May): 394–99.2.

Tularam, G. A., & Machisella, P. (2018). Traditional vs Non-traditional Teaching and Learning Strategies – the case of E-learning. International Journal for Mathematics Teaching and Learning, 19(1), 129-158.
Ültanir, E., & Ültanır, Y. G. (Year). Comparing Teacher Competencies Formed by Professional Teaching Knowledge Lectures in Terms of Teacher Training Moves in Turkey and Germany.

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