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Comprehension-Oriented Learning Strategies: Key in Upskilling Students' Problem-Solving Abilities in Mathematics

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***Abstract*—** The purpose of this quasi-experimental study was to learn the effectiveness of comprehension-oriented learning strategies namely visualization, k-w-c, and three-reads protocol in upskilling the problem-solving solving abilities of students in mathematics. Universal sampling was used as a sampling technique in selecting the research subjects who were grouped using Split-Half method. Moreover, both descriptive (mean) and inferential (t-test) statistics were utilized to address the questions regarding level of competency and significant difference in the pre/post-tests scores of both groups. Quantitative results showed a significant difference in the performance of the students exposed to the comprehension-oriented learning strategies against interactive direct instruction, in favor of the experimental group. With this, an immediate dissemination towards various educational leaders and institutions are recommended to commit in training teachers and students into the utilization of comprehension-oriented learning strategies inside mathematics classrooms to further develop students' problem-solving abilities by improving their comprehension skills.

***Keywords*—** MAEd-Mathematics, comprehension-oriented learning strategies, problem-solving ability in mathematics, quasi-experimental quantitative research, Philippines.

I. INTRODUCTION

Problem solving as one of the twin goals in mathematics education is considered an important skill that K-12 students must acquire and master [1]. Cherry and Goldman [2] defined this as a mental process that involves discovering, comprehending, and solving problems with the goal of overcoming obstacles and finding a solution that best resolves the issue.

Regrettably, this skill is what students lack that make them perceive mathematics as a difficult discipline to learn among all others. Two of the reasons behind this are the poor reading comprehension skills of the students and the incompatibility of the teaching methodology of the teacher to the students' learning styles [3].

The stifling progression on this competency hindered students to reach optimum skills theoretically and in real life. Even first-world country like the United States of America reported flunking results in an international assessment in mathematics literacy which ranked 31st among 79 countries, a smaller-than-average performance that has been stagnant for decades [4].

Much worse in the Philippines who ranked lowest in both reading and mathematics in the past during the administration of the Program of International Student Assessment (PISA) which continuously alarm and threaten the educational system of the country [5]. Local audit of the different school division offices of the Department of Education in the country pointed out that competency like problem solving in mathematics which covers all grade levels is one of the least mastered among all others [6].

In the study conducted by Nicholas and Emata [7], they found out that this phenomenon of poor performance in mathematics problem solving was correlated to the poor reading comprehension skills of the learners. The lack of this skillset disables students to formulate basis solutions to mathematical word problems which eventually compels them to get stuck and give up solving problems at hand. With this, they recommended the employment of reading comprehension-based learning strategies to aid student difficulty in understanding the problem which Kikas, Madamurk and Palu [8] called as comprehension-oriented learning strategies. These strategies are fundamentally literacy strategies used mostly by English language teachers to help students improve their comprehension skills when reading expository texts.

Arciniega [9] used similar learning strategies which she adapted from reading teachers who used it to learners in primary levels when it comes to comprehending expository texts with the goal of utilizing its effectiveness and used it to enable her students to grasp the context of mathematics word problem, which she

believed is the first step in problem solving. In particular, she delved into the employment of visualization (visual representations), k-w-c, and three reads protocol through her action research which yielded to a promising result.

Comprehension-oriented learning strategies implementation in mathematics education has contributed greatly to ease learners' problem in understanding lengthy word problems. According to Abdulrahim and Orosco [10], English learners have improved upon implementing such strategies inside their classroom using concrete linkages of theoretics and real-life application. Arcavi [11] pointed out that *visualization* as one of the few comprehension-oriented learning strategies referring to the transformation of words to visuals helps learners reflect and communicate properly with the problem using their prior knowledge. This process reduces the complexity of reading multitude of words while reading math word problems through various representations and manipulatives, and by seeing concrete objects, students can unlock definite means of addressing the problem [12].

It is further explained by Glenberg et al. [13] that creating mental representations of situations is a fundamental strategy for understanding any kind of verbal problems. The items students play with generate wide range of information for the child to process at the sensory, cognitive, motor, and emotional levels. Also, it allows teacher to quickly check whether the students were able to grasp the context of the text they are reading or in mathematics, the word problems.

On the other hand, Hyde [14] gave emphasis to the magnitude of dissecting the problems using k-w-c approach where it allows students to create a path towards a solution by knowing the available ideas within the problem, looking into what is asked, and considering what are the conditions laid upon reaching the desire solution. Students are program to take this track just like taking a route from their homes to their school. The strategy is methodical in nature and very easy for students to use since it transforms the problem into considerable chunks [15]. Adapted from k-w-l strategy, k-w-c enables students to focus on important information within the problem and discern which ones are expendable.

Likewise, intervention of comprehension-oriented learning strategies to high school students proved to be essential in the development of problem-solving skills in mathematics. The San Francisco Unified School District [16] elaborated that a particular comprehension-oriented learning strategy known as three reads protocol was found effective for students dealing with mathematical word problems. Stemmed from close reading in English, three reads protocol deepens a student's understanding of the structure of rich tasks [17]. The strategy begins with the first reading done by a teacher with the key question of "What is the situation all about?" followed by the second reading in chorus or pair. It asked the question "What are the quantities in the situation?" and then the third reading in chorus or pairs again addressing the question "What mathematical questions can we ask about the situation?". The practice of repetitive reading which is practically the foundation of this strategy coupled with the aid of teacher's prompting questions heightens recall regarding salient information provided in the problem, assists those who still encounters struggles in reading as they transition from word-by-word to a more meaningful reading of the problem, and it increases comprehension and results in more advanced questioning and insights on how to address these problems [18].

Draper [19], in an investigative study, established that upon using these comprehension-oriented learning strategies in mathematics classroom, strengthen the foundation of learning all throughout various disciplines which is reading comprehension. This is likely the reason why there is really a need to integrate subjects, concepts, or strategies in the educative process. According to the Integrative Learning Theory by Dewey [20] in which this study is anchored to, it helps students break boundaries among disciplines and enables them to utilize each learning onto the others. In the context of this study, an integrative learning is exhibited in the adaptation of these so-called comprehension-oriented learning strategies (independent variable) which are basically literacy strategies in English – particularly in comprehension and use it to teach math word problems to upskill students' problem-solving abilities in mathematics (dependent variable).

Thus, in this study, the researcher utilized these so-called comprehension-oriented learning strategies (visualization, k-w-c, and three reads protocol) as intervention to see whether this could be the key in upskilling the problem-solving abilities of the students in mathematics. The aim of this research was to determine the level of competency of the students pre- and post-intervention and whether upon the employment of these strategies there would be a significant

improvement to the skills of the learners in problem solving especially when encountering lengthy mathematical word problems.

All the hypotheses of this study were tested at 0.05 significance level stating that there is no significant difference between the pre- and post-test scores of the control group. Followed by there is no significant difference between the pre- and post-test scores of the experimental group and lastly, there is no significant difference between the pre- and post-test scores of the students in the control and experimental group.

This study may prove significant in contributing better ways for mathematics teachers to upskill the problem-solving abilities of the students. Moreover, this may provide insights into developing a new strategy that would be vital in developing the reading comprehension and problem-solving abilities of students in a mathematics classroom. Students, on the other hand, may benefit from this study through utilization of these strategies during the learning process. Administrators may benefit from this investigation by upgrading teacher's pedagogical competence in teaching mathematics, particularly the competence of problem-solving and providing instructional support through training and seminar of the concerned competency with provisions of instructional materials.

II. METHODS

This study utilized quantitative quasi-experimental research design to determine whether the employment of the comprehension-oriented learning strategies (visualization, k-w-c, three reads protocol) can make a significant difference to the performance of the students in terms of problem-solving in mathematics using test scores as indicators. This type of quantitative design is considered appropriate since it is formal, objective, and systematic process to obtain the numerical data to test these variables [21].

This study applied universal sampling technique in selecting the study's respondents who were divided into two groups, control and experimental. The student assignment to these groups was done through Split-Half method where ninth grade students from Major Angel V. Fajardo National High School, where this study was conducted, were randomly numbered from 1 to 28 and then grouped all odd-numbered students to the former while all even-numbered students to the latter. The participation of the students was purely voluntary. Thus, the participant can withdraw anytime if they are threatened in the conduct of the study.

During the quasi-experiment, both groups took the pre- and post-tests using a 40-item multiple choice questionnaire developed by the researcher (including the table of specifications) composed of word problems in algebra, geometry, and statistics to which 20 of it were intended to measure the comprehension level of the students and the other 20 for their problem-solving skills. To ensure the instrument's validity and reliability, the research instrument underwent peer critiquing from both internal and external validators and pilot testing from 20 randomly selected respondents that was conducted in Camanlangan National High School.

In terms of data analysis, both descriptive and inferential statistics were used to address the statements of the problem in the study. *Group mean* was utilized to determine the level of competency of the students in terms of reading comprehension and problem-solving, while *T-test* was used to determine the significant difference of the students' scores during pre- and post-tests *(paired t-test)* or the post-test scores between the two groups *(independent t-test)*.

III. RESULTS

This section presents the results, analysis and intervention derived from the study conducted. The information is presented in both tabular and textual formats. At a significant threshold of 0.05, all inferential results were evaluated and interpreted. The tables and their interpretation were organized under the following constructs: competency level of the pre-test scores of control and experimental group in reading comprehension; competency level of the pre-test scores of control and experimental group in problem-solving; competency level of the post-test scores of control and experimental group in reading comprehension; competency level of the post-test scores of control and experimental group in problem-solving; pre-test score of control and experimental group; pre-test and post-test score of control group; pre-test and post-test of experimental group; and post-test score of control and experimental group.

Competency Level of the Pre-test Scores of Control and Experimental Group in Reading Comprehension

Table 1 shows the competency level of the pre-test scores of control and experimental group in terms of reading comprehension.

Table 1: Pre-test Competency Level in Reading Comprehension between Two Groups

Pre-test	No. of Students	Mean	Class Proficiency	Competency level
Group A (Control)	14	10.64	81.28%	Satisfactory
Group B (Experimental)	14	12.43	84.86%	Satisfactory

With 14 students in each group, the control group scored a mean of 10.64 in a 20-item comprehension test in mathematics with a class proficiency of 81.28% while the experimental group scored a mean of 12.43 with a class proficiency of 84.86% which is higher than the control group. However, despite this statistical difference between their scores' mean, both groups' competency levels are classified as satisfactory. Meaning, the students had already satisfactorily acquired comprehension skills based on the standards set by the Department of Education. This entails that some of the students in both groups can somehow make sense (at least) of the basic context of the problem at hand.

Competency Level of the Pre-test Scores of Control and Experimental Group in Problem-Solving

Presented in Table 2 is the competency level of the pre-test scores of control and experimental group in terms of problem-solving.

Table 2: Pre-test Competency Level in Problem-Solving between Two Groups

Pre-test	No. of Students	Mean	Class Proficiency	Competency level
Group A (Control)	14	7.29	74.58%	Did Not Meet Expectation
Group B (Experimental)	14	7.07	74.14%	Did Not Meet Expectation

In a 20-item problem-solving test, the control group scored a mean of 7.29 with a class proficiency of 74.58%. On the other hand, the experimental group scored a mean of 7.07 with a class proficiency of 74.14% which is statistically lower than the control group. Consequently, both groups demonstrate a competency level that falls under did not meet expectation. This means that students in both groups had not met and passed the required competency in problem solving set by the Department of Education. Although they have the grasp of some of the context laid in the problem, they still have encountered difficulties finding the accurate methods in solving it.

Competency Level of the Post-test Scores of Control and Experimental Group in Reading Comprehension

Found in Table 3 is the competency level of the post-test scores of control and experimental group in terms of reading comprehension.

Table 3: Post-test Competency Level in Reading Comprehension between Two Groups

Post-test	No. of Students	Mean	Class Proficiency	Competency level
Group A (Control)	14	10.86	81.72%	Satisfactory
Group B (Experimental)	14	14.14	88.28%	Very Satisfactory

From a 20-item comprehension test administered during post-test, the control group scored a mean of 10.86 which provides statistically a class proficiency of 81.72%, while the experimental group scored a mean of 14.14 which gives the group a class proficiency of 88.28%.

The post-test result shows that the control group still has satisfactory competency level while the experimental group has upgraded to very satisfactory after the 3-week intervention. The increase in the class proficiency of the experimental group evinced the positive effect of the comprehension-oriented learning strategies as an intervention in comprehending mathematical word problems. Moreover, the strategies improved the comprehension skills of the students upon its employment.

Competency Level of the Post-test Scores of Control and Experimental Group in Problem-Solving

Shown in Table 4 is the competency level of the pre-test scores of control and experimental group in terms of problem-solving.

Table 4
Post-test Competency Level in Problem-Solving between Two Groups

Post-test	No. of Students	Mean	Class Proficiency	Competency level
Group A (Control)	14	7.43	74.86%	Did Not Meet Expectation
Group B (Experimental)	14	8.86	77.72%	Fairly Satisfactory

It can be observed that the control group got a mean score of 7.43 which explains the group's class proficiency of 74.86%. Meanwhile, the experimental group scored a mean of 8.86 which gives them a class proficiency of 77.72%. Empirically, the experimental group scored higher compared to the control group which improved their competency level to fairly satisfactory compared to the control group which lingered to did not meet expectation. This increment of level in favor of the experimental group confirms the pragmatic effect of the employment of comprehension-oriented learning strategies in mathematics classroom which helps students upskill their problem-solving abilities. The students, upon using comprehension-oriented learning strategies, were able to connect basic mathematical concepts and discern which one to use best for a particular problem.

Pre-test Score of Control and Experimental Group

Exhibited in Table 5 is the significant difference between the pre-test scores of control and experimental group. Inferential statistics (independent t-test) was used to determine the significant difference between the scores and used 0.05 as the level of significance.

Table 5: *Significant Difference between the Pre-test Scores of Control and Experimental Group*

Pre-test	Mean	t-value	p-value	Remarks
Group A (Control)	18.0	-1.5	0.430	Not Significant
Group B (Experimental)	19.5			

Overall, the control group scored a mean of 18.0 from a 40-item test administered while the experimental group got a mean score of 19.5. The t-value was found to be -1.5 implying that the experimental group scored higher than the control group. This value is statistically insignificant as corroborated by the p-value of 0.430 which is far greater than the set alpha value of 0.05. This result suggests that there is no significant difference between the scores of control and experimental group from a 40-item comprehension and problem-solving test at the beginning of the experiment and that no group was intellectually advantageous thus ensured fairness for the experiment.

Pre-test and Post-test Score of Control Group

Shown in Table 6 is the significant difference between the pre-test and post-test scores of control group.

Table 6: *Significant Relationship between the Pre-test and Post-test Scores of Control Group*

Control	Mean	t-value	p-value	Remarks
Pre-test	17.9	-0.4	0.734	Not Significant
Post-test	18.3			

It is noticeable that the group scored a mean of 17.9 on a 40-item test during the pre-test and got a mean score of 18.3 during the post-test. With the use of inferential statistics (paired t-test), it was found out that the t-value was -0.4 in which the sign implies that the post-test is greater than the pre-test.

Moreover, the probability value between the scores from two test administrations was 0.734 which was obviously greater than the level of significance set that is 0.05. This p-value clearly implies that the t-statistics was not significant and therefore there is no significant difference between the pre-test and post-test scores of control group. The null hypothesis was accepted in this case, meaning the interactive direct instruction did not make a significant difference in the scores of the students under the control group.

Pre-test and Post-test Score of Experimental Group

Presented in Table 7 is the significant difference between the pre-test and post-test scores of the experimental group.

Table 7: Significant Difference between the Pre-test and Post-test Scores of Experimental Group

Experimental	Mean	t-value	p-value	Remarks
Pre-test	19.5	-3.5	0.000	Significant
Post-test	23.0			

During the pre-test, the group scored 19.5 from a 40-item test while during the conduct of the post-test, the group got a mean score of 23.0. After running a paired t-test on the data, it was found out that the t-value was -3.5 which suggests promising results, while the probability value between the two sets of scores from two test administrations was found out to be 0.000 which means it is lower than the set p-value and remarks that there is a significant difference between the pre-test and post-test scores of the experimental group. Consequently, the null hypothesis was rejected and therefore supports that the employment of comprehension-oriented learning strategies in the experimental group made a significant difference to their scores even for a short period of time.

Post-test Score of Control and Experimental Group

Table 8 elaborates the significant difference between the post-test scores of control and experimental group.

Table 8: Significant Difference between the Post-test Scores of Control and Experimental Group

Post-test	Mean	t-value	p-value	Remarks
Control	18.3	-4.7	0.000	Significant
Experimental	23.0			

The table shows that the control group attained a mean score of 18.3 while the experimental group got a mean score of 23.0. An independent t-test was used statistically to determine the significant difference between the two groups post-test scores and was found out the t-value was -4.7, meaning the experimental group's score is greater than the control group's which is statistically significant as substantiated by its p-value of 0.000. Evidently, there is a significant difference between the two sets of post-test scores, and as a result the null hypothesis was rejected. In comparison to the two strategies employed in each group, comprehension-oriented learning strategies were more effective than the interactive direct instruction.

IV. DISCUSSIONS AND CONCLUSION

This chapter consists of a report of the researcher's discussions on the results, conclusions, and recommendations based on the data gathered during the procedure of the research. As stated in the previous chapters, the study's main objective which is to determine how comprehension-oriented learning strategies can make a difference in the students' problem-solving abilities in mathematics were addressed with the help of the inferential statistics employed in this quasi-experimental research.

Before continuing to explain the analysis of the results, it is informed that the presentation of the discussion follows the construct: first, elaborating the level of competency of the research subjects, pre- and post-intervention week, between two groups in terms of reading comprehension and problem-solving; next will be the significance of the relationship between conventional strategy and problem-solving ability in mathematics by examining if there exist significant difference between the pre- and post-test scores of the control group; and finally, discussion will proceed on the significance of the relationship between comprehension-oriented learning strategies and problem-solving ability in mathematics by scrutinizing whether there is a significant difference between the pre- and post-test scores of the experimental and the post-test scores between two groups.

Level of Competency in Reading Comprehension

In the preceding chapter, it was found in Table 1 that the level of competency in reading comprehension of both control and experimental group during pre-test demonstrates a satisfactory performance. This means that both groups have already attained the basic competency of comprehension which is an indication of a good foundation for these learners to engage with word problem solving in mathematics, at the same time provides a definite status that this can still be improved.

Subsequently, post-test results in Table 3 from the preceding chapter revealed no changes from the pre-test level of competency in reading comprehension for the control group which remained satisfactory. However, the experimental group showed quite a promising performance after the intervention as it was evident that

from having a satisfactory performance in pre-test, it went to very satisfactory during post-test.

This means that during the 3-week intervention program, the experimental group had shown improvement in their comprehension skills as their competency level moved up from satisfactory to very satisfactory, while the control group, receiving no intervention and was taught the conventional way using interactive direct instruction had an unchanged competency level proved how effective the intervention program was.

This result regarding the increase of scores in a short period of time resembles to what Arciniega [9] had observed in her study which tackles the employment of comprehension-oriented learning strategies support students to comprehend whatever word problems in mathematics they are dealing with.

Conclusively, using whether visual representations in translating the text from a word problem so students will be able to physically see the scenario projected in real-life [11], or dissecting the problem in chunks of information using the k-w-c chart so students are able to internalize the information well resulting to a gradual understanding of it [15], or repetitive reading using three reads protocol where each reading is intentionally addressing the fundamental steps in problem-solving [16], students generate concrete understanding as how to treat the problem and what mathematical concept should they apply.

Level of Competency in Problem-Solving

The result in Table 2 in the previous chapter has established evidence that there is really a perennial issue with the students' problem-solving ability in mathematics as it was revealed that the level of competency in problem-solving of both control and experimental group during pre-test fell under did not meet expectation level. Meaning, students failed to acquire necessary competencies in problem-solving to reach, if not surpass, the standard set by the Department of Education.

Likewise, Table 4 exposed that the control group had stayed in the same level of competency in problem-solving after the post-test has been administered, while the experimental group had successfully climbed up to the next level which is fairly satisfactory.

These results reflect the previous records of the PISA 2018 reported by Philstar Global [5] where Philippines scored second lowest in mathematics more specifically in problem-solving among all other countries who participated in the international assessment. It intensifies the fact that students have not yet mastered the competency of problem-solving especially when dealing lengthy mathematical word problems.

Despite this alarming status, the statistics cannot be neglected. The shift in the level of competency of the experimental group from not having met the expectation set by the Department of Education to fairly satisfactory implies that there is an improvement in the scores of the students who received the intervention for 3 weeks. This is supported by the claim of Hyde [14] in the study he conducted about the effect of reading comprehension strategies to the problem-solving ability of students in mathematics, that the ease these strategies offer to students in processing word problems enables them to think critically and logically in determining appropriate steps in addressing the problem.

On the other hand, this below satisfactory level of competency in problem solving of the students during the experiment might be attributed to other factors outside the scope of this study like self-esteem, achievement motive, self-efficiency and concentration as mentioned by Pimta, Tayruakham and Nuangchalerm [22] in the results of their research. For that matter, the researcher claimed that the improvement of the students' competency due to the employment of the comprehension-oriented learning strategies (visualization, k-w-c, three reads protocol) is just one of the many factors considered as the key to upskill the students' competency in problem-solving.

Conventional Strategy and Problem-Solving Abilities in Mathematics

In the beginning of the experiment, both groups undergone pre-tests to determine the students' current level of competency. Albeit the mean score difference between the two groups in which the experimental group scored 1.5 higher than the control group, it was found in Table 5 in the previous chapter that the t-value is -1.5 ($1.5 < 2.160$) and the p-value between the two groups is 0.430 which means the score difference is not significant. This relationship established during the pre-test was treated as the basis in the future

identification of the success or failure of the experiment.

In the span of 3 weeks while the treatment was administered to the experimental group, the control group was taught conventionally using the "interactive direct instruction" method. This method is wildly used worldwide by a teacher-centered classroom like India and China where teachers cast themselves as the master of the subject matter [23]. Three weeks have passed, and a post-test was administered to both groups. Results were compared with the previous tests. Using paired t-test, the significant relationship between the pre- and post-test of the control group was identified as presented in Table 6 in the preceding chapter. With a t-value of -0.4 (0.4 < 2.160) and p-value of 0.734, it was deemed not significant, and the null hypothesis was accepted. Meaning the employment of "interactive direct instruction" method did not make any significant difference to the scores of the students in the group.

This result is the same reason why countries like UK, US, Australia, and New Zealand are moving away from this form of education [23]. The shift from this strategy to an alternative and constructivist approach has been found helpful in attaining more productive outcomes in the performance of the students, yet some just mix the two to better what is deemed already in the status quo.

It was further explained by Anwar [24] that this method failed to stimulate many students' interests in learning. Although the method is essential to establish some concepts that need to be expounded first, he advised that it must be coupled with other teaching aids that would maintain students' attention hooked on the discussion.

Comprehension-Oriented Learning Strategies and Problem-Solving Abilities in Mathematics

On the same 3 weeks, the experimental group has been receiving a treatment in the form of comprehension-oriented learning strategies (visualization, k-w-c, three-reads protocol) – reading comprehension-based strategies which originally used by English teachers to help students easily comprehend the text they are reading that are strategically incorporated in mathematics education [9]. After the intervention week, scores between pre-test and post-test of the experimental group were compared to determine whether there exists a significant difference between their scores.

Table 7 in the previous chapter proved that there is a significant difference between these scores given that the t-value is -3.5 (3.5 > 2.160) and the p-value is 0.000 which resulted in the rejection of the null hypothesis. This implies that the comprehension-oriented learning strategies have a positive effect that helped the students improve their problem-solving abilities. Likewise, if compared to the post-test results of the control group who did not receive the same treatment, there is also a significant difference between the scores as shown in Table 8 in the preceding chapter in which the t-value is -4.7 (4.7 > 2.160) and the p-value is 0.000 which eventually why the null hypothesis was again rejected. This can only mean one thing which is the intervention of comprehension-oriented learning strategies toward mathematics education has contributed to the improvement of the students' scores while taking the same assessment.

These results agree with Draper [19] who emphasized that these kinds of reading comprehension-oriented learning strategies enable students to unlock hidden clues easily in a word problem solving that lead them to correctly solve them. Aside from that, students found it refreshing and a new whole lot of experience engaging in various activities which these strategies have brought into their classroom rather than sitting in their chairs all day while painstakingly take notes and catch up with the teacher's lecture – a familiar response akin to this research's respondents.

Similarly, Wiley [17] supports this idea as these strategies deepen the students' understanding of the structures of rich tasks like word problems in mathematics and practical issues in real life as these problems cascade into everyday life. It is also noteworthy that the strategies enable students to take the whole problem into tolerable chunks to deal with so they can analytically provide appropriate steps in addressing the problem [15].

Additionally, Hyde [14] authenticated this result in his study that these strategies enable students to connect their previous knowledge to the problems they are solving because it has given them a clearer picture on what the problem is asking them to do and so a concise solution is efficiently formulated and implemented.

In the same manner, such favorable outcome has been found out by Arciniega [9] while conducting a similar study for 10 months. She concluded in her research that these literacy strategies (as she called them) are deemed new building blocks in upskilling students'

performance in assessments involving word problem-solving in mathematics and to finally change the trend of countries who are still below average point in international standings.

Furthermore, the researcher claimed such results could really make a difference in mathematics education particularly in dealing poor performance of students in problem-solving.

CONCLUSION

The results and intervention of this study suggest promising outcomes on the comprehension-oriented learning strategies being an effective tool to support students' comprehension in mathematics word problems and upskill their problem-solving abilities. Moreover, it is within the capacity of these results that the research questions are addressed as follows: (1) the level of competency during pre-test of both control and experimental group in terms of reading comprehension and problem-solving fell under satisfactory and did not meet expectation respectively; (2) the level of competency of the control group during post-test in terms of reading comprehension and problem-solving still fell under satisfactory and did not meet expectation level respectively, while the experimental group has a competency level of very satisfactory and fairly satisfactory respectively; (3) there is no significant difference between the pre-test and post-test scores of the control group; (4) there is a significant difference between the pre-test and post-test scores of the experimental group; and (5) there is a significant difference between the post-test scores of the control and experimental group.

Conclusively, it was evident that the implementation of these comprehension-oriented learning strategies in a mathematics classroom contributed a significant improvement to the problem-solving ability of the students by increasing their accuracy, conceptual understanding, and visual representations. A change in perspectives that is what the students and teachers need to meet halfway in the teaching-learning process instead of creating a teacher-dominated classroom where students are obviously at a disadvantage. The implementation may require careful planning and resources such as time, money, and effort but can pay off with positively impacting the student learning and growth in learning mathematics – a potential tool towards dramatic outcomes on the performance of the students if implemented with fidelity.

With this, the researcher claimed that the work of this study has made the argument that comprehension-oriented learning strategies (visualization, k-w-c, three-reads protocol) can be the key to what the teachers have been looking for to upskill students' problem-solving ability in mathematics.

RECOMMENDATIONS

Upon thorough analysis of the research's results and conclusions, the researcher had formulated the following recommendations as to how comprehension-oriented learning strategies could further foster mathematics education in the Philippine context:

1. To the educational leaders, it is advised to conduct Content and Pedagogical Seminar or Training for teachers with the focus of integrative learning approach to strengthen their foundations as to how the comprehension-oriented learning strategies mentioned in this study and the likes work. A compendium of these strategies with samples of daily lesson plan including the specific activities to be incorporated would be beneficial to teachers if they would be provided to help them understand the procedures in the implementation of these strategies.
2. To the teachers, it is highly recommended to utilize these strategies at the same time conduct his/her own classroom action research about the effectiveness of the strategies. Since students vary differently, it would be helpful to experiment your teaching strategies to identify what really suits best to the students. Practice these strategies inside the classroom so that students can adapt and use these on their own.
3. To the parents/guardians, it is encouraged to give time to facilitating their children in reading regardless of their academic attainment. Just by sitting with your children, you can impose on them how serious and important reading habits are. Moreover, you value accountability in the education of your child, which is part of your responsibility as a parent. This will not only do good to your children, but to the whole society.
4. To the students, the researcher implores you to try and practice these strategies in solving problems in mathematics. Your personal experience and progress upon using these strategies would be a good foundation for future researchers to conduct more research related to this matter but with the consideration of other factors and methodologies.

5. To the future researchers, it is recommended to explore more about this subject matter with this paper as your basis and venture other factors worth taking upon.

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