

Towards Discovering the Best Learning Strategy in Developing Student's Problem-Solving Skills in Mathematics

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Abstract

Problem-solving skill is one of the most important competencies that should be developed to strengthen the students' analytical and critical thinking skills in applying mathematics to real-world situations. This study aimed to develop an instructional intervention to improve the problem-solving skill of the students in mathematics. The discussions of the study followed the Analysis, Design, and Development (ADD) Phases. In the analysis phase, the problem-solving skill of the students was determined using their pretest scores. In the design phase, based on the initial performance of the students, lesson exemplars were crafted and utilized integrating the learning strategies in terms of real-world experiences, visual representations, and learning socially in groups. In the development phase, after the conduct of the lesson using the exemplars, posttest was administered to determine if there is a significant improvement using the learning strategies. The best learning strategy was incorporated in the modular skill enhancement strategy as an instructional intervention which was developed in this study. Descriptive and comparative methods of research were utilized. Forty Grade 11 students under Humanities and Social Sciences Strand of Camarines Sur National High School were chosen through purposive random sampling. Statistical tools such as mean, rank, and paired sample t-test were utilized. Based on the findings, students were advanced beginners ($M=2.38$) in solving word problems in the administered pretest. To address the issues and gaps in problem-solving skill of the students in math, lesson exemplars were made applying the 4A's Model of Jane Vella (2008). After the delivery of instructions using the lesson exemplars, posttest was administered. Comparing the results from the pretest, the student's performance in solving word problems improved. They were found to be competent ($M=4.61$). This study concluded that there are two learning strategies that can develop the problem-solving skills of the students. These are learning through real-world experiences and visual representations. To enhance the students' performance in problem-solving, the suggestions and recommendations were: (1) a compendium of lesson exemplars integrating the learning strategies in terms of real-world experiences and visual representations can be developed; (2) Math Enhancement Program can be proposed by the teachers to improve the students' performance in math; and further investigations can be conducted to assess the factors behind the poor performance of the students. This is possible by assessing their demographic background, learning styles, and interests.

Key Words: Problem-solving Skill, Real-World Experience, Visual Representation, Learning Socially in Groups, Lesson Exemplar, Modular Skill Enhancement Strategy

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Introduction

Mathematics increases its influence on all facets of human life because it is mainly the foundation of the scientific and technological knowledge needed by the people living in the modern era. As people become increasingly dependent to computers, worldwide communication, and global markets, learning mathematics becomes a key to all job opportunities. Such jobs require preparation in constructing new ideas, perceiving patterns, and solving problems. Indeed, it is a must to prepare and motivate the 21st century students to be competitive and skilled to face the future industry and success through providing them opportunities which will enhance their inner talents and skills for effective participation in everyday living. As mentioned by the new curriculum, this necessitates stronger development of mathematical skills, abilities, and values of the students.

Problem-solving skill is one of the most important competencies that should be developed to strengthen the students' analytical and critical thinking skills, especially the sense of solving problems of the students in applying mathematics to real-world situations. According to Moschkovich and Zahner (2018), the common difficulties students face while learning mathematics include lack of confidence when solving problems, weakness in understanding terms and mathematical language, confusion when determining mathematical operations, and lack of conceptual and procedural skills. Additionally, Tambychika and Meerah (2017) emphasized that lack of proficiency with number facts, weakness in computation, lack of ability to connect mathematical concepts, inability to transfer knowledge, lack of ability to make meaningful connections between information, inability to transform information mathematically, lack of proficiency with mathematical terms, lack of proficiency with mathematical language, and difficulty understanding and visualizing mathematical concepts might cause mistakes and confusion when carrying out mathematical tasks. These are the prerequisites that should be practiced improving the level of proficiency of the students in problem-solving.

With this growing concern in learning mathematics, it is evidently shown from the summarized report on the learning progress and achievement of the students issued by the senior high school math teachers of Camarines Sur National High School, for the first semester, school year 2022 – 2023, 24.58% or 438 out of 1,782 students got 90% and above with an outstanding performance, 25.03% or 446 out of 1,782 students got 85% - 89% with a very satisfactory performance, 31.14% or 555 out of 1,782 students got 80% - 84% with a satisfactory performance, 18.46% or 329 out of 1,782 students got 75% - 79% with a fairly satisfactory performance, and 0.79% or 14 out of 1,782 students got 74% and below who did not meet the expectations. Based on this data, it can be noted that 80% - 84% has the percentage which will explain that the students have met the minimum requirements. Students were content with just passing the subject without a line of 7 grade.

In the year-end report of the Department of Education (2019), it highlighted the low performance of Filipino learners in the National Achievement Test (NAT) that was administered in school year 2018-2019, specifically in Science, Math, and English. The Overall Mean Percentage Score (MPS) for Grades 6, 10, and 12 was 37.01%. Highlighting the over-all 21st Century Skills MPS in problem-solving skills in mathematics was 34.82% which is far below the passing percentage of 75%. Moreover, Magsambol (2020) revealed in his article that the Philippines scored significantly lower in participating in The Trends in International Mathematics and Science global assessment among 58 countries. This is evident to show that when it comes to learning mathematics, they show poor progress as well as proficiency in problem-solving skill.

There are many factors that can be considered in developing the level of problem-solving skill of the students. Ukobizaba et al. (2021) confirmed that this includes the learning strategy and evaluation techniques which

can help improve students' acquisition of mathematical problem-solving abilities. Hogbin (2020) discussed in his article that there are efficient teaching techniques for improving students' ability to solve mathematical problems. He began by pointing out that pupils can better understand how an abstract notion relates to a physical situation when visual representations are used. To motivate pupils to solve math problems visually, the teacher can offer illustrated problems or hands-on activities. By developing the brain's neural networks, several perspectives on a subject can improve knowledge and memory. Second, a key component of studying mathematics is to concentrate on actual problem-solving and thinking. Outside the classroom mathematics occurs in a complex form of problems rather than simple questions with a single correct solution. Because of this, the best training gives learners the thinking and problem-solving abilities they will need in the actual world. Instructors might not always be clear about what pupils must do. Students must experiment with various methods before choosing one that is effective. Finally, through sharing ideas with others, students are exposed to a variety of mathematical perspectives that they can utilize to think more creatively. It helps students articulate their mathematical ideas, which improves their clarity of thought and self-awareness of their own approaches to problem-solving. It reflects how mathematics is practiced outside of the classroom, when teams of individuals with varying skill sets collaborate to address difficult problems from the real world. Additionally, as cited by John Bransford of the University of Washington Professor of Education and Psychology, in his book *How People Learn* (1999), the following characteristics are part of how we naturally learn: real-world learning, intrinsic motivation, mental and virtual model-building, multiple pathways to expertise, and learning socially in groups and teams.

To solve the issues and gaps concerning the level of problem-solving skills of the students, this study assessed the best learning strategy in improving the problem-solving skills of the students to be integrated in developing the modular skill enhancement strategy as an instructional intervention.

Framework

The conceptual framework in figure 1 shows the Analysis, Design, and Development (ADD) Phases. In the analysis phase, the problem-solving skill of the students was determined using their pretest scores. In the design phase, based on the initial performance of the students, lesson exemplars were crafted and utilized integrating the learning strategies in terms of real-world experiences, visual representations, and learning socially in groups. In the development phase, after the conduct of the lesson using the exemplars, posttest was administered to determine if there is a significant improvement using the learning strategies. The best learning strategy was incorporated in the modular skill enhancement strategy as an instructional intervention which was developed in this study.

The first theory which was used in the study is Dreyfus Model of Skill Acquisition. It was proposed by Brothers Stuart and Hubert Dreyfus in 1980. The main role of this theory in the study was to assess the level of problem-solving skills of the students based on their performance in the teacher-made tests such as pretest, posttest and the evaluations in each lesson exemplar that were administered.

The second theory was Experiential Learning Theory. It was proposed by David Kolb in 1999. The concept of this theory was applied in the current study since it includes learning strategy based on the real-world experiences of the students in developing their problem-solving skills.

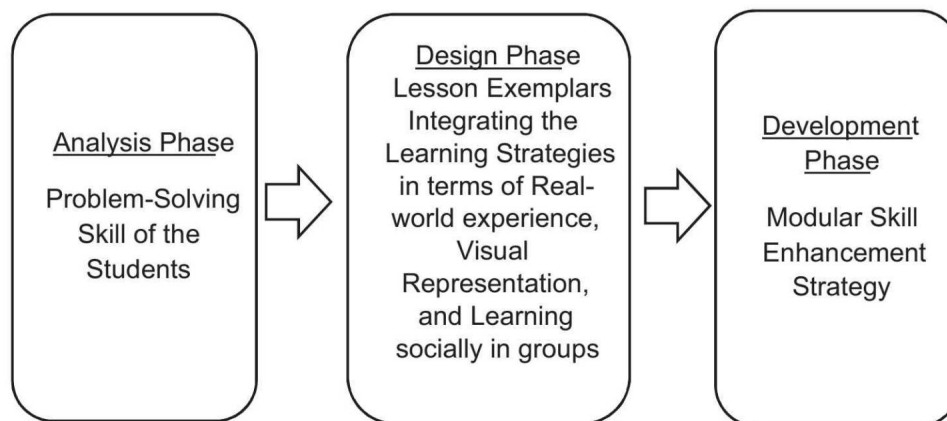


Figure 1. Conceptual Framework

The third theory which was used in the study is the VARK Model Theory. It was developed by Neil Fleming in 1987. This was related to the current study because this used as one of the strategies in learning math which was the focus of this theory. That is using visual representation to improve the problem-solving skill of the students.

The last theory which was incorporated in the current study is the Cooperative Learning Theory. It was proposed by Johnson and Johnson in 1990s. It is a teaching method in which small groups of students collaborate on a single assignment. Students can collaborate on a wide range of tasks, from straightforward math exercises to substantial assignments. It helps students develop their higher order thinking skills, communication skills, and self-management and leadership skills. Students also can build upon their leadership and organizational skills. From this idea, this was adapted in enhancing the students' problem-solving skill as one of the learning strategies.

Objectives of the Study

This study aimed to develop an instructional intervention to improve the problem-solving skill of the students in mathematics.

Materials and Methods

Quantitative research design was used in this study. Specifically, descriptive research method was utilized to determine the level of problem-solving skill of the students considering the pretest results. Also, comparative research method was used to compare the pretest and posttest results. The effects of the facilitation of the lesson exemplars integrating the learning strategies in terms of real-world experience, visual representation, and learning socially in groups were identified to determine the best learning strategy that can help in developing a modular skill enhancement strategy. There were forty (40) respondents that were chosen using purposive random sampling technique. These were Grade 11 students under Humanities and Social Sciences Strand of Camarines Sur National High School.

Teacher-Made Tests and Lesson Exemplars

Teacher-made tests were utilized in this study. These were the pretest and posttest that were used to determine the problem-solving skill of the students using the level of proficiency in terms of Expert, Proficient, Competent, Advanced Beginner, and Novice. Before formulating pretest questions, table of specifications was constructed, that contains the learning competencies of Chapter 1 topics from the curriculum guide of Statistics and Probability, with the corresponding allotted teaching time and number of items. The placement of each question is based on the level of objectives in the Bloom's Taxonomy which are simplified as Knowledge, Understanding and Doing (KUD). All the items in posttest were formulated parallel to the pretest questions. Based on the results of pretest, lesson exemplars were crafted following the 4A's Model Framework by Jane Vella (2008). In each lesson, one learning strategy was incorporated. These strategies are in terms of real-world experiences, visual representations, and learning socially in groups. The teacher-made tests and lesson exemplars were validated by the head teacher, and two master teachers in mathematics department of Camarines Sur National High School using the modified level of acceptability in lesson planning. All the lesson exemplars are rated as highly accepted following the criteria.

Results and Discussion

A. Analysis Phase

The problem-solving skill of the students was determined using the pretest scores. Pretest was administered incorporating the learning competencies in Statistics and Probability.

Table 2 Student's Problem-Solving Skill Based on Pretest Scores			
Learning Competencies	Mean Score	Rank	Level of Proficiency
1. Illustrates a random variable (discrete and continuous). M11/12SP-IIIa-1	2.53	1	Advanced Beginner
2. Distinguishes between a discrete and a continuous random variable. M11/12SP-IIIa-2			
3. Finds the possible values of a random variable. M11/12SP-IIIa-3			
4. Illustrates a probability distribution for a discrete random variable and its properties. M11/12SP-IIIa-4	2.48	2	Advanced Beginner
5. Constructs the probability mass function of a discrete random variable and its corresponding histogram. M11/12SP-IIIa-5			
6. Computes probabilities corresponding to a given random variable. M11/12SP-IIIa-6			

(Continued)

Table 2 Student's Problem-Solving Skill Based on Pretest Scores—cont'd

7. Illustrates the mean and variance of a discrete random variable. M11/12SP-IIIb-1	2.15	3	Advanced Beginner
8. Calculates the mean and the variance of a discrete random variable. M11/12SP-IIIb-2			
9. Interprets the mean and the variance of a discrete random variable. M11/12SP-IIIb-3			
10. Solves problems involving mean and variance of probability distributions. M11/12SP-IIIb-4			
Overall Mean Score	2.38		Advanced Beginner

Pretest Results. As presented in Table 2, the findings reveal that the students were advanced beginners ($M=2.38$) in problem-solving.

Legend

Score		Level of Proficiency
6.41 - 8.00	=	Expert
4.81 - 6.40	=	Proficient
3.21 - 4.80	=	Competent
1.61 - 3.20	=	Advanced Beginner
0.00 - 1.60	=	Novice

It can be inferred that students were advanced beginners without receiving any instruction and learning processes in each learning competency. It may be because of the following reasons. First, students were not yet ready on face-to-face learning activities because of pandemic that impacted their performance in mathematics. They still struggle because they did not master the basic concepts, for years of virtual learning without teacher that will guide them in each step of getting the solution and answer. These concepts are prerequisites. Second, some of the questions are not familiar to them especially the mathematical language or terms which are not used every day. It contains variables, diagrams and graphs which are confusing because they do not know its meaning and use in each question. Third, some of the questions are categorized as part of higher levels of educational learning objectives. These questions intend for the students to use information in new situations, draw connections among the ideas given in each item and make real-life decisions which they cannot make because they need to initially understand the basic concepts which are on the first level of learning. Fourth, students lack willingness to solve the problem because it requires steps to follow before arriving at the correct answer. They did not spend time in computing those because they are too lazy to do the required procedure instead, they chose any of the given options.

The studies of Kuhfeld, M. et al. (2022), Tyaningsih, R.Y. et al. (2021), Tambychika and Meerah (2017), Moschkovich (2018), Bor-de Vries and Drijvers (2015), Ukobizaba et al. (2021), NoprianiLubis (2017), Phonapichat et al. (2013), Angateeah (2017), Saygili (2017), and Telaumbanua et al. (2017), conform with the result of the findings. They confirmed that students are finding difficulty in learning math, mainly, because

of the impact of COVID-19 pandemic on their academic achievement. They are so much overwhelmed by the learning activities in the different subjects which are usually submitted at the same time. Moreover, from the mentioned studies, they confirmed that there are reasons that can affect the problem-solving skills of the students. These are the following: (1) they struggle to understand the keywords that will be translated into mathematical statements, (2) they struggle to determine which assumptions to make and what information from the problem is required to solve it, (3) they struggle to understand a problem, as a result they frequently guess the solution without thinking, (4) they dislike reading long problems because they are impatient, and (5) they dislike reading mathematical problems.

Therefore, it can be recommended that teachers should assess their students on the possible factors which affect their performance especially that they are not yet ready to cope up with learning activities at school because of the impacts of pandemic. Further investigations on the causes and reasons of the low performance of the students should be done by assessing their demographic background, learning styles, and interests. The different learning theories can be adapted to enhance the teaching and learning strategies. From these, teachers may propose enhancement program on reviewing the basic concepts that should be mastered which are prerequisites on the required competencies in the current math subjects of the students. Also, with a constant practice, it will help the students to be familiar with the mathematical language or terms which students can relate to its practical uses.

B. Design Phase

Lesson exemplars were crafted and utilized in the study to address the issues and gaps in the problem-solving skill of the students. The flow of the learning activities is patterned from the 4A's (Anchor, Add, Apply, and Away) Model Framework of Jane Vella (2008). This is shown in Figure 2.

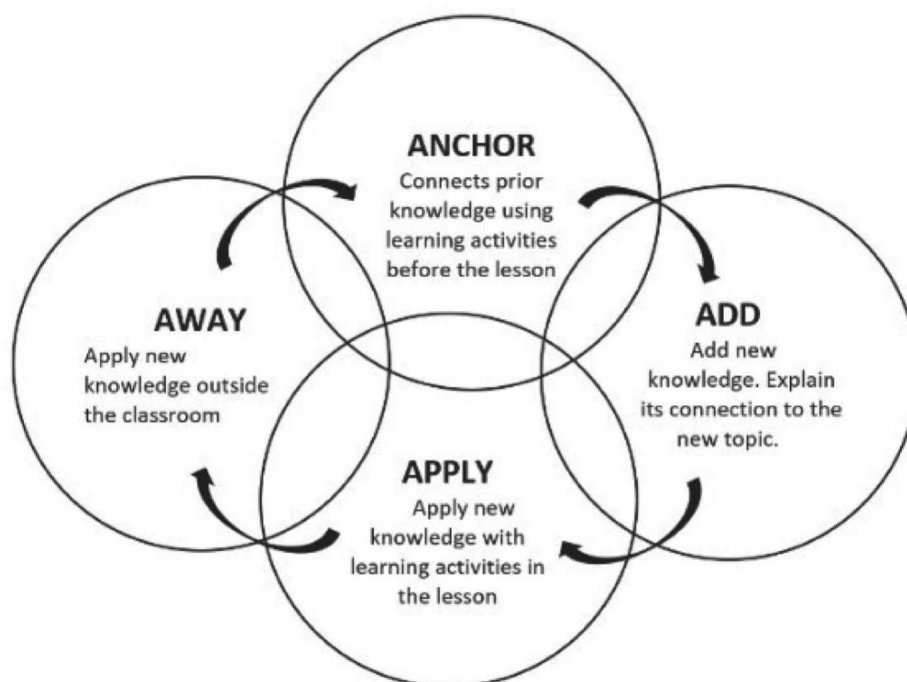


Figure 2. 4A's Model Framework

The idea of this framework and the issued format of the Department of Education were adapted in creating lesson exemplars. It is composed of the following parts: Objectives, Subject Matter, Learning Procedure, Evaluation, and Assessment.

This study used three lesson exemplars. The learning strategies in terms of real-world experiences, visual representations, and learning socially in groups are incorporated in these exemplars.

Real-World Experiences. The first lesson exemplar used real-world experiences to solve word problems. The teacher employed learning activities performing mathematical experiments to analyze real-world scenarios. This discussed the topic about the possible values of a random variable with the following learning competencies: (1) Illustrates a random variable (discrete and continuous), M11/12SP-IIIa-1; (2) Distinguishes between a discrete and a continuous random variable, M11/12SP-IIIa-2; (3) Finds the possible values of a random variable. M11/12SP-IIIa-3.

Visual Representation. The second lesson exemplar incorporated visual representations such as tree diagrams and graph to improve their problem-solving skill. It focused on the topic about the probability distributions of a random variable with the following learning competencies: (1) Illustrates a probability distribution for a discrete random variable and its properties, M11/12SP-IIIa-4; (2) Constructs the probability mass function of a discrete random variable and its corresponding histogram, M11/12SP-IIIa-5; (3) Computes probabilities corresponding to a given random variable. M11/12SP-IIIa-6.

Learning Socially in Groups. The third lesson exemplar integrated teaching strategy that students accomplished problem-solving tasks in group. The teacher discussed the mean and variance of a discrete random variable with the following learning competencies: (1) Illustrates the mean and variance of a discrete random variable, M11/12SP-IIIb-1; (2) Calculates the mean and the variance of a discrete random variable, M11/12SP-IIIb-2; (3) Interprets the mean and the variance of a discrete random variable, M11/12SP-IIIb-3; (4) Solves problems involving mean and variance of probability distributions, M11/12SP-IIIb-4.

Level of Acceptability of the Lesson Exemplars. The lesson exemplars were validated by three Master Teachers. To validate its content, this study modified the Rubrics in Evaluating PIVOT 4A Learner's Materials/Modules and IDEA Exemplars of Department of Education Schools Division Office of Calabarzon. The parts are the following: Purpose-Goals, Objectives, Anticipatory Set, Procedures, Special Accommodations, Closure, and Assessment.

C. Development Phase

In this phase, this discusses the effectiveness of lesson exemplars used in the delivery of instruction integrating the different learning strategies in terms of real-world experiences, visual representations, and learning socially in groups. This can be seen by interpreting and analyzing the results of the administered posttest and comparing it from the pretest scores. Based on the findings of this study, a modular skill enhancement strategy as an instructional intervention was developed to assist the students in developing their problem-solving skill.

Problem-Solving Skill of the Students Using the Posttest Results

Table 3 shows the level of problem-solving skills of the students using the learning strategies in each set of learning competencies through the administered posttest comparing it from the pretest scores. This reveals that the level of problem-solving skills of the students improved. From advanced beginner ($M=2.38$), the students became competent ($M=4.61$).

It can be inferred that among the strategies, learning socially in groups scored the lowest may be because of the following reasons: (1) In the assessment, students were not working in group, since the test is intended for individual assessment; (2) the learning competencies in this area requires higher level of thinking that they tend to forget some parts of the solutions that caused them to be directed in wrong interpretations, connections and transferring of ideas; (3) Some of the students did not learn specific parts in solving word problems when they were in group because they were overwhelmed with the presence of their classmates; (4) Some of the students were not encouraged to participate during the discussion of activities because there were large groups and the group leaders or the other member were dominating the task. Students learned best when they are engaged in real-world scenarios because they realize the importance and application of the subject. They also understood math using visual representations such as tree diagram and graph.

Table 3 Student's Problem-Solving Skill Based on Posttest Results

Learning Strategies	Pretest			Posttest		
	Mean	Rank	Level of Proficiency	Mean	Rank	Level of Proficiency
Real-world Experience	2.53	1	Advanced Beginner	5.20	1	Proficient
1. Illustrates a random variable (discrete and continuous). M11/12SP-IIIa-1						
2. Distinguishes between a discrete and a continuous random variable. M11/12SP-IIIa-2						
3. Finds the possible values of a random variable. M11/12SP-IIIa-3						
Visual Representation	2.48	2	Advanced Beginner	4.83	2	Proficient
4. Illustrates a probability distribution for a discrete random variable and its properties. M11/12SP-IIIa-4						
5. Constructs the probability mass function of a discrete random variable and its corresponding histogram. M11/12SP-IIIa-5						
6. Computes probabilities corresponding to a given random variable. M11/12SP-IIIa-6						

(Continued)

Table 3 Student's Problem-Solving Skill Based on Posttest Results—cont'd

Learning Socially in Groups						
7. Illustrates the mean and variance of a discrete random variable. M11/12SP-IIIb-1	2.15	3	Advanced Beginner	3.80	3	Competent
8. Calculates the mean and the variance of a discrete random variable. M11/12SP-IIIb-2						
9. Interprets the mean and the variance of a discrete random variable. M11/12SP-IIIb-3						
10. Solves problems involving mean and variance of probability distributions. M11/12SP-IIIb-4						
Overall Mean Scores	2.38		Advanced Beginner	4.61		Competent

Legend

Score		Level of Proficiency
6.41 - 8.00	=	Expert
4.81 - 6.40	=	Proficient
3.21 - 4.80	=	Competent
1.61 - 3.20	=	Advanced Beginner
0.00 - 1.60	=	Novice

The studies of Osman et al. (2018), Carden and Cline (2015), Bayazit (2013), Dewolf et al. (2017), and Santia (2019) conform with the result of this findings. They investigated the level of problem-solving skills using the two learning strategies, at the same time, in terms of real-world experiences and visual representation. They evidently showed that mathematical representation has an essential role in solving mathematical real-world problems.

From their samples, the students understand the relevance and meaningfulness of what they learn with the use of these strategies. They supported the idea that in order to improve the relation between mathematical skills from school to everyday life, the relevance of visualization methods and working memory to problem solving should be considered. The differences between the students and contexts can influence the use of visualization and some experience specific difficulties in this area.

Thus, a compendium of lesson exemplars should be developed integrating the learning activities through real-world experiences and visual representations. This will serve as one of the educational tools that will assist the students in developing their problem-solving skills.

Effectiveness of Lesson Exemplars Using the Different Learning Strategies

Table 4 shows the significant effects of lesson exemplars using the different learning strategies in each corresponding sets of learning competencies. The results reveal that there is a very highly significant difference between the pretest and posttest scores ($t=-10.44$, $p=.000$) with the use of lesson exemplars. This is supported by the Cohen's d result of 2.23 which is interpreted with large effect.

Table 4 Significant Effects of Lesson Exemplars to the Student's Problem-solving Skills Using the Pretest and Posttest Scores					
Learning Strategies	t	p-value	int	Cohen's d	Effect Size
Real-world Experience	-9.78	.000	VHS	2.17	Large Effect
1. Illustrates a random variable (discrete and continuous). M11/12SP-IIIa-1					
2. Distinguishes between a discrete and a continuous random variable. M11/12SP-IIIa-2					
3. Finds the possible values of a random variable. M11/12SP-IIIa-3	-8.43	.000	VHS	1.66	Large Effect
Visual Representation					
4. Illustrates a probability distribution for a discrete random variable and its properties. M11/12SP-IIIa-4					
5. Constructs the probability mass function of a discrete random variable and its corresponding histogram. M11/12SP-IIIa-5	-5.13	.000	VHS	1.06	Large Effect
6. Computes probabilities corresponding to a given random variable. M11/12SP-IIIa-6					
Learning Socially in Groups					
7. Illustrates the mean and variance of a discrete random variable. M11/12SP-IIIb-1	-5.13	.000	VHS	1.06	Large Effect
8. Calculates the mean and the variance of a discrete random variable. M11/12SP-IIIb-2					
9. Interprets the mean and the variance of a discrete random variable. M11/12SP-IIIb-3					
10. Solves problems involving mean and variance of probability distributions. M11/12SP-IIIb-4	-10.44	.000	VHS	2.23	Large Effect
Overall					

(Continued)

Legend:

t	=	t computed value
int	=	Interpretation
SI	=	Significantly Improved
df	=	Degrees of Freedom
p-value	=	Interpretation
p .001	=	Very Highly Significant (VHS)
.001p .01	=	Highly Significant (HS)
.01p .05	=	Significant (S)
p > .05	=	non-significant (NS)
Cohen's d	=	Effect Size
0.80 and above	=	Large Effect
0.50 - 0.79	=	Medium Effect
0.20 - 0.49	=	Small Effect
0.00 - 0.19	=	No Practical Effect

It signifies that the use of lesson exemplars incorporating the learning strategies in the delivery of instructions is significantly effective in developing the problem-solving skills of the students. It can be noted that the use of lesson exemplars can be used as educational resources to design instruction that best meets the needs of the learners based on the requirements of the curriculum. It is one of the teachers' tools in assisting students to improve their knowledge, and talents, and acquire the necessary mathematical skills, specifically problem-solving skills. This will not only develop the students' performance in school, but also the life-skills that they may be able to acquire from a quality and standardized set of teaching and learning activities. As this, students may become productive citizens.

In line with this, the studies of Fulay and Labo (2018), Mestiola (2018), and Wimshurst and Manning (2013) supported the findings of the study. Lesson exemplar sets a standard roadmap for a lesson that contains the detailed plan of the teacher in teaching a particular math topic. They confirmed that the use of these materials is an effective way to enhance the problem-solving skills of the students. It helps the students to build up a clear understanding of each activity because it sets a standard and quality among the other lesson guides. It also utilizes the best learning strategies bases on the learning styles and interests of the students that will be needed in completing activities in each part of the lesson. They concluded that not only did the provision exemplars improve students' overall grades for the unit they also enhanced student engagement with the subject.

Thus, the compilation of effective lesson exemplars in mathematics that develop the level of problem-solving skills of the students can be done to provide teachers and administrators with a set of exemplary guides in teaching and assessing students.

Modular Skill Enhancement Strategy as an Instructional Intervention

In the current study, a modular skill enhancement strategy was developed as a compendium of the enhanced lesson exemplars that this study created and used in the conduct of the lesson integrating the learning strategies in terms of real-world experiences, visual representations, and learning socially in groups. Since the enhanced lesson exemplars were transferred in crafting each lesson in the module, it follows the 4A's Model Framework of Learning by Jane Vella (2008). The module adapted the format used by the Department of Education in crafting modules last 2020. This has the following components: the cover page, module overview, and the parts per lesson topic which are *what I need to know*, *what I know*, *what's in*, *what's new*, *what is it*, *what I have learned*, *what I can do*, *assessment*, *answer key*, and *references*.

Conclusions

This study concluded that there are some probable reasons that students performed poor in solving word problems. These are the following: (1) students were not yet ready on face-to-face learning activities because of pandemic that impacted their performance in mathematics; (2) some of the mathematical tasks given are not familiar to them especially the mathematical language or terms which are not used every day; (3) they cannot complete the tasks because these are categorized as part of higher levels of educational learning objectives; and (4) students lack willingness to solve the problem because it requires steps to follow before arriving at the correct answer. Problem-solving skill of the students in mathematics can be improved using learning strategies in terms of real-world experiences and visual representations with the use of lesson exemplars integrating these strategies. Lesson exemplars can be used as educational resources to design instruction that best meets the needs of the learners based on the requirements of the curriculum. It can be one of the teachers' tools in assisting students to improve their knowledge, and talents, and acquire the necessary mathematical skills, specifically problem-solving skills. This will not only develop the students' performance in school, but also the life-skills that they may be able to acquire from a quality and standardized set of teaching and learning activities. As this, students may become productive citizens.

Recommendations

Teachers may assess their students on the possible factors which affect their performance. They can further investigate on the causes and reasons of the low performance of the students. It can be done by assessing their demographic background, learning styles, and interests. From their gathered data, enhancement program on reviewing the basic concepts in mathematics as prerequisites can be implemented. To assist this, a compendium of lesson exemplars can be developed integrating the activities through real-world experiences and visual representations to provide teachers and school administrators with a set of exemplary guides in teaching and assessing students' development in problem-solving skill in mathematics.

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