

# Enhancing the Problem-Solving Skills of Selected Grade 11 Students of Highway Hills Integrated School Through One Word Problem a Day (OWPaD)

*Reynaldo C. Collado Jr.*

[reynaldo.colladojr@deped.gov.ph](mailto:reynaldo.colladojr@deped.gov.ph) / [reynaldo.collado@depedmandaluyong.org](mailto:reynaldo.collado@depedmandaluyong.org)

Highway Hills Integrated School  
Department of Education  
Mandaluyong City, Philippines

**Abstract:** *Problem solving is one of the major components in learning mathematics. It elicits learners' higher order and critical thinking skills. To be able to draw out a learner's potential and problem solving, one must provide a stable foundation of its basics. This study is about enhancing the problem-solving skills of selected Grade 11 students of Highway Hills Integrated School through One Word Problem a Day (OWPaD). The study used 55 students who are under the class of the teacher-researcher. It employed the quasi-experimental design. A pre-test was conducted to determine the existing problem-solving skills of the respondents. The scores obtained were used to determine the level of problem-solving ability of the respondents ranging from poor (0%-58%), good (59%-79%) and satisfactory (80%-100%). This was used as the basis in conducting the day to day intervention for two months. OWPaD is an intervention designed to enhance the problem-solving skills of learners by using the Law of Exercise and Learning by Doing Theory of Thorndike and Dewey respectively. Every day before the start of the lesson, the researcher gives a word problem for the students to solve. A post-test was done after 2 months of implementation. Results were tested at 0.05 alpha level of significance using a t-test which indicated that there was a significant difference between the means of pre-test and post-test scores of the respondents.*

## 1. Introduction

One of the recently alarming news was revealed in the results of Program for International Student Assessment (PISA) 2018 which is a world-wide study by the Organization for Economic Co-Operation and Development (OECD). According to this assessment, learners can be evaluated as to how they are able to transfer what they have been learning from school to real-world applications. The assessment covers science, reading, mathematics, collaborative problem solving, and financial literacy. Mathematics Literacy according to PISA 2018 involves a wide array of distinguishable determinants which is comprised at 6 different levels. Each level has corresponding minimum point requirement for the students to attain. At level 1, students must have at least 358 points. At level 2, students should have 420 points. A student must have 482 points to reach level 3. On the other hand, if a student has 545 points, he will be under level 4, 607 points for level 5 and 669 points for level 6. Each level corresponds to different types of mathematics questions ranging from concepts to real-world applications. Based from this study, Filipino students achieved an average of 353 points in Mathematical Literacy which is significantly lower than the OECD average (489 points) and is classified as below Level 1 proficiency.

With this prevailing problem, the researcher attempted to take a deeper look on the critical contents of Mathematics in the Philippines. After which, researches were made to find the root causes of having this low-level result of PISA 2018 as this may pose a threat on the future of quality of education in the country.

It is stated at Department of Education Order No. 21 series of 2019 that Mathematics has been constantly taught from Kindergarten to Grade 12. Starting from the basic math skills like counting until the very much used real-life skills, the curriculum has been an instrument for these

skills to be taught. Along with Mathematics comes critical thinking, problem solving, reasoning, communicating, making connections, representations, and decisions in real life.

One of the major components of mathematical literacy is problem solving. To be able to accurately solve a word problem, a student needs both mental representation skills and reading comprehension skills as well as representational skills (see [3]).

Several studies have attempted to find out what ways can improve the learners' problem solving skills. In [6], it is revealed that students' reasoning skills and problem solving skills have significantly produced different results when they have undergone computer programming. Moreover, a study in Korea conducted by [4] indicating that the usage of team-based learning (TBL), a learner-centered teaching strategy in efforts to improve students' problem-solving, knowledge and practice performance, has significantly improved the problem-solving skills of their respondents. Also, according to [9], the use of learning models to achieve learning goals can improve learners' problem-solving skills. In their research, they developed an Inquiry Training Learning Model based on Just in Time Teaching (JITT) where they concluded that JITT can influence the problem-solving skills of the learners. [7] revealed in their study that utilizing the metacognitive instruction can produce positive effects on students' problem-solving skills. In connection to this, an attempt by [8] explained the difference between using the expository and conceptual learning model to improve the problem-solving skills of the students which revealed that using the latter gives higher performance among students.

Correspondingly, [5] created a new model of learning while integrating the value of Islam and Science in Mathematics to help the learners elevate their skills in problem solving. The results of their study revealed that the problem-solving skills of their respondents is still low due to the absence of habituation of teachers for the students to think logically.

This research is conducted to determine the problem-solving ability of the selected Grade 11 students of Highway Hills Integrated School as well as the state of the respondents' level of problem-solving ability. Upon identifying certain problems about this case, the researcher will also attempt to apply One Word Problem a Day (OWPaD) to enhance the problem-solving skills of the selected respondents.

## 2. Conceptual Framework

Problem solving is a very crucial area in mathematics and almost every branch of science. It reflects how much a student has learned and built from the concepts being taught to applying such concepts on real-life contexts through problem solving. It also measures higher order thinking skills since word problems can vary in types and level of difficulties.

This study is anchored to the concept of Edward Lee Thorndike that is called Law of Exercise where learners master a skill or set of skills by executing the skill repeatedly. Hence, a learner can learn effectively by repeating what he is doing over and over. Also, John Dewey's Learning by Doing is used as a basis for the conduct of the intervention. Students need to be actively involved in solving word problems in order for them to develop their problem solving skills more.

In this regard, this study uses the IPO (Input-Process-Output) framework which shows the Grade 11 students' problem-solving skills as the input, and the test scores before using the One Word Problem a Day (OWPaD). The process, was the administration of the pre-test, the implementation of the strategy for 2 months, the administration of post-test examination, and the computation for test for the difference between the pre-test and post-test scores. The output was difference between the test scores of Grade 11 students' problem-solving ability before and after using the OWPaD. Below is the Figure1. which presents the Paradigm of the Study.

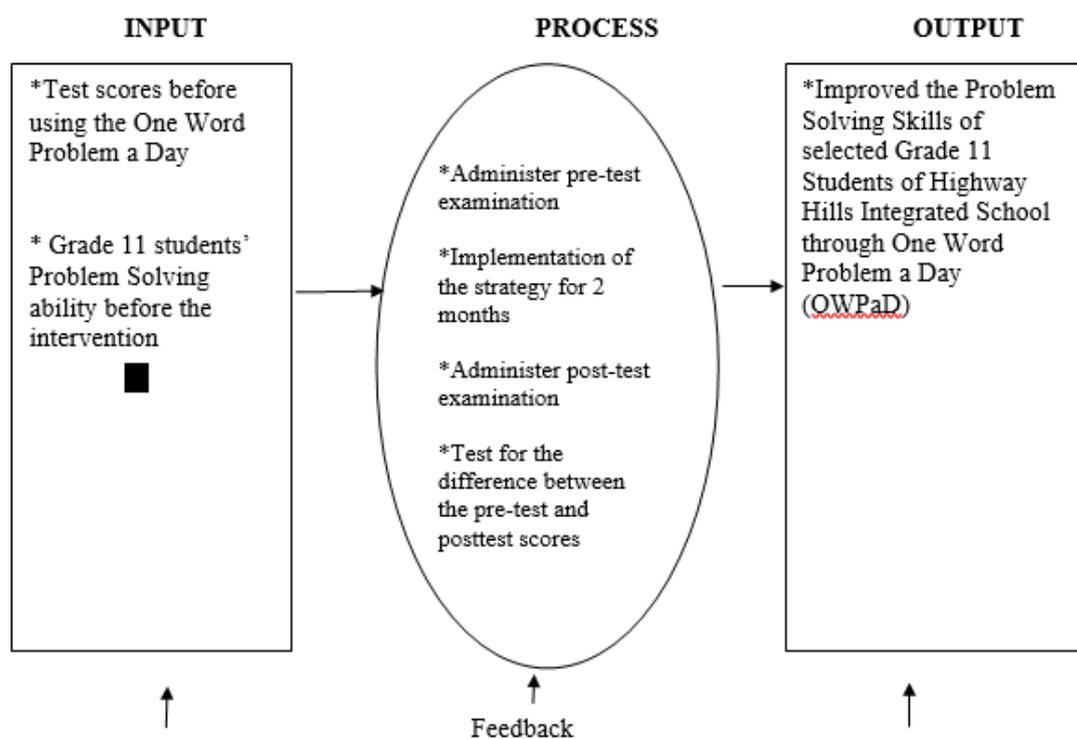


Figure 1.1 Conceptual Paradigm of the study

### 3. Statement of the Problem

This research is conducted to determine the impact of One Word Problem a Day (OWPaD) in improving the problem-solving skills of selected Grade 11 students of Highway Hills Integrated School.

Specifically, it aimed to answer the following questions:

1. What is the level of problem-solving skills of Grade 11 students before the implementation of One Word Problem a Day?
2. What is the level of problem-solving skills of Grade 11 students after the implementation of One Word Problem a Day?
3. Is there a significant difference between the results of pre-test and posttest after employing an intervention strategy?

### 4. Hypothesis

The hypothesis stated that there is no significant difference between the results of the pre-test and post-test of the Grade 11 students on their problem-solving skills through the use of One Word Problem a Day intervention at 0.05 alpha level of significance.

### 5. Scope and Delimitations

This action research was delimited to the fifty-five Grade 11 students of Highway Hills Integrated School for the school year 2019-2020. The respondents are composed of 35 male and 20 females. These students are given pre-test on Problem Solving at the start of the second semester of the school year and post-test after they have undergone the OWPaD intervention program.

## 6. Research Design

The researcher made use of the following research design and method; quasi-experimental design, and one shot pretest and posttest design. The researcher selected to use quasi experimental because the study wanted to determine the level of problem-solving skills of the respondents and the effects of the intervention after it was utilized. The study measured the significant difference between the two assessments.

One Word Problem a Day is an intervention devised by the researcher to solve the said research problem. This intervention is done by giving a one-word problem to the students every day. A word problem is given and questions are answered afterwards to enhance their skills. This activity was done on a daily basis to exercise the students' problem-solving skills 10 minutes before the class discussions.

A pretest was conducted at the start of the second semester for the school year 2019-2020, particularly on the month of November to determine the state of problem-solving skills of the Grade 11 students. After this, OWPaD is implemented on a day to day basis. A monthly test to determine the state of students is then conducted to observe the impacts of the said intervention.

## 7. Sources of Data

The target-respondents were fifty-five (55) Grade 11 students who were enrolled in Highway Hills Integrated School during the school year 2019-2020. The respondents belong to the class of the researcher. There were 35 boys and 20 girls. The study is conducted from Monday to Thursday for 2 months from November 4, 2019 to January 24, 2020 before the start of daily discussions.

## 8. Instrumentation and Data Collection

This study made use of quasi-experimental design, and one shot pretest and posttest design to gather the pertinent data. The researcher employed the One Word Problem a Day (OWPaD) Intervention Program to improve the problem-solving skills of the respondents and recorded the data on the day to day basis of evaluation right after the administration of a word problem.

The data is gathered by recording a day to day evaluation of the students upon solving the word problem. A table graph was used to determine if there is a certain trend on the pre-test and post-test results. This action research was conducted at Highway Hills Integrated School using the Grade 11 FBS-C and Grade 11 CSS-C as respondents.

The researcher first administered a 40-item pre-test on problem solving to determine the undergoing problems regarding the problem-solving skills of the respondents. These problems are based from the basic concepts and foundations of mathematics comprised of number sense, fractions, decimals, comparing and sequencing numbers, time and money, physical measurements, ratios and percentages, geometry and variables. Afterwards, a proposal to the principal of the school was presented to implement the intervention program. After which, the materials that had been used in the intervention program was prepared. After utilizing all the materials needed, implementation of the intervention program was started.

A 40-item post-test composed of the same scope as the pre-test but of different variant was conducted after the implementation of the intervention. The testing was done for an hour for both pre-test and post-test since the problems given were requiring basic knowledge in mathematics. These two tests are designed by the researcher and are subjected to Cohen's Kappa statistic to determine the inter-rater reliability. The supervisor in-charge in Mathematics was invited to rate the tests. It was found that the Kappa statistic is 0.80 indicating that there is a substantial agreement between the raters suggesting a satisfactory inter-rater reliability.

## 9. Tools for Data Analysis

To provide valid and accurate findings from the generated data, appropriate statistical tools were employed by the researcher.

For problem 1 and 2

To determine the Grade 11 students' level of problem skills the following formulae were used:

$$\text{Problem Solving Ability} = \frac{\text{Number of correct answers}}{\text{Number of questions}} \times 100\%$$

Problem Solving skills level of the Grade 11 students was classified as follows:

Level	Problem Solving Ability
Satisfactory	80%-100%
Good	59%-79%
Poor	58% below

Note that these cut off scores are solely based on the assigned point system by the researcher considering the passing score of 75% and considering that using three scales results to 33.33% per scale and adjusting it to a more appropriate scale which is not that low and at the same time not that high.

For problem 3

To determine the significant difference in the level of problem solving skills of the Grade 11 students before and after the assessment, a pre-test post-test T-test was used.

## 10. Results and Discussions

### Performance of the Grade 11 Students in Problem Solving Before the Use of One Word Problem a Day (OWPaD)

The researcher proponent administered a pre-test on problem solving in General Mathematics involving 55 Grade 11 students enrolled this school year 2019-2020. The test aimed to determine the level of problem-solving skills of the Grade 11 students. Based on the pre-test results, the students are classified into three (3) levels: satisfactory, good, and poor.

Table 3.1 reflects the results of the pre- test and the problem-solving ability classification of the Grade 11 students before the use of One Word Problem a Day (OWPaD).

Table 1  
Result of the Pre-Test on Problem Solving

Problem Solving Ability	Frequency	Percentage
Poor	54	98.18%
Good	1	1.82%
Satisfactory	0	0%
Total	55	100%
Mean Score	16.13	
Mean Percentage Score	40.32%	

It can be gleaned from table 1 that out of 55 students, none of them have answered 32 out of 40 questions in the pre-test correctly and are at Very Satisfactory Level in terms of their problem-solving ability. Also, it can be observed that only one out of 55 or 1.82% of the students scored between 24 to 31 out of 40 questions placing them at Good Level in terms of their problem-solving skills. Moreover, 54 out of 55 or 98.18% of the students scored between 32 to 40 out of 40 questions making them under the Poor Level with respect to their problem-solving skills.

Moreover, it can be seen that there is a mean percentage score of 40.32% (obtained from the mean score in pretest of 16.13) which is way below the passing rate of 75%.

These results are parallel in the study conducted by [1] which examined 5 central public schools in the Philippines and found that the level of critical thinking skills of their respondents is above average and that their problem-solving skills is proficient. The study recommended for conduct of intervention in critical thinking and problem-solving skills of Grade-7 students in Mathematics after finding that the level of problem-solving skills of students is highly correlated to their critical thinking skills.

### **Performance of the Grade 11 Students in Problem Solving After the Use of One Word Problem a Day (OWPaD)**

Table 2 presents the performance of the Grade 11 students after the implementation of One Word Problem a Day (OWPaD).

Table 2  
Result of the Post-Test on Problem Solving

Problem Solving Ability	Frequency	Percentage
Poor	16	29.10%
Good	25	45.45%
Satisfactory	14	25.45%
Total	55	100%
Mean Score	27	
Mean Percentage Score	67.5%	

It is noteworthy that after employing the proposed intervention, it can be observed that 29.10% of the students are on the Poor Level of problem-solving ability signifying a great decrease. Also, 45.45% of the students are on the Good Level of problem-solving ability. In connection to this, 25.24% of the students rose to the Satisfactory level in terms of their problem-solving ability. Moreover, it can be seen that the mean percentage score is 67.5% (obtained from the mean score in pretest of 27) which has significantly increased compared to the pre-test mean percentage score.

These results are similar on the publication of [10] which emphasized that Problem Based-Learning is an effective teaching and learning approach, particularly when it is evaluated for long-term knowledge retention and applications. Student engagement with the problem is sufficient to enhance students' learning gains over the traditional approach and the collaborative component did not make a significant difference to student learning.

### **Difference Between the Pre-Test and Post Test Results in Problem Solving**

Table 3 presents the difference between the pre-test and post-test results in problem solving of the 55 selected grade 11 students of Highway Hills Integrated School after the implementation of the One Word Problem a Day (OWPaD).

After the implementation of proposed intervention, the scores on the pre-test and post-test results of 55 students were compared and analyzed to determine if there is a significant difference. T-test for two dependent means was used having 0.05 alpha level of significance and 54 degrees of freedom. Table 3 shows the significant findings of the inferential analysis.

Table 3  
Difference Between the Pre-Test and Post Test Results in Problem Solving

Category	Mean Score	Degrees of Freedom	Computed t-value	Critical t-value	Interpretation
Pre-Test	16.13	54	14.1964	2.0000	Significant
Post-Test	27.00				

Based on these results, the null hypothesis which states that there is no significant difference between the results of the pre-test and post-test of the Grade 11 students on their problem-solving skills through the use of One Word Problem a Day intervention at 0.05 alpha level of significance is hereby rejected. The rejection of the null hypothesis is due to the fact that the computed t-value of 14.1964 is higher than the tabular value of 2.000.

Thus, there is significant difference in the problem-solving ability of the students before and after the implementation of the One Word Problem a Day as clearly indicated in the pretest and post test results. From these results, it could be deduced that the use of proposed problem-solving activities enhanced/improved the problem-solving skills of the respondents. Hence, employing such strategy would eventually increase the problem-solving ability of the students.

This result is the same with [2] which was revealed in their study concerning the use of problem-based learning in improving the problem-solving skills of learners. Using the quasi-experimental method, they are able to determine the significant effect of problem-based learning on students' motivation and problem-solving skills.

## 11. Conclusions

In view of the findings, the following conclusions were drawn.

1. There are 54 identified students under poor level problem solving ability and 1 good level student before the intervention.
2. There are 16 identified students under poor level problem solving ability, 25 good level students, and 14 very satisfactory level students after the intervention.
3. At 0.05 alpha level of significance, there is a significant difference between the problem-solving skills of the selected 55 grade 11 students before and after implementing the One Word Problem a Day (OWPaD).
4. One Word Problem a Day can enhance problem solving skills of students through time.

## 12. Recommendations

With the above conclusion, the following recommendations are offered:

1. Mathematics teachers shall give word problems on a daily basis to improve the problem-solving skills of the students.
2. The One Word Problem a Day (OWPaD) activities shall be used as an intervention to improve the problem-solving ability of students under poor level.

3. The school shall constantly monitor the problem-solving ability of the learners and provide technical assistance on improving problem solving skills.
4. A similar study shall be conducted to ascertain the findings of this research.

**Acknowledgements** The author would like to thank his family, specially Jen, Arjhen and Iah for always inspiring him to do better.

## References

- [1] Alcantara E. and J.M. Bacsa (2017). Critical Thinking and Problem Solving Skills in Mathematics of Grade-7 Public Secondary Students. *Asia Pacific Journal of Multidisciplinary Research*. Vol. 5 No.4, 21-27 November 2017 Part II P-ISSN 2350-7756 E-ISSN 2350-8442.
- [2] Argaw A.S., Haile B.B., Ayalew B.T., & S.G. Kuma. (2016). The Effect of Problem Based Learning (PBL) Instruction on Students' Motivation and Problem Solving Skills of Physics. *EURASIA Journal of Mathematics Science and Technology Education*, ISSN: 1305-8223 (online) 1305-8215 (print), 2017 13(3):857-871, DOI 10.12973/eurasia.2017.00647a.
- [3] Boonen A., de Koning B, Jolles J. & van der Schoot M. (2016). Word Problem Solving in Contemporary Math Education: A Plea for Reading Comprehension Skills Training. *Front. Psychol.*, 17 February 2016 | <https://doi.org/10.3389/fpsyg.2016.00191>
- [4] Kima H., Song Y., Lindquist R., & Kang H. (2016). Effects of team-based learning on problem-solving, knowledge and clinical performance of Korean nursing students. *Nurse Education Today*, Volume 38, March 2016, Pages 115-118. <https://doi.org/10.1016/j.nedt.2015.12.003>
- [5] Nurdyansyah, S. Masitoh & B. S. Bachri. (2017). Problem Solving Model with Integration Pattern: Student's Problem Solving Capability. *Advances in Social Science, Education and Humanities Research*, volume 173. Universitas Negeri Surabaya, Surabaya, Indonesia.
- [6] Psycharis, S., Kallia, M. (2017). The effects of computer programming on high school students' reasoning skills and mathematical self-efficacy and problem solving. *Instr Sci* 45, 583–602 (2017). <https://doi.org/10.1007/s11251-017-9421-5>
- [7] Safari Y., & H. Meskini (2016). The Effect of Metacognitive Instruction on Problem Solving Skills in Iranian Students of Health Sciences. *Glob J Health Sci*. 2016 Jan; 8(1): 150–156. Published online 2015 May 15. doi: 10.5539/gjhs.v8n1p150
- [8] Surya E., Putri F.A., & Mukhtar. (2017). Improving Mathematical Problem-Solving Ability and Self-Confidence of High School Students Through Contextual Learning Model. *Journal on Mathematics Education* Volume 8, No. 1, January 2017, pp. 85-94 85 Universitas Negeri Medan, Jl. Willem Iskandar Pasar V Medan Estate, Medan, Sumatera Utara, Indonesia.
- [9] Turnip B., Wahyuni I., & Tanjung Y.I. (2016). The Effect of Inquiry Training Learning Model Based on Just in Time Teaching for Problem Solving Skill. *Journal of Education and Practice*. Vol.7, No.15, 2016.
- [10] Yew, E. H. J., & Goh, K. (2016). Problem-Based Learning: An Overview of its Process and Impact on Learning. *Health Professions Education*, 2(2), 75–79. doi:10.1016/j.hpe.2016.01.004