ENHANCING THE MATHEMATICS PROBLEM-SOLVING ABILITY OF SENIOR HIGH SCHOOL LEARNERS THROUGH PERSONALIZED MOBILE LEARNING TECHNIQUE

Obias, Mateo B.

Completed 2021

Republic of the Philippines
Department of Education
NATIONAL CAPITAL REGION

Enhancing the Mathematics Problem-Solving Ability of Senior High School Learners through Personalized Mobile Learning Technique

An ACTION RESEARCH
Presented to
Regional Research Committee (RRC)
and Department of Education

MATEO BELTRAN OBIAS
Master Teacher II
Pasay City East High School
Schools Division Office of Pasay City

Grantee of
Basic Education Research Fund 2021

May 2021

Republic of the Philippines
Department of Education
NATIONAL CAPITAL REGION

ABSTRACT

Enhancing the Mathematics Problem-Solving Ability of Senior High School Learners through Personalized Mobile Learning Technique

Mateo B. Obias
Master Teacher II
May 2021

Problem Solving among TVE-learners has been the challenge both to teachers and learners. The main aim of the study is to enhance the Mathematics Problem Solving ability of the senior high school TVE-learners. The study utilized the quasi-experimental as the research design. The participants were given a pre-test and a post-test to see if the method of learning was beneficial or not. To determine the success of the personalized mobile learning technique, the mean and mean percentage scores of the participants' pre-test and post-test scores were used as a main basis. The result revealed that the participant's mean in the post-test had increased by 12.93%. The result of the summative test improved as well as the effect of the intervention as regarded effective. As a result, the researcher concludes that the senior high school-TVL students' problem-solving abilities are improved by using a personalized mobile learning technique. Furthermore, their understanding and approach to problem-solving gradually evolves to their advantage as they participate in a variety of activities and spend more time monitoring and personalizing their approach. It is recommended that the intervention be continued and applied specifically for those handling Tech-Voc students.

Keywords: Teaching and learning, Personalized Mobile Learning, Problem Solving Skill, Quasi-experimental, Action Research

ACKNOWLEDGEMENT

The researcher would like to extend his heartfelt gratitude to the following people who in one way or another help the researcher to finish the research paper;

Dr. Loreta B. Torrecampo, CESO V, Schools Division Superintendent, for all the encouragement that every teacher must engage in research.

Dr. Arturo A. Tolentino, Dr. Myrna B. Gaza, Mr. Librado F. Torres for always urging teachers to foster a research culture in every school.

Mr. Peter R. Cannon Jr, former school principal and Mr. Rouel A. Santero, former assistant principal for allowing the study to be conducted.

Dr. Felina P. Patagan, current School Principal, and Mr. Diosdado Q. Rosales, Assistant Principal, for the encouragement to finish the study.

Ms. Maria Jacqueline D. Bernardino, for the never-ending support, technical assistance and motivation.

Ms. Valerie De Guia, for partnering with the researcher in the conduct of the intervention.

To all the students who participated in the conduct of the students.

Above all, to the Divine Creator, who gave the researcher the gift of life, wisdom and strength to keep going for the realization of this endeavour.

M.B.O

TABLE OF CONTENTS

TITLE PAGE..... i

ABSTRACT..... ii

ACKNOWLEDGEMENT..... iv

TABLE OF CONTENTS..... v

I. Context and Rationale..... 1

II. Intervention/Innovation and Strategy..... 3

III. Action Research Questions..... 5

IV. Action Research Methods..... 5

A. Research Design..... 5

B. Participants and/or other Sources of Data and Information..... 6

C. Data Gathering Methods..... 6

D. Data Analysis..... 7

V. Discussion of Results and Reflections..... 7

A. Research Results/Findings..... 7

B. Reflection..... 10

VI. Action Plan..... 11

VII. References..... 12

VIII. Financial Report..... 14

IX. Annexes..... 15

X. List of Tables..... 24

I. Context and Rationale

Critical thinking has been the concern of many teachers as how this will be developed among learners. One way of nurturing creative thinking is problem solving. As stated in the study of Phonapichat et al. (2014), the main purpose of teaching mathematics is to enable students to solve problems in daily life. The mathematical problem-solving ability itself is not only a goal in mathematics learning, but also something that is very meaningful in daily life (Pinter, 2012), and in the world of work; being a problem-solver can provide benefits or benefits (NCTM, 2000). Therefore, learning should be developed to educate students to be able to realize and solve the problems that they face (Balım, 2009).

In this time of pandemic, learning in a non-face-to-face presents greater challenges on the target learner when it comes to the topic on problem solving, mainly because the delivery of education has changed. In this aspect, it can be synchronously or asynchronously delivered to learners. As we are now on the fourth revolution and gearing towards Education 4.0, everything learning is in the cyber space format. Students can learn anything and everything in just one click in the World Wide Web. In this regard, the researcher further conducts several readings on virtual classrooms which is very popular in the western countries like the United States of America. A virtual classroom is an online learning environment that allows teachers and students

to communicate, interact, collaborate, and explain ideas. It has interactive online whiteboard, library of learning materials and teacher tools and controls. E-learning can have a positive impact on student's collaborative skills, thus improving decision making skills and problem solving (Estrada, 2018).

DepEd Order No.031 s 2020 the Interim Guidelines for Assessment and Grading considering the Basic Education Learning Continuity Plan, as stated in the memo that Department of Education pursues learning continuity and that grading practices must be meaningful and support learner development. Variety of assessment and feedbacking should be a shared responsibility among teachers, learners, and their families as one of the principles of the Department Order. That is why the researcher looked into one of the learning potentials which is problem solving.

The Senior High School of Pasay City East High School mostly caters few of the strands of Technological Vocational Education like Shielded Metal Arts and Welding (SMAW), Beauty Care and Bread and Pastry Production. These strands also are taking the core subjects like any other tracks. Understanding and applying the concepts of Mathematics specifically problem solving is of the struggles of TVE students. This was manifested during the First Quarter Examination. The data shows that the mean percentage score of the students is below mastery level. The mean percentage across senior high school specialization are the following: Shielded Metal Arc and Welding is 33.4,

Barbering is 33.1 and for Home Economics is 42.2. This data implies that there is a problem which need to be solve.

II. Intervention, Innovation and Strategies

Vygotsky believed that learning occurs when students work or learn to handle complex tasks or problems that are still within the cognitive reach of students, or those tasks are in the Zone of Proximal Development (ZPD) (Taylor, 1993). Vygotsky stated that ZPD is between the actual level of development as determined through independent problem solving and the level of potential development as determined through problem solving under the guidance of adults or working with more capable partners. In this time of pandemic, the delivery of education changed. It can be synchronously or asynchronously be delivered to learners. The researcher theorizes that with the use of the personalized and guided learning techniques, learners can attain the Potential Ability Level.

According to Simamora (2019), If the teacher poses a problem to be solved by students, the problem should be between Actual Ability Level (AAL) and Potential Ability Level (PAL) or the problem is in the area of students' cognitive reach. So, mathematical problems can be interpreted as questions or mathematical questions originating from real life whose difficulties still lie in the reach of students' thinking but there are no algorithms or procedures that students can immediately apply. Actual Ability Level is when a problem can be resolved independently while Potential Ability Level if the problem can be

solved by students in the presence of other people (teacher or role models or peers).

The researcher anchored his intervention Personalized Mobile Learning Technique to this principle. This learning technique is used to provide the participants with reading materials, problem solving lectures, and even practice sheets via SMART phones since this is the most accessible tool for the students. Collaboration is through Facebook messenger; virtual consultation is through Google meet. E-clinic in the Google classroom was also created for offline consultation. For almost eight weeks the participants are given materials to work on every after session. They are given problems twice a week following also to the academic ease set by department. Video lessons on problem solving are also provided to the participants. After 6 weeks of continuous intervention, those participants with low scores in the task sheets are required to attend virtual boot camp. The researcher also personalized the approach to adjust in the needs of the learners. E-Clinic is created to address the issues and concerns of the participants regarding problem solving individually, it is like a doctor consultation in a clinic. Part of personalizing the approach is the virtual boot camp.

According to Al-Razgan (2019), Personalization attempts to adjust the learning material according to the needs of individual students and moves away from "one-class-fits-all" instructional approaches. To evaluate the

effectiveness of the technique, teacher made pre-test and post-test was administered.

III. Action Research Questions

This study aimed to enhance the Mathematics Problem Solving Ability of Senior High School-TVE through Personalized Mobile Learning Technique.

Specifically, this study sought to answer the following questions.

1. What is the pre-test and post test scores of the participants in General Mathematics before and after the intervention program?
2. Is there a significant difference between the pre-test and the post-test scores?
3. What are the challenges encountered by the participants during the intervention?

IV. Action Research Methods

A. Research Design

This study employed Mixed Method of research utilizing teacher- made test and interview guide to gather information about the performance of learners in General Mathematics before and during the intervention and determine the challenges they encountered. Mixed method study combines quantitative and qualitative data collection and analysis in one study. This approach can answer different questions so combining them can provide you with more in-depth findings (Creswell, 2019)

B. Participants and/or other Sources of Data and Information

One section in Grade 11-TVE of Pasay City East High School is the participants of the study. The selected group is the section with the lowest mean percentage score in the Diagnostic Test on Problem Solving which was administered during the First semester of the school year 2020-2021. Purposive sampling was used. Students with smart phone, tablet or computer were the participants in the study. There were 23 identified participants in the study.

C. Data Gathering Methods

A teacher-made Pre – Test and Post – Test was administered. The scores in the said test were recorded to determine the effectiveness of Personalized Mobile Learning Technique in improving the Mathematics Problem Solving ability of the selected grade 11 TVE students.

The researcher used mean percentage score on the pre-test and post-test scores of the students on problem solving to determine the effectiveness of the intervention. The researcher also employed t-test to determine the significant difference of pre-test and post-test.

Virtual focus group discussion (FGD) was conducted to determine the challenges met by the participants during the intervention.

Prior to the administration of the instrument, permission was sought from the School Principal. The researcher explained to the participants the nature of the study, the value of their responses and the procedures that needs to be followed. The researcher also sought the approval of the parents of the

participants. The participants were also oriented on the additional task sheets that needs to be accomplished after the main data gathering tool.

D. Data Analysis

The researcher used mean percentage score on the pre-test and post-test scores of the students on problem solving to determine the effectiveness of the intervention. The researcher also employed t-test to determine the significant difference of pre-test and post-test. Categorization and coding were used to interpret the responses after focus group discussion.

V. Discussion of Results and Reflection

This presented the data gathered with the statistical treatment, analysis and interpretation done to answer the questions posed in this study.

A. Research Results/Findings

1. Pre-test and Post Test Scores of the Participants in General Mathematics

Table 1
Pre-Test and Post Test Scores of Grade 11 Learners in General Mathematics

Section	Mean of Pre-test	Mean of Post-test	Pre-test MPS	Post-Test MPS
11-Garnet	10.21	14.09	34.03	46.96

The table shows the mean and the mean percentage of a 30-item Pre-test and Post-test of the participants on problem solving. The mean of the pre-test is 10.21 while the mean of the post-test 14.09. It can be noted the slight increase in the Mean of the test. Nevertheless, it showed that the intervention made is

quite effective. Various factors may have attributed to the results of the problem-solving skills during the implementation of the intervention.

2. Difference between the Pre-test and the Post-test Scores

To identify whether there is a significant difference, T-test was used (with H0, that there is No significant difference in the Pre-Test and Post-Test Result as shown in Table 2.

Table 2
Differences in Pre-Test and Post-Test Scores of Grade 11 Learners in General Mathematics

Computed T-test	Degree of Freedom	Significance Level a	Critical Value	Decision
-4.31	44	0.05	-2.015	Reject the null hypothesis

The table shows that the t-computed value of -4.31 which is beyond the critical value of -2.015 at .05 level of significance with 44 degrees of freedom, the null hypothesis is disconfirmed or rejected. This means that the post-test is significantly higher that the pre-test.

The result showed that the personalized mobile learning technique had an effect to the problem-solving ability skills of the participants. The claim is supported by the increase mean percentage score of the participants in their post-test. The increase in the post-test proved that the intervention was effective and clearly it was also manifested in their summative results since most of the items in the summative are problem solving.

3. Challenges Encountered by Grade 11 Learners during the Utilization Personalized Mobile Learning Technique

The participants were also interviewed via google meet. The questions are open ended. This was the researcher's way to get at deeper meaning and richer understanding of the participant's experiences.

Table 3
List of the Emerging Themes based on the Challenges Encountered during the Intervention

STUDENT'S ATTITUDE AND INTEREST	TECHNICAL FACTOR	FINANCIAL FACTOR	TEACHER FACTOR
"Naglalaro ng mobile games habang nag didiscuss si teacher"	" Madalas na problema na aking nakakaharap sa intervention ay madalas walang load at mahina ang signal	"walang load"	"kapag hindi sapat sa student yung pagpapaliwanag sa isang subject,yung tipong nalilito pa siya...tapos na agad ituro"
"Procrastination"	"no data connection to watch the solution on YouTube or giving the teacher on google class room" (assignment)	" load is not enough"	
	"Cellphone lang, maliit mahirap"		

The challenges encountered by the participants during the intervention program are mostly on the technical and financial factors. Internet

connectivity and load allowance are the major challenges according to the participants, secondary are teacher factor and the participants' attitude towards the intervention program.

The result of the study shows that the personalized mobile learning technique gave a light somehow to the challenges met by Mathematics teachers on how to improve the problem-solving ability specifically of the TVE students. The intervention is deemed effective, but it requires an extra effort to the teachers. Taking into considerations the situation in this time of pandemic and everything is virtually undertaken.

B. Reflection

The researcher learned that teacher's creativity and passion to teaching can bring light to some of the struggles of the learners. Some problems inside the classroom are quite challenging specially when it comes to developing critical thinking of the learners. Teachers cannot be complacent because the course does not require much of critical thinking. The researcher realized during the conduct of the study that even Technical Vocational learners can be at par with the other courses when it comes to problem solving. Constant practice and personalizing the approach towards solving problem must be carried out regularly. The study is deemed successful because of the willingness of the participants to participate and engaged in the process. Maybe another action research on comprehension and vocabulary enhancement of the TVL

students as one of the important skills in problem solving should also be looked into.

VI. Action Plan

The study followed the 3 stages in accomplishing the action research. October was the Pre-implementation stage, January and December was the implementation of the personalized mobile learning technique, post-test and analysis of data was in February and March 2021.

Based on the analysis of data the intervention was effective, the dissemination of result followed. The researcher discussed the findings with the School Principal, Assistant Principal, Department Heads, Subject Group Heads and Mathematics Teachers during the School Learning Action Cell.

This can also be further shared to Junior High School Teachers, for them to adopt the intervention and use it to their struggling learners when it comes to problem-solving.

Based on the analysis of study, another action research on comprehension and vocabulary enhancement of the TVL students as one of the important skills in problem solving should push through. Table below shows the summary of activities.

Table 4
Summary of Activities for Research Sharing

Objectives	Activities/Strategies	Persons Involved	Time Frame
Disseminate research result.	School In-Service Training	School Principal, Assistant Principal, Department Heads, Subject Group Heads, Teachers	August 2021
Share the intervention to Junior High School Math Teachers	Learning Action Cell	Department Heads, Math Teachers	October 2021
Share the intervention to other researchers and teachers.	School research forum.	School Principal, Assistant Principal, Department Heads, Subject Group Heads, Teachers	November 2021

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Deped Order No 031 series of 2020

VIII. Financial Report

EXPENSES	COST ESTIMATE	ACTUAL COST	MEANS OF VERIFICATION
Transportation	PHP 1000.00	PHP 1360.00	CENRR
Communication	PHP 7500.00	PHP 7950.00	OR
Printing Cost	PHP 1000.00	PHP 840.00	OR
Food	PHP 4500.00	PHP 4000.00	CENRR
Supplies and Materials	PHP 1000.00	PHP 1050.00	OR
Internet Cost	PHP 3000.00	PHP 3500.00	CENRR
Notary	PHP 100.00	PHP 200.00	CENRR
TOTAL	**PHP 18 100.00**	**PHP 18 900.00**	

IX. Annexes

PASAY CITY EAST HIGH SCHOOL
E. RODRIGUEZ ST. MALIBAY, PASAY CITY

Name of Interviewer	MATEO B. OBIAS (Researcher)
Place of FGD	
Date of FGD	

INTERVIEW GUIDE/PROTOCOL

Interviewer:

During the interview, I will be asking you about your experiences about solving word problems. I am interested about your activities and experiences as you go through the intervention program. If you think my questions does not apply, let me know.

There are no right, or wrong answer so be honest as possible so I can understand the challenges you have experience in problem solving.

Question 1: Tell me, how do you feel about problem solving in Mathematics?

Question 2: Describe a typical problem-solving lesson.

Question 3: Tell me about your feelings when you perform problem solving.

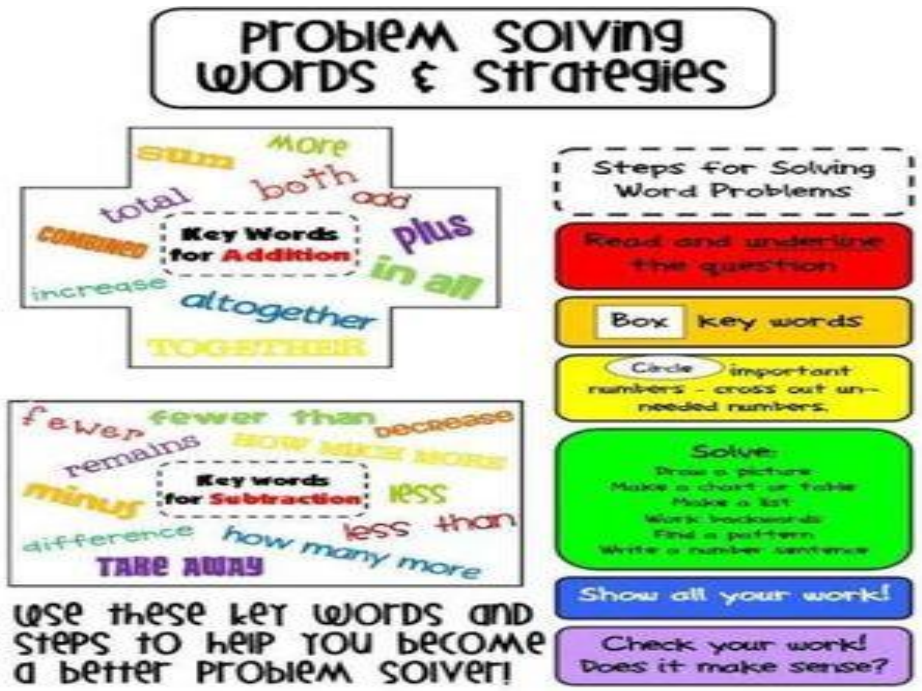
Question 4: Tell me, why students find it difficult to solve worded problem?

Question 5: Tell me, what do you like about the intervention program?

Question 6: Tell me about your challenges during the intervention program

Thank you so much for your honesty. The information will be treated with confidentiality and will be used for research purpose only.

WEEKLY PROBLEM-SOLVING HUDDLES



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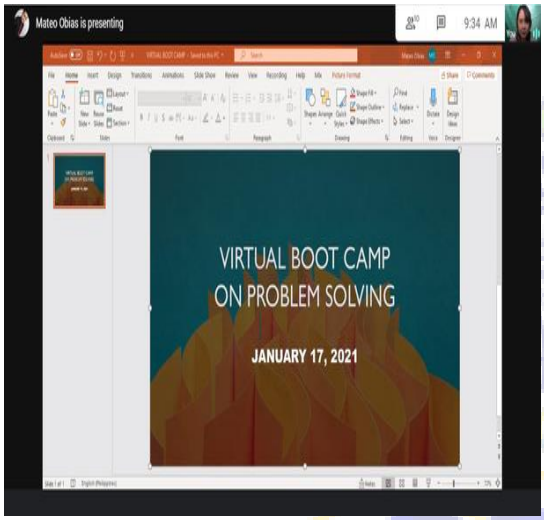
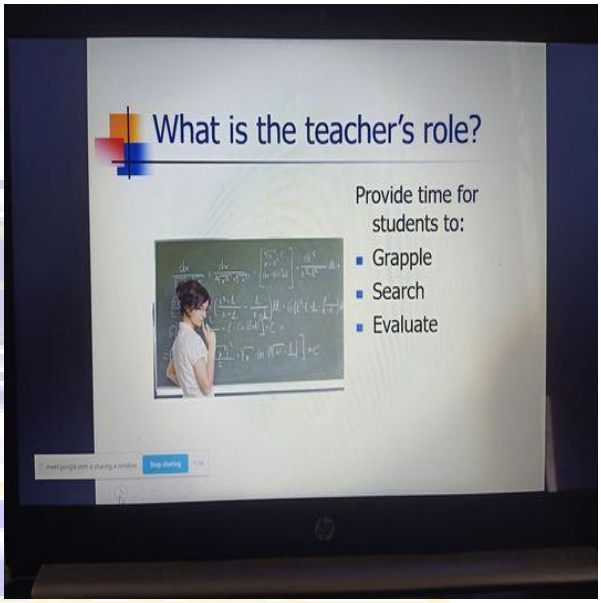
VIRTUAL BOOT CAMP





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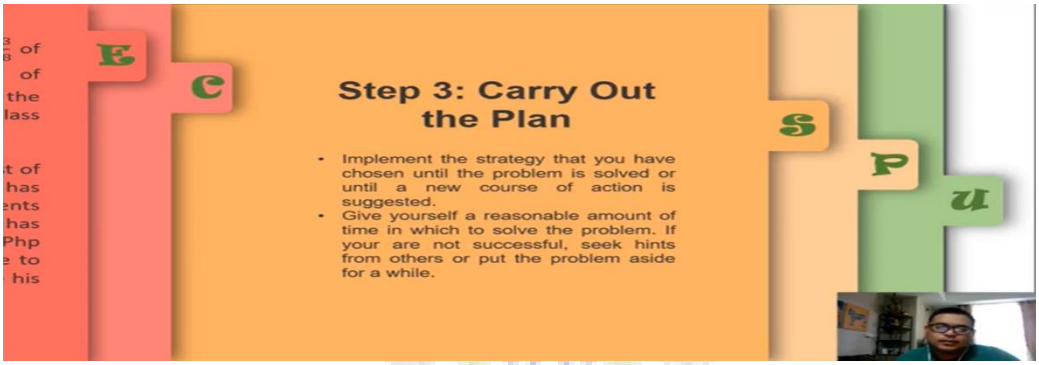
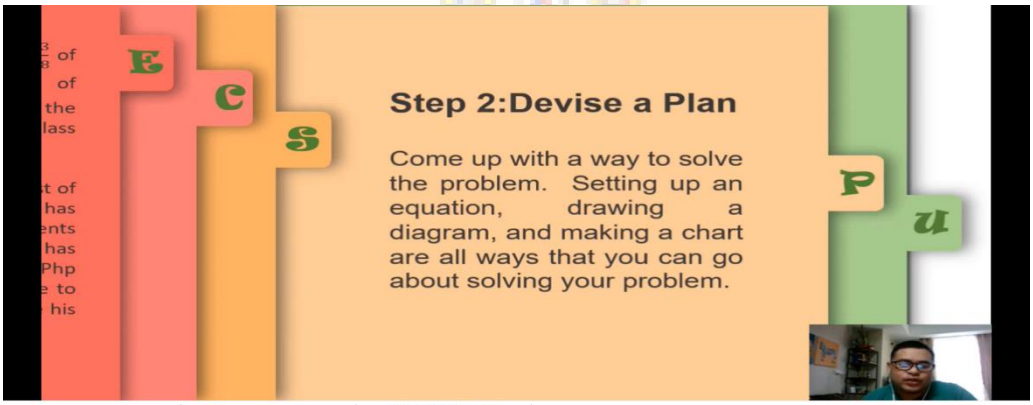
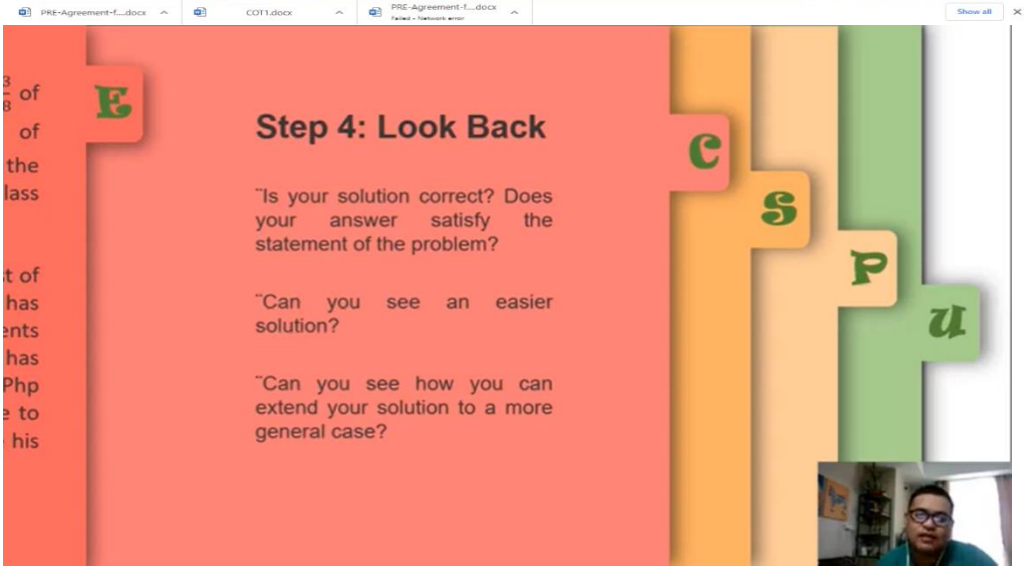
PERSONALIZED VIDEO LESSON FOR PROBLEM SOLVING

(https://www.youtube.com/watch?v=WRvIATif1XA)







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PASAY CITY EAST HIGH SCHOOL
SENIOR HIGH SCHOOL
E. Rodriguez St. Malibay Pasay City

Name: _____ Grade & Section: _____

Mathematics Problem Solving Skills Test (Pre-Test)

DIRECTIONS: Read each of the story problems. In the next box to each problem, work the problem Circle your answer. If you don't need to write your work, just write the answer in the box.

Story Problem	Workspace
1. Melissa plays video games. She also watches the TV shows: Cinderella, Hot Dog, and Wild Animals How many TV shows does Melissa watch?	
2. Tim had some pennants. He gave two of them to Mark. The two he has left are for the Dallas Cowboys. How many did he have at first?	
3. Tom has 1 yellow boat. He has one red car. He has 1 blue car, too. How many cars does Tom have?	

4. Sam's cat, Tabby, had 5 kittens. Sam gave a yellow kitten to Jeff. He gave a white kitten to Sandy' He cannot find new homes for the other Kittens. How many kittens did Sam give away so far?	
5. On Friday Jack will get a star for each book he reads this week. He gets one more star if he reads five books in all. On Monday he read 1 book. On Tuesday he read 2 books. He did not read Wednesday. On Tuesday he read 1 book. On Friday he did not read. How many stars did jack get for the week?	
6. Debbie has 5 marbles. Three are green and 2 are yellow. Jim has 2 green marbles. Bob has 7 marbles. Two are green and 5 are yellow. How many more green marbles does Debbie have than Bob?	
7. Jennifer has two tickets for the big game. Her team is ahead by 4 games. Today is January 2nd. The game is a week from today. What is the date on the tickets?	
8. Jen and Jerry's team had 3 runs. Kevin and Kerry's team had 5 runs. The game was almost over. How many runs Jen and Jerry's team make to win the game?	

9. In 1972 Mark Cruz set a 500-auto race record of 163 kilometers per hour. The winnings that year were Php 1,011,845. In 1948 Mario Jose had won the race with 119 kilometers per hour. How much faster was Mark Cruz car than Mario?	
10. Dan washed 4 pairs of socks. In the dryer, one sock was missing. How many socks did Dan find in the dryer?	
11. The total area of the 50 states is 3,618,467 square miles. Of that area, 78,444 square miles are water. How much are island?	
12. Loma and Lee are 10-year-old twins. Their birthday party is next Tuesday. Lee has asked 4 friends, and Loma has asked 3 friends. How many children should there be at the party on Tuesday?	
13. Alice and a friend sold use games and books. They sold comic books marked at php 275 for 225 each. Comics that were marked at 250 sold for 100 each. One Saturday they sold 15 of the comic books marked 250 when new, and four of the books	

that had once cost 275. How much money did they get from selling comic books?	
14. About 1/20 of a person's weight is blood. About 2/3 of the body's content is water. Laurel weighs 100 pounds. About how much does her blood weigh?	
15. A desk or cards has 52 cards. There are four suits (spades, clubs, diamonds, and hearts). Two suits are red and two are black. If card is picked at random, what is the probability that the card is a diamond?	
16. Six third- graders are helping get treats ready for visitors to their school. They are to share equally any treats left over. They had 143 treats to put into bag for 25 visitors. The bags should each have the same number of treats. Richard is one of the third graders. How many treats will he get when they are through with their job?	
17. Pat's airline ticket showed that the fight was to leave Cebu airport were 24-hour clocks (1 am = 0100, and 1 pm = 1300). What time should Pat watch for in Cebu that would be the same as 7:15 pm?	

18. Melissa took her family for fried chicken at the chicken coup. Her mother was afraid that Melissa would not have enough money to pay. She ordered the "Chicken Dinner" for 150. Dad had "Your Average Chicken dinner" for Php 225. Melissa's "Chicken With" even had a root beer, and all for 330.50. Coffee for Mom and Dad was Php 90 each. Sales tax was 5%. How many much change did Melissa get from her php 500 bills?	
19. The tallest mountain on earth is Mt. Everest. It is 29,028 feet above the sea level. The lowest place on earth is the Dead Sea. It is 1,312 feet below sea level. In Alaska, Mt. McKinley is 20,320 feet above the sea level. What is the difference in feet between the highest and lowest points on earth?	
20 Alissa was on diet of 1,500 calories per day. She used to eat about 3,000 calories a day. On that diet she ate 800 calories for dinner. Her calorie count for lunch was three times that for breakfast. How many calories' worth of food did she eat for lunch?	

X. List of Tables

Table Number		Page
1	Pre-Test and Post-Test Scores of Grade 11 Learners in General Mathematics	7
2	Differences in Pre-Test and Post-Test Scores of Grade 11 Learners in General Mathematics	8
3	Challenges Encountered during the Intervention	9
4	Summary of Activities for Research Sharing	10