THE USE OF SPEAR (STUDENTS' PERFORMANCE TO ENGAGE, ANSWER, AND RESPOND) AND CPA (CONCRETE – PICTORIAL-ABSTRACT) IN EXPLICIT TEACHING OF GENERAL MATHEMATICS

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Abstract

This study determined the performance of grade 11 senior high school students using explicit instruction in teaching General Mathematics and the application of concrete – pictorial-abstract approach during the school year 2022-2023. The study utilized the quasi-experimental research design employing pretest and posttest in general mathematics during the second grading period. The participants of this study were 45 Grade 11 students of ICT B and 42 students of ICT C under TVL – Strand. Purposive sampling technique was utilized in determining the samples of the study. The findings revealed that Grade 11 students had very poor performance in general mathematics but that performance improved when the teachers gave explicit instructions and employed the concrete-pictorial-abstract approach. Grade 11 students in the control and experimental groups increased their mean gain scores, which proved that explicit instructions and application of the concrete-pictorial-abstract approach were effective in teaching General Mathematics. The study recommends that senior high school teachers use explicit instructions and apply a concrete-pictorial-abstract approach in teaching general mathematics. They may also integrate the SPEAR in Math where the students' performance was engaged in their performance tasks, and the teacher recorded their responses through the output using the rubrics.

Keywords: *Concrete – Pictorial-Abstract Approach, Explicit Instruction, General Mathematics*

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Context and Rationale

Explicit instruction is a highly structured and direct teaching method that provides clear lessons to students. It focuses on teaching children how to effectively initiate and complete tasks while also offering ample feedback and practice opportunities. Research on mathematics intervention has demonstrated that struggling students benefit most from explicit teaching of mathematics. With a systematic approach, explicit teaching fosters essential classroom interactions between teachers and students, allowing for comprehensive coverage of various mathematical concepts, including measurement, geometry, and more (Ashman 2021, 12).

Furthermore, Explicit Instruction is a structured approach that offers a clear framework and set of supports in a logical sequence (Doabler et al., 2013, 1). The three key components of explicit mathematics instruction, as described by Doabler et al. (2015, 16), are teacher modeling, guided practice, and academic feedback. This model of instruction provides a systematic series of scaffolds and instructional aides to facilitate effective learning in mathematics.

In contrast, the Concrete-Pictorial-Abstract (CPA) approach is a progressive method of learning mathematics that follows a sequential step-by-step process. Each level of understanding in the CPA approach builds upon the previous level and should be taught in a specific order. The approach consists of three stages: starting with hands-on manipulation of concrete objects, advancing to pictorial representations of those objects, and finally solving problems employing abstract notation. Numerous studies, including research conducted by Witzell (2005, 1), have provided evidence supporting the effectiveness of the CPA approach. These studies indicate that when solving algebraic variables, pupils who use the CPA approach make fewer procedural mistakes than those who use more traditional learning strategies.

Furthermore, according to Athienitis (2022, 17), the concrete, pictorial, abstract approach (also known as the CPA method) utilizes tangible objects to combine numbers, including fractions, with mathematical operations such as addition, subtraction, division, and multiplication. This approach involves representing these concepts graphically through devices or structures, such as bar models or part-whole models, before transitioning to the more "abstract" representation of numbers and mathematical symbols. Children who struggle with understanding mathematics often find it challenging due to its abstract nature, as many mathematical symbols seem disconnected from their everyday experiences. The CPA approach addresses this issue by allowing children to relate new concepts to their existing knowledge and experiences, providing a familiar and realistic starting point for learning.

To address students' need for mathematical proficiency, NCTM (2000) recommends providing opportunities for students to use various mathematical representations when solving problems related to physical models, social contexts, and mathematical phenomena. One teaching and learning approach that allows students to employ representations in problem-solving is the CPA (Concrete-Pictorial-Abstract) approach, as identified by Witzell (2005, 2). The CPA approach comprises three steps: 1) utilizing concrete objects for hands-on manipulation and learning; 2) employing pictorial representations to visualize the concrete manipulations; and 3) solving problems using abstract notation, such as numerical symbols or letters. During the learning and teaching process, concrete components such as manipulative objects (e.g., cakes and measurement tools) can be employed. Pictorial depiction involves the capability to create, interpret, and graphically represent images, as noted by Sousa

(2007, 9). Abstract notation refers to the use of symbolic representation, such as numbers or letters, when solving problems.

The progression of learning activities within the CPA approach is crucial. Concrete materials must be prioritized to demonstrate how mathematical operations could be applied to real-world problems. Pictorial representation aids in visually depicting the manipulation of concrete objects, helping students understand how images relate to the concrete context. Finally, working with symbols in a formal manner demonstrates how symbols provide a more concise and efficient method of expressing mathematical processes. Ultimately, students should strive to achieve a high level of proficiency in using symbols and possess a wide range of mathematical abilities (Putri 2015, 21).

As mentioned in the research of Cooper (2012, 13), the Concrete-Pictorial-Abstract (CPA) approach to teaching and learning mathematics involves the use of manipulative objects. These manipulatives offer both advantages and potential drawbacks. One benefit is that they can positively impact students' attitudes and enthusiasm towards learning in the classroom. However, a potential pitfall arises when students view the manipulation of objects as a recreational activity rather than a valuable opportunity to improve their mathematical understanding.

General mathematics has some inherent difficulties because of its abstract and cumulative nature. As such, students need a solid foundation and may only be able to learn new things with prior knowledge. Many students have high expectations of the difficulty of mathematics and have observed a low personal value attached to mathematics. For senior high school students, there is no difference. Many of them need to improve at solving math problems. They also need concrete examples and the use of real objects when resolving. They are also interested in using pictures to solve math problems and appreciate the symbols shown in the task. Teaching general mathematics to high school students requires a great deal of effort on the part of teachers, not only in preparing teaching materials but also in choosing different teaching strategies to use.

The use of the Concrete-Pictorial-Abstract (CPA) approach in mathematics education has significant policy implications. This approach, which utilizes physical materials, visual representations, and abstract symbols to teach mathematical concepts, has proven to be highly effective in enhancing students' comprehension and problem-solving skills. By integrating the CPA approach into classrooms, policymakers can create a more inclusive and impactful mathematics education system. This approach caters to diverse learning styles and abilities by providing concrete experiences for tactile learners, visual representations for visual learners, and abstract symbols for more advanced learners. Additionally, the CPA approach fosters active engagement and critical thinking among students, allowing them to explore mathematical ideas and develop a deeper understanding actively. It also cultivates problem-solving abilities by encouraging students to visualize and manipulate mathematical concepts before transitioning to abstract representations. From a policy standpoint, the CPA approach has the potential to address achievement gaps in mathematics education. By offering a multi-modal learning environment, this approach supports students who struggle with traditional teaching methods and promotes educational equity by ensuring that all students have access to effective instructional strategies.

In conclusion, the policy implication of the utilization of the Concrete-Pictorial-Abstract approach is that it can contribute to a more inclusive, engaging, and effective mathematics education system. By incorporating this approach into educational policies, policymakers can support the diverse learning needs of students and foster a better comprehension of mathematical ideas.

During a recent pre-test for the 2nd quarter exam in general mathematics, a significant number of Grade 11 students faced difficulties in solving problems related to simple and compound interest. The researcher finds this issue particularly intriguing and relevant to real-life situations. As a result, the researcher decided to undertake a study that aims to assess the performance of senior high school students in Grade 11 by employing both the concrete-pictorial-abstract (CPA) approach and explicit instructions in teaching general mathematics.

This study was conducted at Baliwasan Senior High School Stand-alone during the first semester of the 2022–2023 academic year, with a specific focus on the general mathematics curriculum and the utilization of explicit instruction and the CPA approach.

Innovation, Intervention, and Strategy

Innovation. SPEAR in Math (Students' Performance to Engage, Answer, and Respond) in Math refers to a collaborative or group activity conducted in the classroom where students follow instructions conveyed by the teacher. This activity is a one-time occurrence in which all group members have equal tasks and privileges, such as being the leader, assistant leader, or regular member. The purpose of SPEAR in math is to enhance students' confidence in their abilities and allow them to showcase their skills and accomplish their tasks in front of the class. Students may also present their group work as a means to demonstrate their abilities.

In addition, the teacher uses group or collaborative activities as a measure of **Students' Performance**. Students actively **Engage** in their performance tasks, and the teacher assesses their answers and responses using rubrics. Collaborative learning embraces small groups of learners working together to solve problems, complete tasks, and achieve shared objectives. By integrating collaborative learning into mathematics instruction, a more student-centered environment is created, moving away from the traditional, passive approaches to learning that are often observed in math classrooms. When engaging in collaborative learning activities, participants combine their own experiences and insights with those of their teammates, fostering the development of new ideas. Two learning strategies that emerge from collaborative learning are an increased understanding of the content, higher levels of engagement and motivation, and enhanced participation from learners to **Answer** and **Respond** to the activities.

Intervention. CPA stands for Concrete, Pictorial, and Abstract (CPA) approach is a teaching method that starts with using real objects for children to perform mathematical operations like addition, subtraction, multiplication, and division. From there, they move on to using pictures to represent these objects and, eventually, abstract symbols. Children often struggle with math because it is abstract, but the Concrete, Pictorial, and abstract approach (CPA) addresses this challenge effectively. It is a highly effective teaching approach that assists students to develop a deep and continuing understanding of math concepts. Also known as the concrete, representational, and abstract framework, CPA was advocated by American psychologist Jerome Bruner. It is a fundamental technique used in the Singapore method of teaching math for mastery, and it plays a fundamental role in helping learners excel in math (Putri et al. 2020, 5).

Mathematics can be challenging for both children and adults because of its abstract nature. However, the CPA approach recognizes this difficulty and seeks to overcome it by connecting abstract concepts to concrete and tangible examples that children are familiar with. This approach involves progressing from using physical objects to represent mathematical ideas to using pictures or diagrams and finally to working with abstract symbols and solving problems. The use of the CPA framework is so deeply ingrained in the teaching of math in Singapore that the Ministry of Education requires all teaching materials to incorporate this approach (Putri et al. 2020, 5).

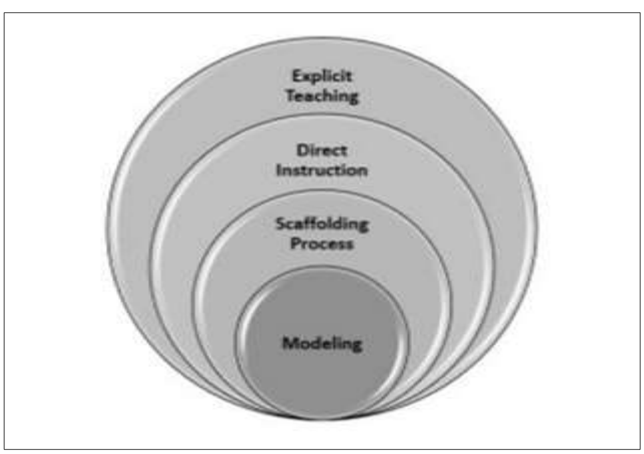
The concrete stage of the CPA approach is focused on active learning. Students are encouraged to use physical objects to represent and solve math problems. Unlike traditional teaching methods that rely on teacher demonstrations, the CPA approach allows children to engage with and manipulate concrete materials, bringing concepts to life. In this stage, abstract ideas are introduced through hands-on interactions with tangible materials, providing a more immersive learning experience (Putri et al. 2020, 5)

During the pictorial stage of the learning process, visual representations are used to depict real objects and model mathematical problems. The main purpose of this phase is to facilitate establishing a connection between physical objects and abstract pictures or models that denote those objects within the problem. By creating or drawing models, students find understanding complex concepts like fractions simpler. This stage allows students to visualize abstract problems, making them more understandable and manageable (Putri et al. 2020, 5).

In contrast, the abstract stage encompasses the use of symbolic representations to solve problems. Students only advance to this point after clearly recognizing and understanding the concrete and pictorial stages. In the abstract stage, teachers introduce abstract concepts like mathematical symbols. Children learn these concepts at a symbolic stage, using figures, notation, and mathematical symbols like +, -, x, / to represent addition, multiplication, or division operations (Putri et al. 2020, 5).

Strategy: EXPLICIT INSTRUCTION. Research consistently highlights the significant impact of daily classroom instruction on students' overall academic achievement. It is crucial for all students to gain access to high-quality instruction that aligns with standards and grade-level expectations. Teachers should strategically implement evidence-based instructional practices to support students in reaching their learning goals. Two closely related practices are explicit teaching and modeling. Explicit teaching involves a systematic approach where teachers carefully analyze the elements they plan to teach and continuously assess student understanding. Direct instruction and modeling are two important approaches to explicit teaching (Ashman 2021, 12).

Figure 1. Explicit Teaching and Modeling



Teachers often mistakenly use the terms "explicit instruction" and "direct instruction" interchangeably, but there is a distinction between the two. Explicit teaching indicates a comprehensive system that goes beyond a single lesson's episode, while direct instruction is a specific pedagogical approach within that system (Ashman 2021, 13). Findings of studies support the use of explicit teaching strategies as an effective student-centered approach. Combining interactive methods with direct instruction, which involves explicit and direct teaching of certain skills or knowledge, has been found to yield better results. While explicit teaching is backed by research, it is sometimes unpopular in education due to its perceived conflict with theories like inquiry and project-based learning (Moore 2010,3).

Some educators believe that students should acquire knowledge through investigation and learning as opposed to direct instruction. Nonetheless, it is argued that discovery and explicit learning can coexist and have their own intention in the classrooms of today. The misconception arises from observing suboptimal forms of explicit teaching, such as teacher-centered lectures, which leads to a lack of accurate understanding and recognition of true explicit instruction by educational leaders (Salisu and Ransom 2014, 2).

The process of modeling in math begins with a teacher providing a detailed explanation of how to solve a problem. This explanation should be seen as a dialogue between the teacher and students. It may consist of one or multiple examples that have been carefully planned.

Practice is the next stage, where students begin to internalize the math concepts. Guided practice is a part of this stage, where the teacher and students work together on the same problems. Additionally, independent practice is also included in this stage.

Explicit instruction is a systematic and teacher-led approach that involves clearly explaining concepts, modeling skills, providing guided practice, and offering feedback to students. Here are some activities that can be undertaken using explicit instruction in teaching business math:

1. Direct Instruction: Begin by introducing the specific concept or skill you want to teach, such as calculating percentages, understanding interest rates, or solving financial problems; Provide a clear and concise explanation of the concept, breaking it down into smaller steps or components; Use visual aids or examples to illustrate the concept and its application in real-world business scenarios; and Give clear instructions and expectations for student participation and engagement in the lesson.

2. Modeling: Demonstrate step-by-step procedures for solving business math problems; Show students how to perform calculations, interpret data, or analyze financial statements; Think aloud while solving problems, explaining your thought process and decision-making strategies; and Use visual representations, charts, or graphs to illustrate the steps involved in solving problems or making financial decisions.

3. Guided Practice: Provide structured practice exercises or worksheets related to the concept being taught; Break down complex problems into manageable parts, allowing students to practice each step with support; and Offer guidance, assistance, and feedback as students work through the problems, identifying any misconceptions and providing clarification as needed.

4. Independent Practice: Assign independent practice activities that allow students to apply the skills and concepts learned; Provide a variety of business-related problem-solving tasks, such as calculating profits, analyzing sales data, or interpreting financial reports; and Encourage students to explain their reasoning and justify their answers, fostering critical thinking and communication skills.

5. Review and Assessment: Regularly review previously taught concepts and skills to reinforce learning; Use quizzes, tests, or other assessment methods to evaluate students' understanding and proficiency in applying business math principles; and Provide timely feedback on assessments, highlighting areas of strength and areas for improvement.

By using explicit instruction techniques, you can provide students with clear explanations, structured practice, and feedback, enabling them to establish a solid understanding of business math concepts and their practical applications.

The Concrete-Pictorial-Abstract (CPA) approach is a widely used teaching strategy that supports students' deeper understanding of mathematical concepts by progressing from concrete materials to pictorial representations and then to abstract symbolism. Here are some activities that can be undertaken using the CPA approach in teaching business math:

1. Concrete Stage: Begin by introducing a real-life business scenario, such as starting a small business or managing finances; Provide concrete manipulatives, such as play money, cash registers, or financial documents like receipts or invoices; Encourage students to engage in hands-on activities, such as counting money, calculating profits, or making purchases; and Discuss and analyze the outcomes of the concrete activities, relating them to business math concepts.

2. Pictorial Stage: Move on to representing the concrete materials and scenarios using visual aids or drawings; Use diagrams, charts, graphs, or bar models to illustrate financial data, trends, or calculations; Ask students to create their own pictorial representations to demonstrate their understanding of business math concepts; and Compare and contrast different visual representations, discussing their strengths and limitations.

3. Abstract Stage: Finally, transition to the utilization of abstract symbols and equations to represent business math concepts; Introduce mathematical formulas or calculations related to business topics, such as profit margins, interest rates, or break-even analysis; Provide opportunities for students to practice solving problems using abstract representations; and Encourage learners to explain the meaning behind the abstract symbols and how they relate to real-world business scenarios.

4. Integration and Application: Integrate the CPA approach into various business math activities, such as budgeting, financial planning, or analyzing sales data; Assign projects or tasks that necessitate learners to employ their understanding of business math concepts in practical situations; and Encourage learners to reflect on their learning process, discussing how the utilization of concrete materials and pictorial representations helped them understand and solve business math problems.

By incorporating the CPA approach, you provide students with multiple representations of business math concepts, enabling them to transfer from the concrete to the abstract, and facilitating a deeper understanding of the subject. This approach helps them to make connections between real-life situations, visual representations, and mathematical symbols, enhancing their overall comprehension and problem-solving skills in the field of business math.

The duration of the intervention program was one quarter (3rd Quarter), one hour per session, three times a week (Monday, Wednesday & Friday) during the school year 2022-2023.

Action Research Questions

This study aimed to determine the performance of grade 11 senior high school students using explicit instruction in teaching General Mathematics and the application of the concrete–pictorial–abstract approach during the school year 2022- 2023.

This study sought to the following research questions:

1. What is the performance of Grade 11 senior high school students before and after using explicit instruction in teaching general mathematics?
2. What is the pretest result in general mathematics of the control and experimental groups?
3. What is the posttest result in general mathematics of the control and experimental groups?
4. What are the mean gain scores of Grades 11 students in general mathematics of the control and experimental groups?
5. Is there a significant difference in the mean gain scores of the Grade 11 students in General Mathematics?
6. Is there a significant difference in the pretest and posttest results in general mathematics of the control and experimental groups?

Action Research Method

Research Design

The study utilized the quasi-experimental research design utilizing pretest and posttest in General Mathematics during the second grading period. This was quantitative research to determine the performance of grade 11 senior high school students using explicit instruction in teaching General Mathematics and the application of concrete – pictorial-abstract approach. Studies with the goal of evaluating interventions but without the use of randomization are known as quasi-experiments. Similar to randomized trials, the goal of quasi-experiments is to show that an intervention causes an effect. Quasi-experimental designs identify a comparison group that is as comparable as possible to the treatment group in terms of baseline (pre-intervention) attributes (White and Sabarwal 2014, 4).

Participants and Other Sources of Data and Information

The participants of this study were Grade 11 TVL- ICT students of TVL – Strand who are enrolled in General Mathematics during the school year 2022-2023. In determining the samples, the researcher collected the students' grades of all strands and sections and chose the students who obtained the least mastered skills in General Mathematics during the first grading period. The researcher utilized the purposive sampling technique in determining the study samples. Hence, the researcher chose TVL-ICT A and TVL-ICT B sections who were part of the study.

Instrument

The research instrument for this study was a 20-item Multiple Choice Exam in General Mathematics used for Pre and Posttests. The instrument was taken from the CapSLET and Math Modules, which was the tool to evaluate the math performance of the students. The instrument was validated by the Math Master Teachers, who were experts in terms of content validity. The experts validated the instrument in terms of its relevance and students' capacity level to answer. The suggestions and remarks of the validators were incorporated into the final draft. The instrument was subjected to item analysis to test the reliability and validity of the instrument. Twenty-five copies of the instruments were administered to the non-respondents with similar characteristics to the grade 11 students. The data were computed and statistically analyzed using the norm reference item analysis. The result of the reliability test using the norm-referenced test was .897, which means that the instrument was reliable and valid.

Data Gathering Procedure

Data gathering was conducted after the approval of the research proposal. The researcher secured approval from the Schools Division Superintendent through a letter to conduct the gathering of data from the Grade 11 students at School A. The data gathering started after the approval of the study by presenting the permission letter to the District Supervisor and school principal. The researcher presented the approved letter to the principal.

On the resumption of classes for the second quarter, the researcher collected the grades of all students from different sections and checked the level of proficiency of the students based on the result of the proficiency level per section and then based also on the most essential learning competencies. The researcher chose two sections that obtained the least mastered skills during the pretest for the second grading period. On the second day of the class, the researcher conducted a series of conditioning activities.

In addition, the researcher gave an overview of the topic and used explicit teaching and activities on the application of a concrete-pictorial-abstract approach to the experimental group. The respondents were oriented that they were part of an educational experiment to be conducted by the researcher. A consent form was given to them for their approval in the inclusion of themselves in the study. At the next meeting with the respondents, the researcher/teachers gave a 20-item – multiple-choice test to both the control and the experimental groups. The respondents were given approximately an hour to answer. After administering the pretest materials, the teachers did the routinary activity by using explicit teaching and the application of a concrete-pictorial-abstract approach. This served as the treatment. After the intervention, the researcher administered, collected, and personally checked posttest materials. After this, the researcher tabulated the data for statistical treatment. Lastly, the researcher analyzed, interpreted, and discussed the results of the study.

Data Analysis

Mean/Average was used to determine the pre and post-test results in General Mathematics of the control and experimental groups. This was also used to determine the mean gain scores of Grades 11 students in general mathematics of the control and experimental groups. Moreover, the Paired-Sample T-test was used to determine the significant difference in the mean gain scores of the students of Grade 11 General Mathematics. This was also used to determine the significant difference in the pre and post-test results in general mathematics of the control and experimental groups.

Results and Discussion

Students' performance before and after the intervention. Table 1 presents the students' performance in General Mathematics before and after using explicit instruction and CPA application.

Table 1: The Performance of Grade 11 Senior High School Students Before and After Using Explicit Instruction and CPA Application in Teaching General Mathematics

Performance of Grade 11 Senior High School Students Before Explicit Instruction				**Performance of Grade 11 Senior High School Students After Explicit Instruction**			
Control Group		Experimental Group		Control Group		Experimental Group	
Grade	Description	Grade	Description	Grade	Description	Grade	Description
80.00	Satisfactory	78.00	**Fairly Satisfactory**	80.00	Satisfactory	85.00	**Very Satisfactory**

Legend:
90-100 = Outstanding 85-89 = Very satisfactory 80-84 = Satisfactory
75-79 = Fairly Satisfactory Below 75 = Did not meet expectations

Table 1 illustrates the performance of Grade 11 senior high school students before and after using explicit instruction in teaching General Mathematics. It is evident that the Grade 11 senior high school students from the control group obtained a general average of 80, which is verbally described as satisfactory, while the students from the experimental group garnered an average grade of 78, which is described as fairly satisfactory. This indicates that the performance level of the students in Mathematics was satisfactory. These students performed an acceptable achievement, and their math fluency shows their ability to perform mathematical problems with average accuracy.

This result is similar to Onal, Inan, and Bozkurt (2017,21), who pointed out that apart from developing calculating abilities and teaching numbers and mathematical operations, mathematics gives important skills like thinking in life, drawing connections between occurrences, reasoning, estimating, and problem-solving.

On the other hand, the performance of Grade 11 Senior High School students after explicit instruction from the control group was 80, described as satisfactory, and the students from the experimental group obtained an average grade of 85, which is described as very satisfactory. This signifies those students from the control group still had a satisfactory performance level, and their performance did not improve because they obtained the same rating of 80. However, the students from the experimental group improved their performance from 78 to 85, which implies that after the teachers used explicit instructions, the students showed a remarkable improvement in terms of solving math problems. Moreover, the students enjoyed the presentation using the concrete–pictorial–abstract approach when the teacher employed explicit instructions through SPEAR. This also implies that they learned a lot from the teachers after using explicit instructions.

Analysis suggests that the learners from the experimental group had a 7% increase in mathematics performance after the teachers used explicit instructions. This implies that the explicit instruction and the application of the concrete–pictorial–abstract approach were effective in teaching general mathematics to Grade 11 students.

The results of this study support the idea that explicit mathematics instruction is more effective than constructivist instruction for low-achieving students in basic multiplication (Kroesbergen et al. 2014, 33). The result of their study showed that students in the explicit instruction group demonstrated significantly greater improvement in math performance compared to the constructivist group. Both experimental groups showed substantially better performance than the control group. However, there were only minimal effects on students' motivation. Based on these findings, the study concludes that current changes in mathematics instruction, that emphasize student construction of knowledge, may not be beneficial for low-achieving learners in this particular context.

Pretest Results. Table 2 presents the results of the control and experimental groups in the pretest.

Table 2. The Pretest Result in General Mathematics of the Control and Experimental groups

Pretest Result of the Control Group			Pretest Result of the Experimental Group		
Mean	Equivalent	Description	Mean	Equivalent	Description
5.56	70.00	***Did not meet expectations***	5.09	70.00	***Did not meet expectations***

Legend:
90-100 = Outstanding 85-89 = Very satisfactory 80-84 = Satisfactory
75-79 = Fairly Satisfactory Below 75 = Did not meet expectations

Table 2 shows the pretest result in General Mathematics of the control and experimental groups. It is evident that the pretest result of the control group obtained the mean of 5.56, which is equivalent and transmuted as 70, and was verbally described that the students did not meet the expectations. In addition, the pretest result of the experimental group obtained the mean of 5.09, which is equivalent and transmuted as 70, and was verbally described that the students did not meet the expectations. This suggests that the students from the control and experimental groups had very poor performance in general mathematics during the pretest. This indicates further that the students did not meet the expectations based on their performance in General Mathematics.

This result is similar to the findings in the PISA 2018 International Report (OECD, 2019, 2), which stated that the average mathematical literacy score for Filipino learners was 353 points, which is much lower than the OECD average of 489 points and indicates below Level 1 proficiency. A 15-year-old's ability to articulate, apply, and interpret mathematics in a variety of situations to describe, predict, and explain occurrences is also measured by the outcome, which acknowledges the importance of mathematics in society.

Despite the fact that students performed very low in the pretest, it is still considered that in addition to developing calculating abilities and teaching numbers and mathematical operations, mathematics provides fundamental skills, including thinking in the real world, creating linkages between occurrences, reasoning, estimating, and problem-solving (Onal, Inan and Bozkurt 2017, 12).

Posttest Results. Table 2 presents the results of the control and experimental groups in the posttest.

Table 3. The Posttest Result in General Mathematics of the Control and Experimental Groups

Posttest Result of the Control Group			Posttest Result of the Experimental Group		
Mean	Equivalent	Description	Mean	Equivalent	Description
11.78	80.00	**Satisfactory**	13.31	85.00	**Satisfactory**

Legend:
90-100 = Outstanding 85-89 = Very satisfactory 80-84 = Satisfactory
75-79 = Fairly Satisfactory Below 75 = Did not meet expectations

Table 3 exhibits the posttest results in general mathematics of the control and experimental groups. It is evident that the students from the control group obtained a mean of 11.78, which is equivalent to 80 and is described as satisfactory. This means that the students had average performance in general mathematics after the teacher administered the posttest. Moreover, it is also apparent that the students from the experimental group obtained a mean of 13.31, equivalent to 85, and was described as satisfactory. This denotes that the students from this group had an average performance in General Mathematics after the teacher administered the posttest.

This implies an increase of 6.22 points or 10% in the performance of the students from the control group and an increase of 8.22 points or 15% in the performance of the students from the experimental group. The increase in the students' performance indicated that they have gained and learned mathematics and problem-solving in General Mathematics. Hence, the explicit instruction and the application of concrete – pictorial – abstract approach were effective in teaching general mathematics.

The result of these findings is supported by Magbanua (2018, 5), who found that explicit instruction (EI) is effective in improving students' problem-solving and creative thinking skills in a Problem-Solving course. The exploration evaluated the effectiveness of explicit instruction and traditional instruction (TI) by assessing students' performance before and after the instruction. Both EI and TI were found to be effective in enhancing problem-solving and creative thinking skills, but the EI group had a greater confidence interval. The EI group exhibited significantly greater mean gain scores in problem-solving and creative thinking skills versus the TI group. Students in the EI group demonstrated a better understanding of problems, the ability to identify and implement strategies, and the generation of various ideas for problem-solving. They also developed a positive attitude towards explicit instruction.

Mean Gain Scores of the control and experimental groups in the pre and posttest. Table 4 shows the mean gain scores of Grade 11 students in General Mathematics of the control and experimental groups. It is also revealed that the students from the control group obtained a mean of 5.56 in the pretest and 11.78 in the posttest. This results in the mean gain score of 6.22 achieved by the students from the control group. It is evident that the standard deviation of 1.94 reveals that the scores are narrowed and close to the mean in the pretest. Given the standard deviation of 2.35, the scores are scattered from the mean. This means that students' scores lie far from the mean. This implies that the scores of the students from the control group have improved.

Table 4. The Mean Gain Scores of Grades 11 Students in General Mathematics of the Control and Experimental Groups

	Control		**Experimental**	
Variables	**Mean**	**Std.**	**Mean**	**Std.**
Pretest	5.56	1.94	5.09	1.26
Posttest	11.78	2.35	13.31	1.92
Mean Gain Score	**6.22**	**0.41**	**8.22**	**0.66**

It is also shown in the table that the students from the experimental group obtained a mean of 5.09 in the pretest and 13.31 in the posttest. This results in the mean gain score of 8.22 attained by the students from the experimental group. It is also revealed in the table that the standard deviations of 1.26 and 1.92 indicate that students' scores are narrowed and close to the mean. This means that students' scores lie within the mean. This implies that the scores of the students from the experimental group were increased.

This finding is supported by Khashi'ie et al. (2018, 16), who confirmed that the student's performance in the posttest was superior compared to the pretest. However, statistical analysis of learners' performance by each question demonstrated that most students understood the basic concepts in Algebra, Trigonometry, and Functions.

Testing the difference in the mean gain scores of the experimental and control groups. Table 5 shows the result of the Paired Samples T-test on the significant difference in the mean gain scores of the students of Grade 11 General Mathematics. It is evident that the mean gain scores of the experimental and control are 8.22 and 6.22, respectively, and the t-value of 4.890 with a p-value < 0.05 indicated that a significant difference existed. This means that both groups improved. Just that there is a significant difference in their performance. Thus, the experimental group performed better given the intervention.

Table 5: The Significant Difference in the Mean Gain Scores of the Grade 11 Students in General Mathematics

Respondents	Mean Gain Scores	t-value	P-value	Interpretation
Experimental	8.22	4.890	.000	Significant
Control	6.22			

**Significant at @=0.05*

This infers that students from the experimental group improved their scores during the posttest because the teachers used explicit instructions and applied the CPA approach. Hence, it can be implied that the explicit instruction and the application of the concrete–pictorial–abstract approach were effective in teaching general mathematics to Grade 11.

These findings were supported by Archer and Hughes (2011, 21), who emphasized the effectiveness of explicit instructions in enhancing student learning outcomes. It outlines research-based strategies that promote explicit teaching, such as providing clear explanations, modeling, guided practice, and corrective feedback. By explicitly instructing the students so they learn the content and skills, providing modeling and guided practice, and offering explicit feedback, teachers can enhance students, performance posttest. In addition, Putri et al. (2019) concluded that learners who learnt using the CPA approach had improved spatial sense compared to those who received traditional instruction. Therefore, teaching with the CPA technique helps enhance and strengthen students' spatial sense skills.

Testing the difference in the pre and posttest results of the control and experimental groups. Table 6 shows the result of the Paired – Samples T-test on the significant difference in the pretest and posttest results in General Mathematics of the control and experimental groups. It is evident that the t- t-value of the pretest was 4.274, and the posttest had the t-value = 2.989 with p-values < 0.05 indicating that the significant difference exists. This means that the hypothesis stated a significant difference in the pretest and posttest results in General Mathematics of the control and experimental groups.

Table 6. The Significant Difference in the Pretest and Posttest Results in General Mathematics of the Control and Experimental Groups

Respondents	Control	Experimental	t-value	P-value	Interpretation
Pretest	5.56	5.09	4.274	.000	Significant
Posttest	11.78	13.31	2.989	.000	Significant

**Significant at @=0.05*

This suggests that the students improved their performance in General Mathematics by obtaining an increase in the posttest result. It is also evident that students from the experimental group had satisfactory performance during the posttest, because they obtained an increase of 8.22 mean scores compared to those in the control group.

The result is supported by Doabler et al. (2015), who emphasized that the students showed improved academic performance in mathematics during posttest when teachers utilized explicit instructions. This aligns with research and pedagogical practices that emphasize effectiveness of explicit instructions in enhancing student learning outcomes. By providing clear explanations, modeling, guided practice, and corrective feedback, explicit instructions assisting students in comprehending mathematical ideas, refining their problem-solving techniques, and successfully applying their knowledge.

Conclusions and Recommendations

This study determined the performance of grade 11 senior high school students using explicit instruction in teaching General Mathematics and the application of concrete–a pictorial-abstract approach. Based on the findings, it can be concluded that the performance of Grade 11 senior high school students before using explicit instruction was fairly satisfactory, and after using explicit instruction was satisfactory. The pretest result in General Mathematics of the students from both the control and experimental groups was very poor. The posttest result in General Mathematics of the control group was satisfactory, and the experimental group was very satisfactory. The mean gain scores of Grades 11 students in General Mathematics of the control group increased by 6.22, and the experimental group increased by 8.22. There was a significant difference in the mean gain scores of the Grade 11 students in General Mathematics. There was a significant difference in the pretest and posttest results in General Mathematics of the control and experimental groups.

The teachers' commitment to enhancing current teaching practices for Grade 11 senior high school students in General Mathematics through explicit instruction and a concrete-pictorial-abstract approach is commendable. By reflecting on teaching methods and student needs, the significance of incorporating explicit instruction is highlighted. This method guarantees students receive precise and direct guidance, facilitating a more profound comprehension of mathematical concepts. It also aids in addressing any misunderstandings or knowledge gaps that students may have.

Additionally, the use of a concrete-pictorial-abstract approach in teaching mathematics is highly effective. By starting with concrete objects or manipulatives, students are able to engage in hands-on learning experiences that help them visualize and understand the concepts. This is then followed by the use of pictorial representations, such as diagrams or models, which further reinforce understanding. Finally, students are able to move towards abstract thinking and problem-solving.

It is highly recommended that teachers are advised to apply their learnings in teaching General Mathematics to Grade 11 senior high school students using explicit instruction and a concrete-pictorial-abstract approach in order to demonstrate a commitment to improving existing practices and ultimately enhancing the learning outcomes of the students. They may also integrate the SPEAR in Math where the Students' Performance was engaged in their performance task and the teacher recorded their Response through the output using the rubrics.

Action Plan

Objectives	Strategies/ Activities	Time Frame	Persons involved	Resources Needed	Expected Outcomes
PPA 1: Administration of Pretest & Posttest					
Administer Pretest & Posttest every quarter	Administering the Pretest & Posttest every quarter	First Semester of Every School Year	• Subject Group Head • Teachers • Students	Printed Copy of the Modules, Lesson Plan, Handouts, Pretest and Posttest	Students equipped with life learning skills.
PPA 2: Remedial classes and utilization of explicit instruction in teaching in general mathematics for grade 11 students					
Give remedial classes and utilize explicit instruction in teaching general mathematics	Giving remedial classes and utilizing the Explicit instruction in Teaching General mathematics	First Semester of Every School Year	Subject Group Head Teachers Students	Printed Copy of the Modules, Lesson Plan, Handouts	Students improved the Average grade in general mathematics
PPA 3: Peer tutorial in general mathematics for students and integration Concrete Pictorial abstract approach					
Provide peer tutorial in General mathematics to students and integrate Concrete Pictorial abstract approach	Providing the peer tutorial in General mathematics to students and integrating the Concrete Pictorial abstract approach	First Semester of Every School Year	Subject Group Head Teachers Students	Printed Copy of the Modules, Lesson Plan, Handouts	Students performed outstanding achievement in general mathematics

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Financial Report

A. Supplies and Materials					
ITEMS	QTY	UNIT	DESCRIPTION	UNIT PRICE	TOTAL AMOUNT
1	4	Reams	A4 size S20 Bond Paper	250.00	1,000.00
2	2	Set	Cannon Computer Ink	1500.00	3,000.00
3			Binding Expenses	2,000.00	2,000.00
5			Miscellaneous		5,000.00
Total					**11,000.00**
6			Contingency Expenses (5%)		550.00
Grand Total					**PHp11,550.00**

Appendix A

Pre & Post Tests in Gen Math
2nd Quarter (1st Semester SY 2022-2023)

MULTIPLE CHOICE
Directions: Choose the letter of the correct answer and write the letter on the space provided for.

_______1. The amount of money borrowed or invested on the origin date.
a. rate b. principal c. future value d. interest

_______2. The amount of time in years when the money is borrowed or invested.
a. term b. origin date c. maturity date d. rate

_______3. The person or institution that invests the money or makes the funds available.
a. lender b. collector c. borrower d. debtor

_______4. The amount after t years that the lender receives from the borrower on maturity date.
a. present value b. rate c. maturity value d. principal

_______5. It is based on a 30-day month computation.
a. actual time b. approximate time c. ordinary interest d. exact interest

_______6. Find the actual time from February 20, 2018 to December 15, 2018.
a. 296 days b. 297 days c. 298 days d. 299 days

_______7. Find the approximate time from October 23, 2018 to June 9, 2019.
a. 225 days b. 226 days c. 227 days d. 228 days

_______8. How much simple interest would acquire the an amount of PHP 10, 000 after 6 years at a rate of 3%?
a. PHP 1,500.00 b. PHP 1,800.00 c. PHP 1,900.00 d. PHP 2,100.00

_______9. Suppose you invested PHP 35, 000 at a simple rate of 2.5%, how much will be your investment after 10 years?
a. PHP 43,750.00 b. PHP 45,370.00 c. PHP 45,730.00 d. PHP 47,350.00

_______10.Peter borrowed PHP 153, 000 at 8% compounded annually. How much he will be paying after 3 years?
a. PHP 129, 375.49 b. PHP 192, 735.94 c. PHP 195, 372.94 d. PHP 197, 273.94

_______11. What interest remains constant throughout the investment term?
a. simple b. compound c. annuity due d. ordinary annuity

_______12. It is an interest computed based on the principal amount.
a. simple b. compound c. annuity due d. ordinary annuity

_______13. What is the difference between simple and compound interest?
a. Simple yields higher interest than compound interest.
b. Simple interest has a shorter term than compound interest.
c. Simple interest is always better than compound interest.
d. Simple interest is computed based on the principal while compound interest is computed based on the principal and also on the accumulated past interests.

_______14. If you would like to invest money, which bank offer would you prefer if you do not plan to withdraw your money in 2 years?
a. 5% simple interest per annum b. 4% compounded interest per annum

c. 3% compounded interest semi-annually d. 2% compounded interest quarterly

_______15. Which of the following statement is true about the borrower or debtor?

a. It is the amount of money borrowed or invested on the origin date.

b. It is the interest computed on the principal and also on the accumulated past interests

c. It refers to the person (or institution) who owes the money or avails of the fund from the lender.

d. It refers to the person (or institution) who invests the money or makes the funds available.

_______16. Which of the following statements is/are true?

I. Compound interest of a loan favors the borrower.

II. Simple interest remains constant throughout the investment term.

III. In compound interest, the interest from the previous year also earns interest.

a. I only b. I and II c. II and III d. I and III

_______17. Which of the following formula can be used to solve for the simple interest?

a. $I = Prt$ c. $A= P(1 + rt)$

b. $SI = \frac{Prt}{100}$ d. All of the above

_______18. It is an amount after t years that the lender receives from the borrower on the maturity date.

a. loan date c. maturity value

b. maturity date d. term

_______19. Which of the following describes time or term?

a. It is the date on which money is received by the borrower.

b. It is the amount of time in years the money is borrowed or invested; length of time between the origin and maturity dates

c. It is the date of which the money borrowed or loan is to be completely repaid

d. It is the amount paid or learned for the use of money.

_______20. In the formula, I= Prt, what is r?

a. revenue c. repaid

b. real value d. rate of interest

Appendix B

Informed Consent Form

Dear Respondent,

Greetings!

I am currently writing my action Research study with the title. **"EXPLICIT INSTRUCTION IN TEACHING GENERAL MATHEMATICS AND THE APPLICATION OF CONCRETE – PICTORIAL-ABSTRACT APPROACH".** You are invited to take part in this research. It is my hope that this study will benefit you as a student. The objective of this study is to determine the performance of grade 11 senior high school students using explicit instruction in teaching general mathematics and the application of a concrete–pictorial–abstract approach. There are no identified risks from participating in this research. There are no costs and no monetary compensation to you for your participation in this study.

Your participation in this research is completely voluntary and you may refuse to participate without consequence. Responses to the survey will only be reported in aggregated form to protect your identity. The collected data will be treated with utmost confidentiality.

Sincerely yours,

DEBORAH E. BANDAHALA
Researcher

CONSENT:
By signing this consent form, I confirm that I have read and understood the information and have had the opportunity to ask question/s. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving a reason and without cost. I voluntarily agree to take part in this study.

____
Respondent's Signature over Printed Name