PERFORMANCE OF GRADE 8 LEARNERS IN SOLVING PISA-LIKE QUESTIONS IN MATHEMATICS

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DepEd – Digos City Division

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Abstract

Philippines has participated in the Programme for International Student Assessment (PISA) since 2018. The recent results of PISA urged the researchers to think about the possible interventions that the schools can offer to learners. Limited information on the capability of Grade 8 learners to answer PISA questions has prompted the researchers to delve on the study which aims to determine the level of the difficulty of these learners to solve mathematics PISA-like questions focusing on the following topics, namely: sets with the use of Venn diagrams, algebraic expressions, and equations and inequalities in one variable. The self-made questions were validated by five experts, achieving a content validity index of 1.00, and then were subjected for reliability test to 30 participants, resulting in an acceptable Cronbach's alpha coefficient of 0.739. Out of 3,061 Grade 8 learners, 250 of them were randomly chosen from all public schools, and were interviewed to assess at which stage they were unable to proceed with the solution to the problems. It was found that five to eight out of ten learners were unable to proceed due to a lack of comprehension of the given problem. However, it was noted that only 10% to 30% of learners were able to provide complete and accurate solutions to the problem. To address this, intervention programs were suggested.

Keywords: PISA, problem-solving skill, Venn diagram, algebraic expression, linear equation and inequality.

Approval Sheet

This research entitled "PERFORMANCE OF GRADE 8 LEARNERS IN SOLVING PISA-LIKE QUESTIONS IN MATHEMATICS", prepared and submitted by Jem Boy B. Cabrella, Kremia Katrina C. Thiam, Imma Tessie Donne D. Llemit, is hereby recommended for approval.

Recommending Approval:

BEVERLY S. DAUGDAUG, EDD
Chief Education Supervisor- Curriculum Implementation Division
Digos City Division

Approved:

MELANIE P. ESTACIO, PhD, CESO VI
Schools Division Superintendent

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-Jem Boy, Kremia Katrina, Imma Tessie Donne

Chapter I
Introduction

Rationale

Mathematics is a subject universal to all human beings. Humans need mathematics because it is a way of life; it is embedded in cultures and histories; it is present in workstations; and it is indispensable in the scientific and technical communities. Thus, understanding how to apply mathematics to real-life situations is a crucial aspect of enhancing the quality of education on a global scale.

Md (2019) mentioned that in order to withstand the challenges of the world students need to acquire one of the 21st century skills and that is problem-solving. It is a basic cognitive function of human beings to have the ability to solve problems and find an appropriate solution to achieve the desired goal. This is also highlighted in the Partnership for 21st Century Skills in which problem-solving skills are essential to become successful in the modern world. Problem-solving has been identified as one of the five important strands of school mathematics (National Council of Teachers of Mathematics, 2000, as cited in Suseelan et al., 2022).

In the Philippines, the Department of Education (DepEd) has continued to revamp the mathematics curriculum throughout the years with the aim to find solutions to the learning gaps and identify the areas that can be improved. In order to adapt to the evolving landscape of education together with the changes in international standards, problem-solving is an essential skill for junior high school students to learn and it is one of the goals of mathematics in the basic education levels of the K to 12 Basic Education Curriculum (Department of Education, n.d., p. 3). All learners who have completed the K to 12 Basic Education Program are individuals fostered and honed to become Filipinos with 21st-century skills.

While hardly a major shift, the Philippines participated for the second time in the Programme for International Students Assessment (PISA) 2022 and its mathematics results were about the same as in 2018. In the country, 16% of students attained at least Level 2 proficiency in mathematics which was significantly less than the average across Organization for Economic Cooperation and Development (OECD) countries which is 69%. Almost no Filipino students attained Level 5 or 6 in the PISA math (OECD, 2023)

The PISA 2022 report also noted that 84% are low-performing students meaning they scored below Level 2 while only 9% are high-performing, scoring at Level 5 or above. This implies that most of them do not have sufficient problem-solving skills to use simple formulas and strategies to solve word problems that involve using one variable as part of the solution. At a minimum, the students can interpret and recognize word problems without direct instructions (OECD 2023).

In the 2018 PISA result (Department of Education, 2019, p.27-28), Filipino students achieved an average score of 353 points in mathematics, which was significantly lower than the OECD average of 489 points and classified as below Level 1 proficiency. The majority of them (80.70%) were classified as having Proficiency Levels below Level 2, with 54.4% below Level 1 proficiency. Also, 19.7% attained Proficiency Levels 2 to 4 and as little as 0.01% of students performed within Proficiency Levels 5 to 6. In Region XI, the average score in Mathematical Literacy is 344 which is lower than the national average of 353 points. The region also ranked 9th, with students below level 1 proficiency at 59.16% and only 3.51% and 0.23% of students reached Level 3 and Level 4 proficiencies, respectively (Department of Education, 2019, p.31-32).

The results above mean that a great number of students can barely employ basic algorithms, formulae, procedures or conventions to solve problems involving whole numbers, let alone perform a higher-level skill that involves selecting, comparing and evaluating appropriate problem-solving strategies for dealing with complex problems (Department of Education, 2019, p.25-26). This clearly implies that students have difficulties in terms of solving word problems in Math. Comparing the 2018 and 2022 PISA math results, the country has barely improved with its average score from 353 to 355.

In the National Achievement Test (NAT) for Grade 10 during S.Y. 2022-2023, the MPS for Mathematics at the national level was 36.06% for Problem-Solving, 36.05 % for Informational Literacy and 36.03% for Critical Thinking. At the regional level, the math MPS was 32.76% for Problem-Solving, 32.71% for Informational Literacy and 33.07% for Critical Thinking.The grades are comparable in the Digos City Division as the MPS fell in the same range-30.53% in Problem-Solving, 31.10% in Information Literacy, and 33% in Critical Thinking. Similarly, Grade 12 students' NAT MPS in Problem-Solving, Information Literacy, and Critical Thinking were 33.06%, 38.95%, and

45.14%, respectively. All scores fell in the low proficient level indicating that students did not meet the minimum level of skills in solving problems, managing and communicating information, and analyzing and evaluating data to comprehend ideas (Department of Education Region XI, 2024, slides 4-6).

This situation was also evident in the Regional Achievement Test (RAT) in 2024 where the scores in math are generally low, especially in junior high school. The overall MPS ranged from 28.289% (Grade 8) to 40.356% (Grade 4). While the Grade 4 students performed the best, the performance declined in higher grade levels. A steady drop in math performance after Grade 6 can suggest a challenge in the upper levels. Grades 11 and 12 also struggled in their General Math as both levels underperformed with MPS of 25.382% and 25.338% respectively (Department of Education Region XI, 2024). A minimal difference between the two grades indicates that the students have trouble understanding math concepts in their senior years.

Difficulty in solving mathematical problems can be attributed to students' beliefs about the subject. Some think that there is only one correct, specific formula or process to solve a problem or there is only one right answer for every mathematical problem. Conventional teaching methods such as demonstrations, exercises, and practice using mathematical problems with known formulas and expected procedures fall short of equipping students with the necessary skills in the future (Tan, 2018). This is in line with the research of Gavaz et al. (2021) in which they noted that some students do not have the flexibility in solving math word problems and gravitate to using only one strategy.

This is very common to students who are used to solving routine problems in which they follow specific formulas and general rules to arrive at a correct answer. As defined by Polya (2004), a problem is a "routine problem" if it can be solved either by substituting special data into a formerly solved general problem, or by following step by step, without any trace of originality. The downside is that learners find it hard to solve non-routine problems because they are not practiced in thinking "outside of the box" and finding alternative solutions or procedures to the given word problems. These kinds of problems are rarely presented in the classrooms and as a result, their cognitive abilities are not trained to solve Higher Order Thinking Skills (HOTS)

questions which international assessments have. This could be one of the factors contributing to the low PISA scores.

Non-routine problems are problems that resemble real-world circumstances and don't offer hints to solve using established methods (Arslan & Altun, 2007). Finding answers to non-routine problems necessitates the development of strategies and tests one's ability to think of what mathematical concepts are involved (Johnny et al., 2017). Countries that performed well in international mathematics assessments like TIMSS (Trends in International Mathematics and Science Study) and PISA (Program for International Student Assessment) devote more time to non-routine problems (Arslan & Yazgan, 2015, as cited in Shawan et al., 2021).

Therefore, providing an opportunity for the students to exercise their abilities to plan, evaluate and decide which methods to use can advance their capacities in solving problems. The mathematical problem-solving ability of the students can be greatly improved by exposing them to non-routine problems specifically PISA-like questions so that they can learn to use their judgement and reasoning skills, and gain a higher ability to think mathematically.

Numerous educators have sought ways to address educational issues and develop innovations, interventions and methods to solve learning gaps and find areas of improvement through research. Research provides valuable information on which our lawmakers can have a basis to create or ameliorate policies, standards, programs and strategies. As such, this study was actualized.

Based on the above discussion, the purpose of this research is to explore the difficulties faced by the students in solving mathematics PISA-like questions using Newman's Error Analysis method. This method can be utilized to analyze errors committed by students in solving problems (Priliawati et al., 2019). The researchers find it urgent to conduct this study with the optimism that it can serve as a valuable guideline for teachers, administrators and future researchers to design interventions or innovations in the future that can effectively enhance students' problem-solving skills.

Literature Review

Improving Mathematical Problem-Solving through the Utilization of PISA-like Questions

The main goal in teaching mathematics is to equip students with 21st-century skills that can help them in solving their daily life problems. In the PISA 2022 Mathematics Framework, mathematical literacy is defined as follows:

> *"Mathematical literacy is an individual's capacity to reason mathematically and to formulate, employ, and interpret mathematics to solve problems in a variety of real-world contexts. It includes concepts, procedures, facts and tools to describe, explain and predict phenomena. It assists individuals to know the role that mathematics plays in the world and to make the well-founded judgments and decisions needed by constructive, engaged and reflective 21st-century citizens."*

The three terms "formulate," "employ," and "interpret" offer a practical and relevant framework for organizing the mathematical procedures that people use to link the context of the problem with mathematics and find a solution. Problem-solving is one of the aspects of mathematical literacy (PISA 2022 Mathematics Framework, 2018). By training students to solve PISA-like questions, the students become analytical and logical and are able to branch out their knowledge and build thinking processes that can advance their problem-solving ability. These types of problems drill skills in their minds that they need to prepare them in the realities of life.

Fadlila et al. (2023) stated that their developed PISA-like math problems about Change and Relationship have positive potential effects on the students' mathematical literacy skills involving communication skills, using of math symbols, formula and operations, and their reasoning abilities. Also, research by Sutama et al. (2020) has proven that using questions developed from PISA model can have a positive potential effect on the students' mathematical literacy skills.

In the works of Dasaprawira et al. (2019), the generated PISA mathematical problem can have potential effects in improving the reasoning ability, mathematization, representation, and communication of the students. The students were able to give logical reasons and from that they were able to

do mathematical calculations. They were also able to present and justify their answers.

Further study (Usnul et al., 2019) has reported that the developed PISA question using contextualization had a potential effect on students. The majority of the pupils were motivated to solve the provided equivalent PISA questions. In addition, rather than the typical math problems, the majority of pupils were eager to work on the PISA questions that had been developed.

Almarashdi & Jarrah (2022) created MEP (Maths Enrichment Program) based on the framework of PISA for mathematical literacy. Part of the program was solving PISA-related items. The findings obtained from the intervention affirmed the idea that using math problems from PISA can increase the mathematical literacy of the students.

Dewantara et al. (2015) further concurred that well-developed PISA-like mathematics problems which were validated by experts can have potential effects in developing students' mathematical literacy as shown by the activation of these three mathematical processes: formulate, employ and interpret. The results of the study revealed that the highest percentage of what the students accomplished came from interpreting the problems correctly (52.5%) followed by doing tasks that involved them to employ (40.74%) and to formulate (39.63%). In this aspect, providing students opportunity to work on PISA-like problems can have promising impact on the development of their problem-solving skills.

Nizar, et al. (2018) also suggested that using contextualized math problems like in PISA can help students train their problem-solving ability. The purpose of PISA questions is to enhance students' problem-solving skills through applying math to real-world scenarios. PISA-like questions can help students become accustomed to solving problems similar to PISA questions and can have an impact on PISA scores in the future (Islamirta, 2022).

Impact of PISA results on the Philippines' educational system and other participating countries

In alignment with DepEd's Sulong Edukalidad program, the Philippines participated in PISA- an international system assessment meant to measure the quality of education in the country. The goal of PISA is to evaluate education systems worldwide by testing the skills and knowledge of 15-year-old students in three main domains: Reading, Mathematics and Science which

is done every three years. PISA tests how students can apply their knowledge to real-life situations and problems, rather than testing their knowledge retention (DepEd Order No. 29, S. 2017).

In a DepEd Memorandum (DepEd Order No. 29, S. 2017) titled "Policy Guidelines on System Assessment in the K to 12 Basic Education Program", the implementation of PISA can provide reliable data for international benchmarking and can show evidence that would be bases for the improvement of learner development programs, measure the effectiveness of K to 12 curriculum in schools and aid higher authorities in educational planning and policy formulation at the division, regional and national levels.

When the OECD published the results of the 2018 PISA test, the figures were not stellar. It showed the urgency of finding solutions to the issues and gaps that hinder DepEd in attaining its vision and mission. With this, the agency implemented reforms in 4 key areas: a) review and update the K to 12 curriculum, b) improve learning facilities, c) upskill and reskill teachers through trainings and d) engage all stakeholders for collaboration and assistance (DepEd Press Release, 2020).

In particular, PISA results call for appeals to the government and policymakers to make changes in the educational system of the country based on the students' performance, in which the significant data provided by PISA showed how ready students are with the realities of the world and meet their country's expectations (Gür et al., 2012). This implies that PISA has become the 'judge' for global education standards, awakening up minds for the possibility of reforms and confidence in its implementation.

According to Anne-Berlit Kavli (Panjeta, 2019), large-scale assessments such as PISA can bring improvement of the quality of learning and can reveal imperfections in an education system. By comparing the effectiveness of educational systems in various countries, analysis of the effectiveness and efficiency of different educational systems can be used as anchors of which educational reforms can be made. This puts education on the national and international agenda by which the development of education system is prioritized.

The Welsh government (Hughes, 2021) also used the PISA 2009 result as catalyst to build a large-scale school improvement reform. Policies were introduced which ultimately led to the present 'tripartite reform' of the curriculum. This revision highlighted the importance of providing professional

development programs for presently teaching educators and trainings for aspiring teachers.

In Ireland (Kirwan, 2015), the PISA conceptual framework had a significant impact on the Irish government's revision of its mathematics education policy, and the country's concern over scoring "average" on the international assessment helped to determine the revision's course. It had an impact on the founding of Project Maths and the rationale of its implementation. It was demonstrated that the goal of Project Maths, which was to teach mathematics in contexts that enable students to see connections between mathematics alongside other subjects as well as between mathematics and its application in everyday life, facilitated the establishment of the curriculum within the conceptual framework of PISA.

In Asia, Singapore is consistent in achieving outstanding performance ratings in the PISA test. The education in Singapore has received immense recognition and admiration among Asian countries of which it prioritized high-quality instruction and learning (Mustafa, 2023). Singapore’s participation in PISA showed its commitment to excel in education and through comparing its educational system's performance to global norms, the country is able to formulate and update educational policies, initiatives and curriculum that are relevant and suitable to the needs of their students (Kaur, 2014).

The data from PISA was also used by Chinese education officials to accomplish two main goals: a) draw attention to current issues in Shanghai's schools in order to demonstrate the need for reform and b) increase support for ongoing reform efforts so that Shanghai's educational goals and nature are re-defined. This was clearly seen as the country emerged top in Mathematics, Reading and Science in PISA 2009 and 2012 (Tan, 2019).

Sharing knowledge across borders to raise the standards of education is more necessary than ever. The requisites for education and educational policies and reforms are at an all-time high. PISA is not only the most thorough and trustworthy international comparison of the students’ abilities in the world, but it is also integrated with a variety of techniques and tools at the OECD, such as country and thematic policy reviews, that nations can use to place the results from PISA in the various contexts in which students learn, teachers teach, and schools operate and to fine-tune their educational policies. These tools can help education lawmakers in the same way that business executives learn to guide their organizations toward success: by

looking to others for inspiration and then applying what they have learned to their own circumstances (Schleicher, 2019).

Statement of the Purpose

The study intends to explore the difficulties faced by Grade 8 learners in solving mathematical PISA-like questions and determine the factors behind those challenges. It is believed that identifying these difficulties could help improve the understanding between the PISA Framework in mathematical literacy and the standards of the K to 12 curriculum.

Gaps in education in the aspects of the students' learning, the teachers' strategies used when teaching solving problems, the implementation of educational policies and reforms in schools are intertwined together and must be scrutinized to assess how to strengthen the campaign to make education not just accessible but provide it with quality and hone students to become globally competitive.

Since PISA is the way moving forward, this research is very timely and relevant in addressing one of the dilemmas in mathematics education and eventually create and develop interventions to better the problem-solving skills of the students when answering PISA-like questions. In addition, this study could provide significant data to forge scholarly discussion amongst researchers who are interested work on the same educational issues and provide an overview for new researchers in the subject of international large-scale assessments and may inspire others to reflect upon the relationship between the scope of PISA-related research and knowledge obtained from it (Hopfenbeck, 2018).

Research Objective

Generally, this quantitative research aims to assess Grade 8 learners on their difficulties in solving mathematics PISA-like questions. Following is the research objective:

- Determine the difficulties experienced by Grade 8 learners in solving mathematics PISA-like questions on the following most essential leaning competencies under numbers and number sense, and patterns and algebra:
    a. solves problems involving sets with the use of Venn diagram;
    b. solves problems involving algebraic expressions; and

c. solve problems involving equation and inequalities in one variable

Conceptual Framework

The study utilizes the Input-Process-Output (IPO) model which serves as a structured framework for understanding and analyzing how activities and resources transform into desired outputs. It is grounded on the Systems Theory which emphasizes the interaction between components to achieve efficiency and effectiveness. In this model, input represents the foundational element required for a process to begin such as human resources, materials, policies and information. The process stage uses systematic processes, including planning, execution and evaluation, to transform inputs to outputs. Finally, the output stage is made up of the tangible or intangible outcomes produced by the process, such as achieved objectives, enhanced abilities or completed projects (Von Bertalanffy, 1968).

Figure 1 explicitly illustrates the conceptual framework of the study using Input-Process-Output (IPO) Model. It depicts that the input of the study is the profile of Grade 8 learners on their difficulties in solving mathematics PISA-like questions regarding the selected most essential learning competencies.

In the process, the data can be gathered by conducting an assessment using Newman Error Analysis (NEA) which is analyzed using appropriate descriptive statistics. According to White (2010), Newman's Error Analysis provided a framework for considering the reasons that caused the difficulties students experienced in solving word problems in Mathematics and a process that helped teachers identify where misunderstandings or errors occurred. Additionally, it provided an excellent professional learning program for teachers and made a nice link between literacy and numeracy.

Furthermore, the output will be a Mathematics Intervention Program formulated based on the profile of the learners on the difficulties of Grade 8 learners.

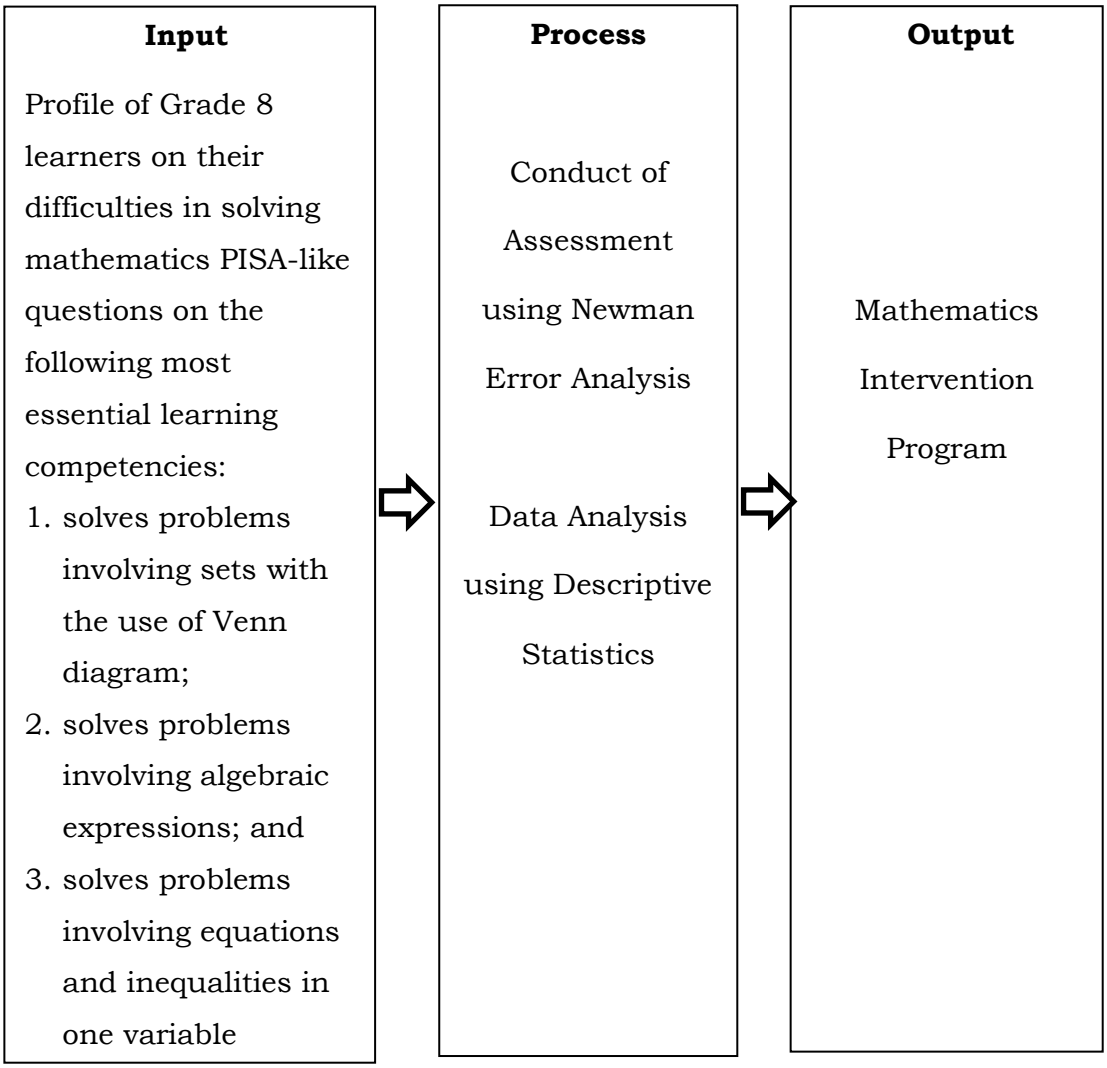

Figure 1. Conceptual Framework of the Study Using Input-Process-Output (IPO) Model

Scope and Limitation

This research focused on finding out the difficulties of Grade 8 learners in solving mathematics PISA-like questions. The data collection was conducted in the 12 public secondary schools of Digos City Division with 250 Grade 8 learners as the participants. Thus, the results of the study do not automatically apply to students in other divisions or regions. Using the same questions, the results may differ in the distribution of the types of errors.

The researchers only utilized mathematics PISA-like questions. The contents only included the following most essential learning competencies, namely: (1) solves problems involving sets with the use of Venn diagram; (2) solves problems involving algebraic expressions; and (3) solves problems involving equations and inequalities in one variable. Therefore, the difficulties are unique to the set of developed PISA-like questions in the specified contents and somehow not an exhaustive list. Other PISA contents and questions might elicit different student responses and errors.

Significance of the Study

The results of this research will benefit the following:

Division Education Program Supervisor. The data will provide significant information to the Division Education Program Supervisor in mathematics to develop an intervention that can be institutionalized at the division level, design training that can enhance school heads and master teachers' instructional leadership skills in the provision of technical assistance to master teachers and teachers specifically on problem-solving skills or numeracy in general and provide policy direction such as, but not limited to, the inclusion of integration of literacy to numeracy.

School Heads. This research will provide insights to the Principals or Schools Heads on how to address concerns regarding the mathematical problem-solving skills of the students that are beneficial in solving PISA-like questions, especially that the students are being prepared for the PISA assessments.

Department Heads. The current study will give relevant knowledge to the department heads to conduct meetings with the Master teachers to stress the importance of equipping the teachers with the right approaches in preparing students for PISA assessments and improving their mathematical problem-solving abilities.

Master Teachers. It will offer important details to the Master teachers as to how they can mentor their teachers in applying interventions designed in the division level that can improve problem-solving in PISA-like questions and to conduct Learning Action Cell (LAC) sessions to collaboratively discuss with them how to solve difficulties in solving PISA-like problems.

Teachers. The data will guide the teachers to better understand the factors behind the difficulties of the students when answering PISA-like questions and implement interventions in their classrooms or change of teaching techniques to help students enhance their mathematical problem-solving.

Students. It will help the students in improving their mathematical problem-solving and PISA questions will not be foreign to them anymore. Thus, in the succeeding years, they will be prepared to take PISA assessments.

Future Researchers. This study will serve as a helpful reference for educators, educational authorities and researchers who intend to conduct research or expand their studies related to addressing the difficulties of the students in answering PISA-like questions.

Chapter II
Method

This chapter discusses the methods used for collecting and analyzing the data in this research including research design, population and sample, research instrument, data collection, ethical consideration and data analysis tool.

Research Design

Descriptive statistics was utilized to facilitate the description and summarization of data (Cooksey, 2020). In this study, descriptive statistics is employed to summarize and analyze data, providing insights into the patterns, trends, and characteristics of a dataset on the difficulties of Grade 8llearners in solving mathematics PISA-like questions. Hence, it is a preliminary analysis strategy used to better comprehend the dataset before using more sophisticated statistical methods (Alabi & Bukola, 2023).

Apart from textual format, pictorial or graphical presentation of the data or the computation of an index design was used to summarize a specific characteristic of a variable or measurement. The summarized data can provide insights into the problem's scope that can help decide on the direction for further anlaysis or intervention programs.

Population and Sample

Of the 3,061 Grade 8 learners in the Digos City Division, 250 were randomly chosen from the 12 schools to participate in the research study. The sample size of the stratum (school) was determined through Proportionate Stratified Random Sampling. This method enhances the accuracy and representativeness of the research findings (Hassan, 2024). The calculation of the sample size of the stratum used the formula:

$$(n_h)=\frac{\text{population size of stratum } (N_h)}{\text{entire population size } (N)} \text{ X entire sample size}$$

Table 1 shows the population and sample size distribution per school.

School	Population (N_h)	Sample size (n_h)
Digos City National High School	1927	157
Dawis NHS	106	9
San Roque NHS	49	4
DiCNHS-Aplaya Extension	74	6
Goma NHS	58	5
Matti NHS	206	17
Balabag NHS	51	4
Igpit NHS	142	12
Ruparan NHS	55	4
Soong NHS	76	6
Kapatagan NHS	295	24
Palan- Tagabawa NHS	22	2
	N = 3061	250

Table 1. Data of the Proportionate Stratified Random Sampling

Research Instrument

The developed math PISA-like questions relative to the identified most essential learning competencies were used to determine the profile of the learners in terms of their difficulties in solving mathematics PISA-like questions on the identified most essential learning competencies under numbers and number sense, and patterns and algebra. Five experts validated the instrument, including 3 regional supervisors and 2 professors from a higher educational institution. For the reliability test, Cronbach's alpha was used which resulted in a 0.739 coefficient making it acceptable. *(See Annex for Validity and Reliability Test of Instrument)*

Furthermore, Newman Error Analysis was used following the oral procedure that determines the type of errors learners commit, namely: (1) reading errors, (2) comprehension errors, (3) transformation errors, (4) process skill errors, and (5) encoding errors (as cited in White, 2010).

Data Collection

Consent and assent forms were distributed and secured. The data were collected using interviews of learners. This was done individually by the researchers. The researchers took approximately half an hour to interview each learner.

The format used for the interview consisted of the following oral procedures:

1. Read the question aloud.

   (Proceed to 2 if the question is read correctly, otherwise show correct words and symbols before proceeding to 2)
2. What do you need to find? What is the question asking for?

   (Proceed to 3 if learner is able to comprehend the problem, otherwise ask questions to ensure understanding and comprehension before proceeding to 3).
3. Without doing any work, tell me how are you going to solve this problem? What are you going to have to do in order to solve this problem?

   (Proceed to 4)
4. What method will you use to solve the problem? How are you going to solve the problem? Show me how you solve the problem. Explain to me what you are doing as you solve the problem.

   (Proceed to 5)
5. How can you check to see if your answer is sensible? Study the problem again and decide if your answer is sensible or correct.

Ethical Consideration

Consent and assent forms and an interview guide were designed before the interview process commenced. The following are some of the ethical considerations that were observed by the researchers during the interview process (Laryeafio & Ogbewe, 2023):

Anonymity. No personal information about the interviewees, such as name, address, or email, is included in any data that might be used to identify them. Ensuring anonymity of information collected gives protection to the interviewees and allows them to give out key information which ensures reliability of findings (Saunders et al., 2015).

Privacy and confidentiality. To ensure that no other party gets access to the raw data, the interviewer must ensure that any information obtained from the interviewee must remain private and confidential, unless the interviewee specifically requests that it be made public.

Voluntary participation. None must be coerced or induced to engage in the study investigation in order to obtain trustworthy information from the interviewee. Participants who are coerced into participating will not be willing to divulge any information, but they will participate in exchange for pecuniary benefits, which could result in the gathering of inaccurate data. Making participation voluntary will guarantee that participants are aware of the research topic and agree to participate in the data collection (Mumford et al., 2021).

Option to opt out. Any time during the data collection process, an interviewee's right to withdraw must be respected by the researcher. Any previously gathered information on the participants must be deleted when this occurs. This makes sure that no interviewee is coerced into participating in the study if any of the questions are incongruous with their character (Mumford et al., 2021). Furthermore, respecting the rights of the interviewees is the researcher's duty.

Non-maleficence/Beneficence. The ethical principle of non-maleficence and beneficence describes the researcher’s obligation to fully avoid causing any harm to the participant intentionally or be able to identify and eliminate any source of harm to the participant (Guillemin & Gillam, 2004). The researcher in this instance should not over-burden the participant with more questions or create a situation where the participant feels uncomfortable. Any deliberate attempt by the researcher to cause an unwelcome environment will impact negatively to the responses that will be gathered (Wilson et al., 2008).

Data Analysis

The statistical tool used is percentage. Percentages tend to be easy to visualize because they show part of a whole. They are also a good way to show relationships and comparisons - either between categories of respondents or between categories of responses (Tobacco Control Evaluation Center, n.d.).

Percentage is calculated by taking the frequency in the category divided by the total number of participants and multiplying by 100%. The formula of the percentage of learners who got the highest type of error correctly is:

$$Percentage = \frac{number\ of\ learners\ who\ got\ the\ highest\ type\ of\ error\ correctly}{total\ number\ of\ learners} \times 100$$

The percentage results are presented in a vertical stacked bar chart. This kind of chart provides visualization methods to present how each data attributes contribute to the overall total (Streit and Gehlenborg, 2024). The chart illustrates the relative proportion of each difficulty faced by the sample in answering the given problems.

Chapter III
Results and Discussion

This section presents the findings from the analysis of data gathered during the interview to answer three problems of this quantitative research undertaking. The results are summarized and presented in 100% stacked bar chart to show relative proportion contribution of each level of difficulty experienced by Grade 8 learners in solving PISA-like questions to a whole while maintaining a clear comparison across problems and items. This 100% stacked bar chart provides a summary of the analysis of the interview data. It depicts at which stage the learners were unable to proceed with the solution to a problem. It gives the breakdown of the occurrences at the various stages for this group of 250 learners of the Schools Division of Digos City. Levels of difficulty are categorized as Level A to Level F before obtaining the correct response, described as follows:

Level A – The learner could read the problem but required assistance with some words and/or symbols.

Level B – The learner was able to read the problem but could not understand its meaning.

Level C – The learner understood the problem but had no idea on what approach to use or how to solve it.

Level D – The learner described a method to tackle the problem but could not translate it into a mathematical form.

Level E – The learner translated the problem into a mathematical form (e.g., equation or open sentence) but could not perform calculations or continue solving it.

Level F – The learner performed the calculation but arrived at an incorrect solution.

Level of Difficulty of Grade 8 Learners in Solving PISA-Like Questions Relative to Solving Problem Involving Sets with the Use of Venn Diagram

Figure 2 shows the 100% stacked bar chart on the level of difficulty of Grade 8 learners in solving PISA-like questions relative to solving problem involving sets with the use of Venn diagram. There were two problems being asked, namely: Reading Preferences and Menu with two items each.

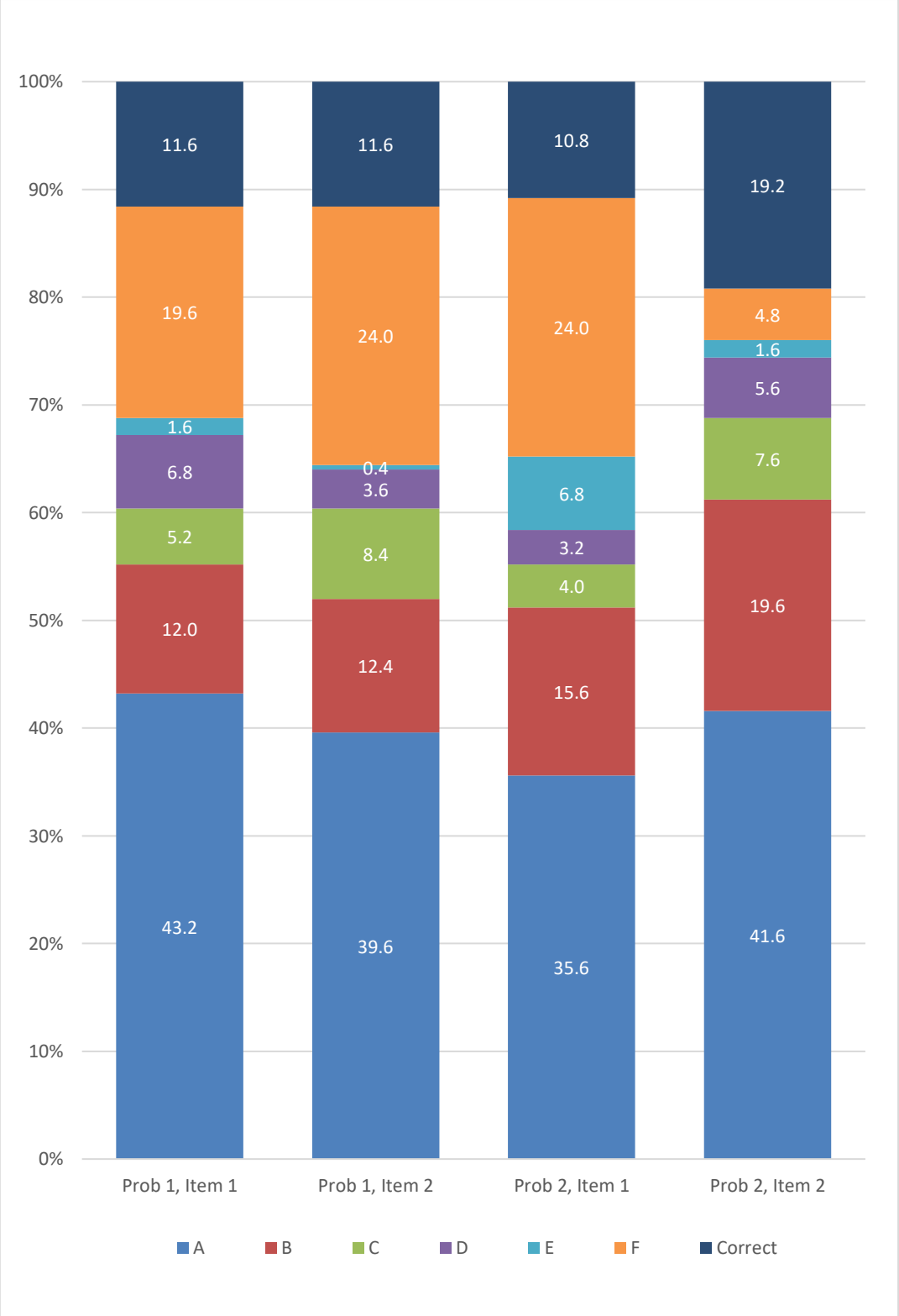

Figure 2. Level of Difficulty of Grade 8 Learners in Solving PISA-Like Questions Relative to Solving Problem-Involving Sets with the Use of Venn Diagram

Figure 2 depicts that two in five learners (approximately 40%) belong to Level A. This means the learners can read the problem but need assistance with some words or symbols in the questions. The learners could not remember or were unfamiliar with a few words, such as, "librarian, Venn diagram, *x* meters, express".

However, only 1% to 7% of the learners reached Level E. This means learners translated the problem into a mathematical form (e.g., equation or open sentence) but could not perform calculations or continue solving it. The learners were struggling to understand the key terms like "both", "only", "neither", and "either".

Furthermore, one to two out of ten learners performed the calculation but arrived at an incorrect solution. They were able to make a Venn diagram but got confused about what each region of the Venn diagram represents.

Forty percent of the learners can read the problem, however only a few proceeded with answering the problem. Few of the students struggled to comprehend the problems. This might also be because they do not know the meaning of some words. Moreover, 6.3% of the learners had trouble remembering the Venn Diagram and others had difficulty categorizing the given information to the appropriate section in the diagram. Some performed the calculation but made an error in basic arithmetic – they forgot to consider the overlapping values. However, only 13.3% of the learners arrived at the correct solution.

Level of Difficulty of Grade 8 Learners in Solving PISA-Like Questions Relative to Solving Problem-Involving Algebraic Expressions

Figure 3 shows the percentage bar chart on the level of difficulty of Grade 8 learners in solving PISA-like questions relative to solving problems involving algebraic expressions. There were two problems being asked, namely: Cover Cellophane with two items and Rice Retailer with three items.

It is presented in Figure 3 that approximately 35% to 45% of the interviewees belong to Level A while approximately another 35% to 45% of them belong to Level B. This means that roughly seven ouf of ten interviewees (70%) can at most read the problem but cannot understand its meaning. Some learners were having a tough time understanding mathematical language and variables.

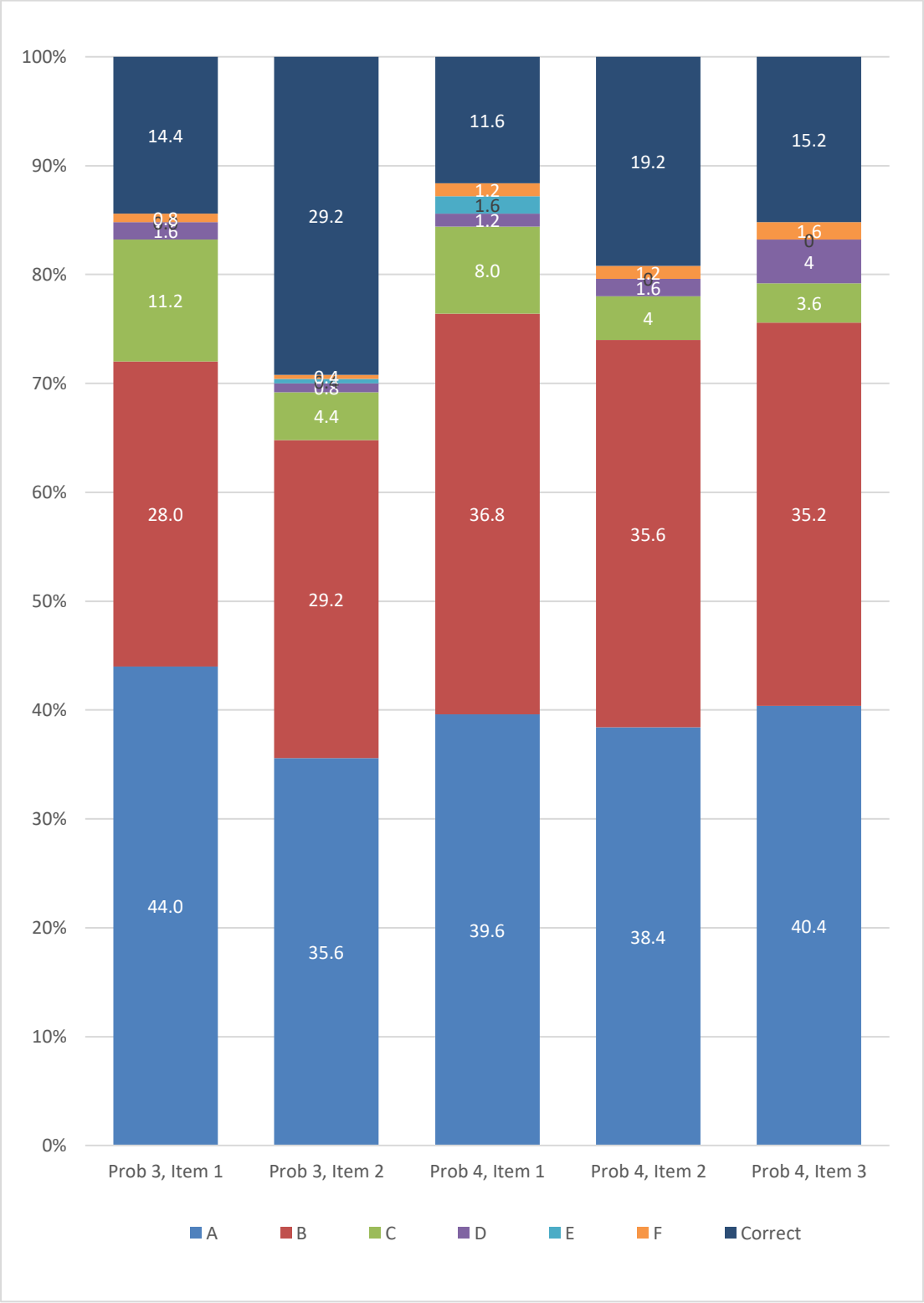

Figure 3. Level of Difficulty of Grade 8 Learners in Solving PISA-Like Questions Relative to Solving Problem-Involving Algebraic Expressions

However, only three out of ten learners reached at least Level C. This means that the learner at least understood the problem but had no idea what approach to use or how to solve it. The learners were intimidated by the word "algebraic expression", they were to focus on remembering what algebraic expression is rather than trying to solve it through alternatives.

Furthermore, one to three out of ten learners performed the calculation but arrived at an incorrect solution. The learners struggled with identifying which operations to use and what actions to take next.

Despite being able to read the problems, 32.96% could not proceed to problem-solving because of a lack of comprehension. The learners were too focused on remembering the concept of algebraic expression which led them to say they didn't know how to solve the given problem rather than trying other alternatives or doing simple arithmetic. Moreover, 1.72% of the learners struggled to understand that the given variables x and r represent unknown quantities. Only 7.92% of the learners were able to do the calculation, but they incorrectly applied properties or forgot what to do next. Furthermore, 17.91% were able to do the calculations correctly.

Level of Difficulty of Grade 8 Learners in Solving PISA-Like Questions Relative to Solving Problems Involving Equations and Inequalities in One Variable

Figure 4 shows the proportional bar chart on the level of difficulty of Grade 8 learners in solving PISA-like questions relative to solving problems involving equations and inequalities in one variable. There were two problems being asked, namely: Art Project and Tricycle with two items each.

It is presented in Figure 4 that approximately 72% to 82% of the interviewees belong to Levels A and B. This means that roughly seven to eight out of ten interviewees can at most read the problem but cannot understand its meaning. Few learners were overwhelmed with the details given in the problem – they were having difficulty in identifying relevant and irrelevant details of the problem.

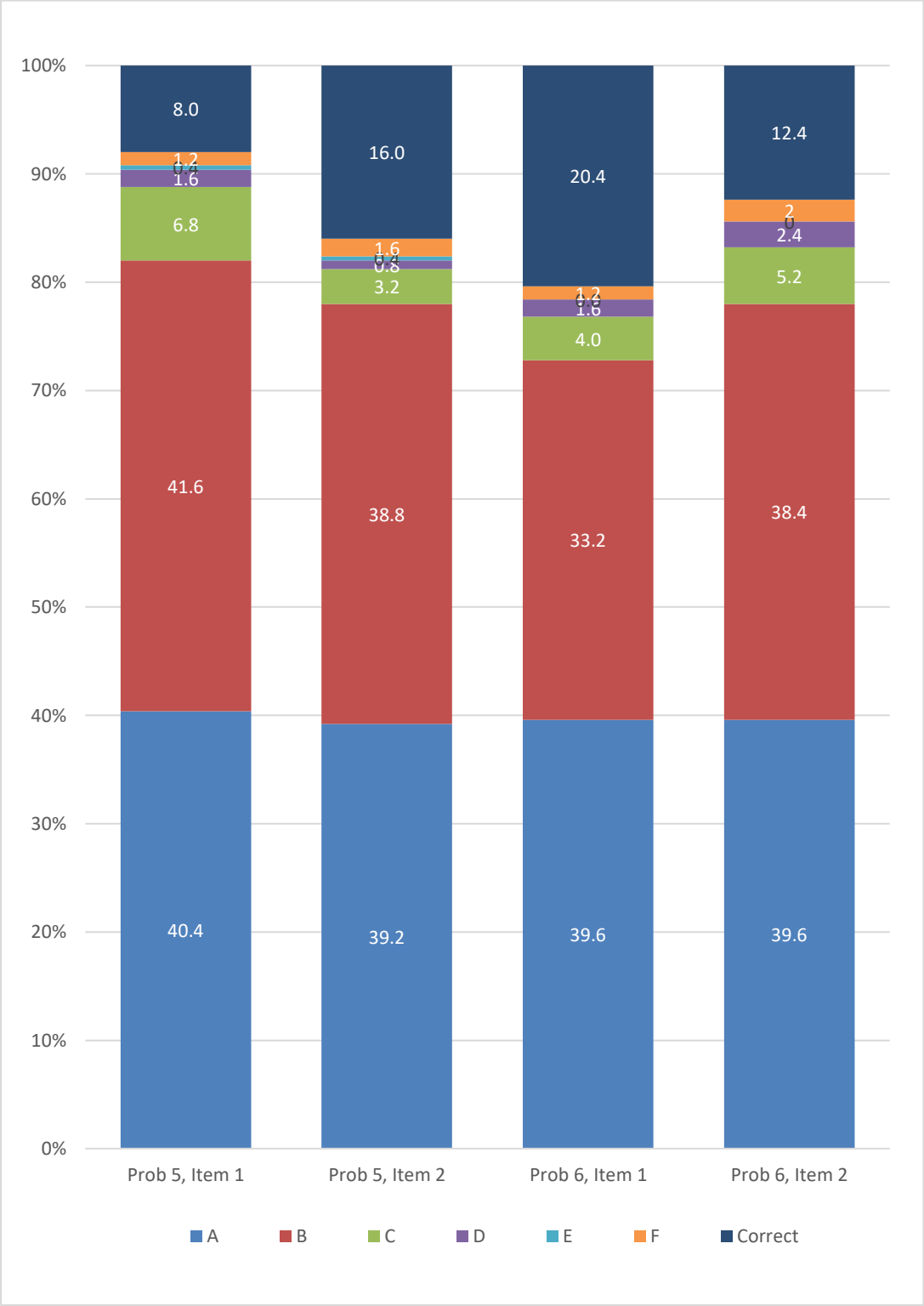

Figure 4. Level of Difficulty of Grade 8 Learners in Solving PISA-Like Questions Relative to Solving Problems Involving Equations and Inequalities in One Variable

However, only roughly three out of ten learners reached at least Level C. This means that the learners at least understood the problem but had no idea on what approach to use or how to solve it. The learners tried to remember the concept of "algebraic equations and inequalities", instead trying to solve it through alternatives.

Furthermore, one to two out of ten learners were able to perform the calculation but arrived at an incorrect solution. The learners were struggling with basic computations, especially in division.

Thirty-eight percent of the learners can read about the problem, however, they cannot understand what the problem is. They had difficulty distinguishing relevant from irrelevant information in the problem which led them not able to visualize what the problem was looking for. Despite this, 14.2% of the learners got the solution correctly.

In general, while all learners exhibited difficulties in solving the PISA-like questions, the charts showed that most of them fell in the Level A and Level B categories. They can read the problem but they have to be guided because they do not know the meaning of some words. They can read the problems but lack comprehension and with this, they cannot proceed anymore to the next steps in solving the problem. The lack of comprehension posed a major factor in them not being able to solve the PISA-like questions.

Numerous research have studied the relationship between problem-solving and other variables. These studies have demonstrated how crucial reading comprehension is in improving the problem-solving skills of the students (Hadianto et al., 2021; Harangus, 2019; Nicolas & Emata, 2018; Ulu, 2017; Vilenius-Tuohimaa et al., 2008). As evidenced by Boonen et al. (2016), there is a positive correlation between reading comprehension and problem-solving, as people with higher reading comprehension skills were more adept at solving word problems.

Nahdi (2024) also discussed that the ability of primary school pupils to solve mathematical problems and their reading comprehension abilities are positively and significantly correlated. Polya (2014) stressed that understanding is the crucial initial step in the problem-solving process. Effective comprehension facilitates subsequent stages, whereas failure to grasp the problem situation impedes successful problem resolution (Cho & Kim, 2020).

Mathematical problems, particularly during assessments or exams, are usually given in narrative or textual formats. Proficiency in reading and comprehending information in mathematical problems is an essential first step before trying to solve the problems themselves (Szabo et al., 2020; Verschaffel et al., 2020). When a learner can accurately comprehend instructions, questions or mathematical information in a problem, they are more likely to come up with appropriate problem-solving strategies.

Chapter IV
Conclusions and Recommendations

Conclusions

Around 50% to 80% of the students had difficulty solving the PISA-like math problems. It was observed during the conduct of interviews that 39.75% of the learners have reading difficulty. In a class, 2 students could not proceed with the interviews due to their inability to read words; 28.95% of the learners have poor reading comprehension. They could not understand what was being asked in the problem; 5.82% of learners have little to no knowledge about certain math concepts (e.g. Venn Diagram, algebraic expression, inequality, equation) that made them unable to solve the problems. From the students' accounts, they forgot the concepts and even if they understood the question or remembered the concepts, they were unsure what to do next; 2.68% could identify a method or approach to solve the problem but could not transform the problem mathematically like making equations or inequalities; 1.02% could transform the problems mathematically but have trouble in the calculations; and 6.43% of the learners can perform the calculations but fail to arrive at the correct answers.

Recommendations

Findings on the lack of reading and comprehension skills, and struggle with problem-solving highlight the need for interventions and programs to support the students in their academic challenges.

With the results of the study, and in support of the aim of DepEd Order No. 13, s. 2023 which is to strengthen the numeracy and literacy of low-performing learners to improve performance during international large-scale assessments including PISA and national assessments, the researchers recommend the following:

1. Curriculum Implementation Division, led by the Education Program Supervisor in Mathematics may take action on the the following:
    a. coordinate with the Division Reading Focal to discuss the findings and address reading and comprehension challenges of Grade 8 learners as outlined in DO No. 14, s. 2018 which highlights the use of Phil-IRI as a tool to assess learners' reading performance and

guide targeted interventions to address their specific needs and improve reading skills;

b. develop a Comprehensive Intervention Plan to improve understanding of key mathematical concepts. This can be integrated into the National Mathematics Program (NMP) where learners are given a set period of time to review math topics, operations, and terminology that they may have forgotten or need to re-learn or go into in-depth discussion of present lessons. Strengthen the time for NMP, as reflected in teachers' class programs, through monitoring as stated in DepEd Order No. 29, s. 2022 that mandates DepEd operating units to conduct Monitoring and Evaluation (M&E); and

c. Take the lead in the development of more resources such as strategic intervention materials (SIM) in Mathematics to address least learned competencies and lesson exemplars with PISA integration to guide teachers for the delivery of the lessons in Grades 8 through 10 to support students in improving problem-solving skill.

2. Curriculum Implementation Division, led by the Public Schools District Supervisors, along with school heads and department heads, may intensify the monitoring and guide teachers in strengthening the conduct of remedial programs on the 5th week of each quarter compliant to DepEd Order No. 8, s. 2015 to narrow the gap on low proficiency in Mathematics, which can be done by giving ample time for the enhancement of the problem-solving skills of the learners.
3. Human Resource Development Division (HRDD) in coordination with the Curriculum Implementation Division may reinforce and provide professional development opportunities for teachers along with a review of the curriculum to ensure that it aligns with students' learning needs and current best practices, in alignment with the MATATAG Curriculum, which is to give support for teachers, as outlined in the Philippine Professional Standards for Teachers (Deped Order No. 42, s. 2017). As teachers play a vital role in the success of DepEd's programs, their professional growth should be taken into consideration.
4. Teachers may establish regular monitoring and evaluation of student performance to identify areas for immediate intervention and adjust

instructional strategies accordingly and develop more engaging and hands-on learning activities focusing on improving problem-solving and critical thinking in alignment with strengthening the assessment and intervention implementation of DepEd Order No. 8, s. 2015, which specifies the importance of classroom assessment to track and measure the learner's progress and adjust instruction accordingly.

Dissemination and Advocacy Plans

a) Dissemination Plans

The research results will be communicated to the internal and external beneficiaries of this study through division and district conferences school management committee meetings, parents-teachers assembly and departmental Learning Action Cell (LAC) sessions in July to September 2025. Findings about the current research and recommended interventions will be shared and discussed with division personnel, the principal, math teachers, and parents. Further dissemination will also be done during the Research Division Forum and Regional Research Congress in September to November 2025. Also, the results of the study will be cascaded to ensure that it will be utilized for decision-making and policy formulation on curriculum planning.

b) Advocacy Plans

The findings of the study will be utilized to develop interventions and programs that would enhance the mathematical problem-solving abilities of the students in the Division of Digos City when working on PISA-like questions and widen the understanding between the PISA framework in mathematical literacy and the present K-12 Basic Education Curriculum so that teachers can improve their strategies in teaching PISA-related word problems.

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ANNEXES

Workplan

Activities	August 2023	September 2023	October 2024	November 2024	December 2024	January 2025	June - December 2025
1. Preparation of the research proposal (Chapters 1 and 2) and identification of topics in the chosen level							
2. Writing the Basic Research proposal							
3. Presentation of the Basic Research proposal to the DEREG							
4. Finalization of the proposal							
5. Preparation, presentation, and finalization of the PISA-like questions							
6. Validation of the research instrument							
7. Pilot testing of the research instrument							
8. 7. Simulation of the interview of the participants							
9. Identification of the participants							
10. Orientation of the study							
11. Conference with the participants and their parents							
12. Data collection							
13. Data analysis and interpretation							
14. Writing the final manuscript							
15. Submission of the final manuscript							
16. Research dissemination							

Cost Estimates

Activities	Date and Time	Persons Involved	Expected Output	Budget
1. Conceptualization	August 16, 2023	Researchers	Initial Plan for the implementation of the study	Internet Load ₱500.00
2. Writing of the Basic Research proposal	August 16 to 31, 2023	Researchers	Action Research Proposal	Printing Materials and Internet Load ₱300.00
3. Presentation of the Basic Research proposal to the DEREG	September 01, 2023	Researchers Division Supervisors	Refined Research Proposal	Food ₱1,000.00
4. Finalization of the proposal	September 04, 2023	Researchers	Finalized Research Proposal	Printing Materials ₱500.00
5. Preparation, presentation, and finalization of the PISA-like questions	September 04 to 29, 2023	Researchers	Finalized Teacher-Made PISA Questions	Printing Materials ₱ 300.00
6. Validation of the research instrument	October 21-30, 2024	Researchers Math Teachers	Validated Teacher-Made PISA Questions	Printing Materials ₱ 100.00
7. Pilot Testing of the research instrument	November 2024	Researchers Participants	Results of Reliability Statistics	Printing Materials ₱ 200.00
8. Simulation of the interview of participants	November 2024	Researchers Participants	Common understanding on the implementation of the study	Internet Allowance ₱100.00
9. Identification of the Participants	November 2024	Researchers Math Teachers	List of Participants	Printing Materials and Snacks ₱ 500.00
10. Orientation of the study	November 2024	Researchers Participants	Common understanding of the implementation of the study	Food and Internet Allowance ₱1,000.00
11. Conference with the participants and their parents	November 2024	Researchers Participants Math Teachers	Agreement and Implementation	Food ₱1,000.00
12. Data collection	December 2024	Researchers Participants	Research Data	Food, Printing Materials,

		Math Teachers		fuel and loads ₱8,000.00
13. Data analysis and interpretation	December 2024	Researchers	Analyzed and Interpreted Data	Food and Printing Materials ₱1,000.00
14. Writing of the final manuscript	December 2024	Researchers	Initial Manuscript	Food and Printing Materials ₱1,000.00
15. Submission of the final manuscript	January 2025	Researchers	Final Manuscript	Manuscript Packaging and Fuel ₱3,500.00
16. Research dissemination	June to December 2025	Researchers	Research Dissemination	Food and Printing Materials ₱1,000.00
TOTAL				**₱ 20,000.00**

RESEARCH INSTRUMENT

PISA-Like Questions

Problem 1: **READING PREFERENCES**

Description: Use the concept of Venn Diagram to solve real-world problems.

Mathematical Content Area: Quantity

Context: Occupational

Process:

Formulate: Representing a situation mathematically, using appropriate variables, symbols, diagrams, and standard models

Employ: Making mathematical diagrams, graphs, and constructions and extracting mathematical information from them

Interpret and Evaluate: Interpreting information presented in graphical form and /or diagram

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You are a librarian and tasked to survey the preferred book genres of the students in your school. The survey showed that **romance** and **mystery** are the two most popular genres for students.

The following is the detailed result of the survey:

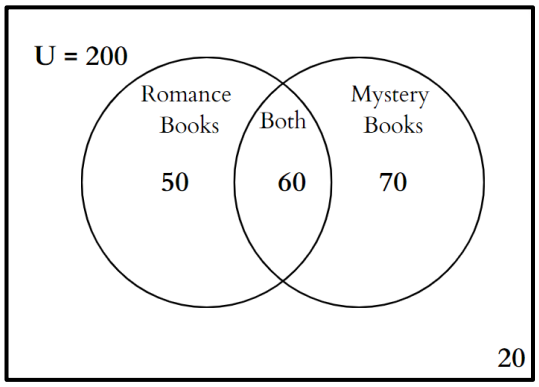
Among the 200 students, there are

- 110 who loves to read romance books
- 130 who loves to read mystery books
- 60 who loves to read both romance and mystery books

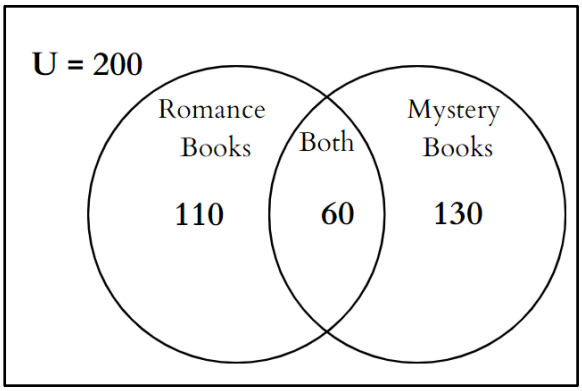
Item No. 1: Construct a Venn Diagram to illustrate the preferred book genres of the students.

Answer Key:

Full Credit



Partial Credit



No Credit *No Answer*

Item No. 2:

Utilize the created Venn Diagram in Item No. 1 to complete the report below.

Students' Preferred Genre

	Number of Students
Students who love to read romance books only	
Students who love to read mystery books only	
Students who love to read both romance and mystery books only	
Students who neither love to read romance nor mystery books	

Answer Key:

Full Credit

	Number of Students
Students who love to read romance books only	**50**
Students who love to read mystery books only	**70**
Students who love to read both romance and mystery books only	**60**
Students who love to neither read romance nor mystery books	**20**

Partial Credit

	Number of Students
Students who love to read romance books only	**110**
Students who love to read mystery books only	**130**
Students who love to read both romance and mystery books only	**60**
Students who love to neither read romance nor mystery books	

No Credit *No Answer*

Problem 2: **MENU**

Description: Using your representation of the data in the Venn Diagram, design a menu that will satisfy all the officers' dietary preferences.

Mathematical Content Area: Quantity

Context: Personal

Process:

Formulate: Selecting an appropriate model from a list
Employ: Performing a simple calculation
Interpret and Evaluate: Interpreting a mathematical result back into the real-world context

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The School Math Club plans to have a get-together with its 20 officers. As the President of the club, you are to select an appropriate bilao package that will satisfy the food preferences of all officers.

Among the 20 officers, there are

- 12 who prefer eating fish
- 9 who prefer eating meat
- 5 who prefer eating both fish and meat

Item No. 3: To select the appropriate bilao package that meets the officers' food preferences, answer these questions:

1. How many officers prefer eating fish?
2. How many officers prefer meat?
3. How many officers prefer either fish or meat?
4. How many officers do not prefer either option?

Answer Key:

Full Credit *1. How many officers enjoy eating fish?* ***7***
2. How many officers prefer meat? ***4***
3. How many officers like either fish or meat? ***5***
4. How many officers do not like either option? ***4***

Partial Credit *1. How many officers enjoy eating fish?* ***12***
2. How many officers prefer meat? ***9***
3. How many officers like either fish or meat? ***5***
4. How many officers do not like either option? ***0***

No Credit *No Answer*

Item No. 4:

With the trend of doing boodle fights, select one bilao package that caters to the food preferences of your officers.

Answer Key:

Full Credit	*Bilao Package 2*
No Credit	*No Answer*

Problem 3: **COVER CELLOPHANE**

Description: Use the concept of algebraic expressions to solve a real-world problem.

Mathematical Content Area: Change and Relationships

Context: Personal

Process:

Formulate: Translating a problem into mathematical language or a representation

Employ: Performing a simple calculation

Interpret and Evaluate: Interpreting a mathematical result back into the real - world context

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You purchased a cover cellophane for Php 52.00 per meter to wrap your books.

Item 5: Write an algebraic expression to describe the amount you will pay if you buy x meters of cover cellophane.

Answer Key:

Full Credit	$\boldsymbol{Amount} = 52x$
	$= 52x$
No Credit	*Other responses.*
	No Answer

Item 6: If you buy 5 meters of cover cellophane, how much will you pay? Show your solution.

Full Credit	$= 52x$
	$= 52(5)$
	$= \boldsymbol{Php}\ \mathbf{260.00}$
No Credit	*Other responses.*
	No Answer

Problem 4: **RICE RETAILER**

Description: Use the concept of algebraic expressions to solve a real-world problem.

Mathematical Content Area: Change and Relationships

Context: Occupational

Process:

Formulate: Recognizing mathematical structure (including regularities, relationships, and patterns) in problems or situations

Employ: Performing a simple calculation

Interpret and Evaluate: Interpreting a mathematical result back into the real - world context

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You own a rice retail store where you sell rice at a *r* pesos per kilo. In one day, you sold 80 kilos of rice and earned a total revenue of Php 4,000.

Item 7: Express your total earnings from rice sales that day in algebraic expression.

Answer Key:

Full Credit $80r = 4{,}000$ $80\ x\ r = 4{,}000$

Partial Credit $r = 4{,}000$

No Credit *No Answer*

Item 8: Given that you earned Php 4,000 from the sale, how much did you charge per kilo of rice? Show your solution.

Answer Key:

Full Credit

$$\frac{80r}{80} = \frac{4{,}000}{80}$$

$$\boldsymbol{r = 50}$$

Php 50.00 per kilo of rice

$4{,}000 \div 80 = \mathbf{50}$

Php 50.00 per kilo of rice

No Credit *No Answer*

Item 9: If you want to earn Php 5,000 the next day, how many kilos of rice you need sell to achieve the target? Show your solution.

Answer Key:

Full Credit

$$k = \frac{5{,}000}{50}$$

$$\boldsymbol{k = 100}$$

You need to sell 100 kilos of rice.

$5{,}000 \div 50 = \mathbf{100}$

You need to sell 100 kilos of rice.

$4{,}000 = 80\ kilos$, add $1{,}000 \div 50 = 20\ kilos$.

Therefore, you need 100 kilos of rice.

No Credit *No Answer*

Problem 5: **ART PROJECT**

Description: Use the concept of equations and inequalities in one variable to solve a real-world problem.

Mathematical Content Area: Quantity

Context: Personal

Process:

Formulate: Translating a problem into mathematical language or a representation

Employ: Performing a simple calculation

Interpret and Evaluate: Interpreting a mathematical result back into the real - world context

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You have Php 200.00 to buy bar soap and nail cuticle pusher for your art project. If the nail cuticle pusher costs Php 62.00, what is the largest amount you can spend for the bar soap??

Item 10: Write an equation/inequality to represent the problem.

Answer Key:

Full Credit $62 + x \leq 200$ or $x + 62 \leq 200$

No Credit *Other responses.*
No Answer

Item 11: What is the largest amount you can spend on your bar soap? Show your solution.

Answer Key:

Full Credit

$$62 + x \leq 200$$
$$62 - 62 + x \leq 200 - 62$$
$$x \leq 138$$

$$200 = (Price\ of\ Materials + Price\ of nail\ cuticle\ pusher)$$
$$200 = Price\ of\ Materials + 62$$
$$Price\ of\ Materials = 200 - 62$$
$$\boldsymbol{Price\ of\ Materials = 138.00}$$

Checking 1: Php 138 – amount less than Php 200 $62 + x \leq 200$ $62 + 138 \leq 200$ $200 \leq 200$	Checking 2: Php 250 – amount greater than Php 200 $62 + x \leq 200$ $62 + 250 \leq 200$ $312 \leq 200$
Using the inequality above, and solving for the unknown x, the largest amount you can spend for bar soap is P138.00.	

No Credit *Other responses.*
No Answer

Problem 6: **TRICYCLE**

Description: Use the concept of equations and inequalities in one variable to solve a real-world problem.

Mathematical Content Area: Quantity

Context: Occupational

Process:

Formulate: Translating a problem into mathematical language or a representation

Employ: Performing a simple calculation

Interpret and Evaluate: Interpreting a mathematical result back into the real - world context

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Danny is a tricycle driver in the downtown area. He aims to earn at least Php 825 each day to support his personal and family expenses, including the boundary fee he must pay. Danny charges a Php 15.00 for each passenger he transports.

Item 12: If Danny only transports thirty passengers in one day, will he reach his goal? Explain your answer.

Full Credit

$= 15p$

$= 15\ x\ 30$

$= Php\ 450$

Since Php 450 is less than the Php 825, therefore, he will not reach his goal.

No Credit *Other responses.*

No Answer

Item 13: To help Danny reach his daily goal of Php 825 in earnings, try to find the minimum number of passengers he needs to transport. Show your solution.

Answer Key:

Full Credit

$$\frac{15p}{15} = \frac{825}{15}$$

$$p = 55$$

Danny needs to have 55 passengers to achieve his goal.

No Credit *Other responses.*

No Answer

Republic of the Philippines
Department of Education
REGION XI
SCHOOLS DIVISION OF DIGOS CITY

VALIDITY AND RELIABILITY TEST OF THE INSTRUMENT

Name: Jem Boy B. Cabrella, Kremia Katrina C. Thiam, Imma Tessie Donne D. Llemit

Research Title: Difficulties of Grade 8 Learners in Solving Mathematics PISA-Like Questions

Number of Raters	Grand Mean Item Assessment	Content Validity Index	Remarks
5	4.74	5 out of 5 raters each item in terms of content and construction on a scale of at least 4	Excellent Content Validity CVI = 1.0

Scale: Internal Consistency of the Survey Questionnaire

Reliability Statistics

Number of Items	Number of Respondents	Cronbach's alpha	Internal Consistency
10	30	0.739	Acceptable

Findings:

The result indicated that all expert validators rated all the items of the instrument to be highly relevant. This indicates that the instrument passed the validity test having a content validity index of 1.00. Furthermore, the instrument also passed the reliability test with Cronbach's alpha coefficient of 0.739 which is greater than the threshold of 0.70. This only implies that the self-made questionnaire is both valid and reliable.

Prepared by:

Jem Boy B. Cabrella, PhD
Researcher

Address: Roxas Street cor. Lopez Jaena Street, Zone II, Digos City 8002
Telephone No: (082)553-8396 | (082)553-8376 | (082)553-9170
| (082)553-8375