

## Equipping Educators: A Collaborative Action Research Approach to Addressing Math Challenges in the Classroom Set-up

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**Abstract:** The field of education is constantly evolving, with new challenges and opportunities arising every day. The results of 2022 Programme for International Student Assessment (PISA) in the Philippines for math indicates poor performance and there is a clear indication of the areas that need improvement in the Philippine education system. This study aims to investigate various aspects concerning mathematics education in the Philippines. Firstly, it seeks to understand the demographic profile of teachers, including age, sex, location, grade level of teaching, and years of service. Secondly, it aims to identify the primary challenges students face in mathematics, encompassing achieving proficiency, understanding concepts, applying problem-solving skills, and relating mathematical knowledge to real-life situations. Furthermore, it endeavors to determine if there's a significant difference in these challenges based on respondents' profiles. The researchers make use of the 5-point Likert Scale to create survey questionnaires. Then, the researchers use Raosoft sample size formula to get the sample size needed to know the respondents of the study. Microsoft Excel and IBM SPSS were used to evaluate and validate the survey questionnaire data using weighted mean, standard deviation and One-Way ANOVA Test. The researchers gathered the data from the mathematics teachers at the School Division Office of Manila City that are Mathematics teachers who are math major and not math major. achieving mathematical proficiency, understanding mathematical concepts, applying problem-solving skills, and relating mathematical knowledge to real-life situations all showed statistically significant discrepancies among different service categories. The p-values for achieving mathematical proficiency, understanding mathematical concepts, applying problem-solving skills, and mathematical knowledge in real-life situations were 0.022, 0.032, 0.013, and 0.005, respectively—all below the significance level of 0.05. This shows a significant difference in applying mathematical knowledge in real-life situations across different services.

**Key Words:** Mathematics; PISA; One-Way ANOVA; problem-solving skills; proficiency

### 1. INTRODUCTION

The field of education is constantly evolving, with new challenges and opportunities arising every

day (Li & Schoenfeld, 2019). According to Li & Schoenfeld, numerous opportunities for teaching and learning mathematics are made possible by the continuous advancement of understanding of the topic. This flexibility does, however, come with a

drawback in that it leaves open the decision-making process regarding pedagogical method and content. Efficient decision-making in this domain necessitates the precise expression of diverse perspectives regarding the essential knowledge that students should acquire in and through mathematics. For varied learners, each of these ideas will have advantages and disadvantages of its own, and choosing the best course of action for education will depend greatly on how thoroughly these are considered. According to Chorlay, investigating potential connections between mathematics education and mathematics history has developed during the past 40 years as an interdisciplinary field of study and practice in education. During the past 20 years, it has reached a mature state. Due to its interdisciplinary nature, this growth necessitates an overview of the general issues pertaining to the foundational issues addressed as well as the key themes and reasons underpinning research and applications in its context. One of the most significant challenges that educators face today is the teaching and learning of mathematics. Despite its fundamental importance in the daily lives and the broader scientific community, mathematics often poses a significant challenge for both students and teachers alike (Chorlay et al., 2022).

### *1.1 Background of the Study*

According to the 2018 Program for International Student Assessment (PISA) results, pupils in the Philippines performed worse than students in other nations, even those from Southeast Asian states that are neighbors to them, such as Indonesia, Malaysia, and Thailand. The average score for Filipino pupils in reading, math, and science was 340, 353, and 357, respectively. These scores fall short of the minimal competency level, which is at least 407, 420, and 410 (Mateo, 2019). The current state of mathematics education in the Philippines has faced challenges in mathematics education, with students often struggling in this subject. Based on the Philippine News Agency, the country ranked last in both Mathematics and Science in the 2019 Trends in International Mathematics and Science Study among 58 countries. Only 17 percent of Filipino Grade 5

learners met the minimum standards in Mathematics (Philippine News Agency, 2022).

In the year 2022, the Department of Education participated in the Programme for International Student Assessment (PISA). The result was sad news in the country as it stated that in Math, the Philippines is 76th. The OECD average is at Level 2 or a score of 472 but the Philippines' average is at Level 1b or a score of 355. This is a clear indication of a poor performance of the country in the said subject (Hernando-Malipot, 2023). This result is a clear indication of the areas that need improvement in the Philippine education system. It's important to note that these results are part of a larger global assessment and reflect the performance of 15-year-old students across different countries. The Department of Education in the Philippines is aware of these results and is taking steps to address these challenges (Ines, 2023).

Mathematics education is a critical component of a well-rounded education, providing students with essential skills for problem-solving, logical reasoning, and quantitative analysis. According to Dr. Angel de Dios, in the Philippines, many students face significant challenges in learning mathematics, which can hinder their academic progress and limit their future opportunities. Moreover, the traditional classroom set-up in the Philippines often relies on teacher-centered instruction, emphasizing rote memorization and procedural knowledge. This approach may not effectively promote conceptual understanding, critical thinking, and problem-solving skills in mathematics. Students may struggle to apply mathematical concepts to real-life situations, leading to a limited appreciation of the subject's relevance and practicality (de Dios, 2021). According to Dr. Lagon being a math and physics professor in Manila and like many other teachers of the former subject, he faced ongoing challenges. Traditional teaching methods and digital innovations struggle to captivate students, and the pandemic has further complicated the situation. Throughout the years, learners' lack of foundational skills from kindergarten to college has decreased their interest in math-related courses (Lagon, 2023).

However, within the constraints of a traditional classroom set-up, it can be challenging to

cater to diverse learning preferences and ensure that every student receives the necessary support and guidance (Magayon & Tan, 2018). A study involving 16 focus groups from Grade 7 students in Manila explored their experiences with differentiated instruction in Mathematics. The most observed differentiations by the respondents such as relating real-life situations to the lessons, modified learning activities, learning activities according to students' preference, teachers' assistance during learning activities and grouping students based on projects and choice of students.

### *1.2 Statement of the Problem*

The study aims to investigate various aspects concerning mathematics education in the Philippines. Firstly, it seeks to understand the demographic profile of teachers, including age, sex, location, grade level of teaching, and years of service. Secondly, it aims to identify the primary challenges students face in mathematics, encompassing achieving proficiency, grasping concepts, applying problem-solving skills, and relating mathematical knowledge to real-life situations. Furthermore, it endeavors to determine if there's a significant difference in these challenges based on respondents' profiles. Finally, the study intends to propose strategies and actions to address these challenges and enhance mathematics education nationwide. By addressing these questions comprehensively, the research aims to contribute valuable insights towards improving mathematics education in the Philippines.

### *1.3 Scope and Limitations of the Study*

This action research focuses on equipping educators by addressing Mathematics challenges. This action research will show how these challenges affect the student's Mathematics performance, Mathematics teachers' challenges in teaching the subject and the different strategies that teachers can do to address these challenges. Knowledge about the demographic profile of the teachers in terms of Age, Sex, Location, Grade level of teaching and Service were included. The researchers also sought the

challenges in mathematics in leui to the Achieving mathematical proficiency, understanding mathematical concepts, applying problem-solving skills, and mathematical knowledge in real-life situations. The researchers make use of the 5-point Likert Scale to create survey questionnaires. Then, the researchers use Raosoft sample size formula to get the sample size needed to know the respondents of the study. The researchers expanded the survey thru Google forms that were also used as a tool for communication of the researchers and the respondents. Microsoft Excel were used to evaluate and validate the survey questionnaire data. This action research is only limited to gathering the data from the mathematics teachers of the School Division Office of Manila City. Outside the city and other places are not included in the statistical survey of this action research. Mathematics teachers who are math major and not math major were the main respondents of this study. Other teachers in another field were not included.

## **2. METHODOLOGY**

### *2.1 Research Design*

This study utilized quantitative which McCombes (2020) described as investigating if there is measuring the relationship between the variables without the researcher controlling either of them. A quantitative method uses numerical data and mathematical techniques (Bhandari, 2020) to measure and describe the result of collected or gathered data from a large population sample. Moreover, this approach can generalize the gathered data from a large population to explain a phenomenon. In this research, survey questionnaires would be used by the researchers to gather data from the participants of the study, including their personal information and thoughts about the questions made by the researchers. The researcher's survey design will help accomplish the quantitative method and objectives set in this research. However, the surveys are limited to online modalities as there are governmental limitations on the ability of the research proponents to do face-to-face interviews. In this state,

regarding online surveys, the researchers use Google forms to replace physical survey questionnaires. A questionnaire was formulated to measure the challenges in mathematics and the teaching methods. A five-point Likert type scale ranging from 1 = —strongly disagree to 5 = —strongly agree was used to measure the level of agreeableness for each respondent.

## 2.2 Population and Sampling

The researchers coordinated with the Schools Division Office (SDO) of Manila to get the total numbers of teachers in elementary, junior high school (JHS) and senior high school (SHS). With these data, the researchers make use of the Raosoft Sample Size formula to get the population sample size for each grade level category. Based on the computation, ten percent (10%) margin of error, ninety-nine percent (99%) confidence level and fifty percent (50%) response distribution sampling was chosen for the calculation from the total population of 10,863 teachers which is equal to one hundred sixty-four (164) mathematics teachers will be the sample respondents in this study.

## 3. RESULTS AND DISCUSSION

### 3.1 Weighted Mean and Standard Deviation Results

Achieving Mathematical Proficiency	Weighted Mean	SD	Interpretation	Rank
1. My students appear confident in their overall mathematical abilities.	3.96	1.12	Agree	1
2. I believe my students have mastered the essential mathematical skills.	3.41	0.78	Agree	2
3. My students are able to successfully tackle challenging mathematical problems.	3.34	0.80	Agree	3.5
4. My students find mathematical tasks easy to accomplish.	3.01	0.98	Neutral	5
5. My students are comfortable with the level of difficulty in their math assignments.	3.34	0.75	Agree	3.5
<b>General Assessment</b>	<b>3.41</b>	<b>0.89</b>	<b>Agree</b>	

Fig. 2. Weighted Mean and Standard Deviation Results for Achieving Mathematical Proficiency

Understanding Mathematical Concepts	Weighted Mean	SD	Interpretation	Rank
1. My students grasp new mathematical concepts quickly.	3.26	0.73	Neutral	2
2. My students find it easy to understand complex mathematical ideas.	3.01	0.78	Neutral	5
3. My students feel confident in their understanding of foundational mathematical principles.	3.32	0.73	Neutral	1
4. My students can easily connect different mathematical concepts.	3.18	0.73	Neutral	4
5. My students find mathematical concepts intuitive.	3.23	0.67	Neutral	3
<b>General Assessment</b>	<b>3.20</b>	<b>0.73</b>	<b>Neutral</b>	

Fig 3. Weighted Mean and Standard Deviation Results for Understanding Mathematical Concepts

Applying Problem-Solving Skills	Weighted Mean	SD	Interpretation	Rank
1. My students are comfortable applying problem-solving techniques in mathematics.	3.17	0.77	Neutral	3
2. My students can effectively approach and solve mathematical problems.	3.13	0.73	Neutral	4
3. My students feel confident in their ability to tackle real-world math problems.	3.30	0.70	Neutral	2
4. My students enjoy the process of solving mathematical problems.	3.34	0.76	Neutral	1
5. My students can apply multiple problem-solving strategies.	3.05	0.75	Neutral	5
<b>General Assessment</b>	<b>3.20</b>	<b>0.74</b>	<b>Neutral</b>	

Fig. 4. Weighted Mean and Standard Deviation Results for Applying Problem-Solving Skills

Mathematical Knowledge in Real-Life Situations	Weighted Mean	SD	Interpretation	Rank
1. My students can relate mathematical concepts to real-life situations.	3.75	0.71	Agree	2
2. My students see the practical applications of the math they learn	3.67	0.73	Agree	3
3. My students are confident in using mathematical knowledge in everyday life	3.62	0.74	Agree	4
4. My students believe mathematics is relevant to real-world scenarios. believe mathematics is relevant to real-world scenarios.	3.84	0.69	Agree	1
5. My students enjoy applying mathematical concepts to solve real-life problems.	3.55	0.72	Agree	5
<b>General Assessment</b>	<b>3.69</b>	<b>0.72</b>	<b>Agree</b>	

Fig. 5. Weighted Mean and Standard Deviation Results for Mathematical Knowledge in Real-Life Situations

The figures 2 to 5 shows the results for the weighted mean and standard deviation. The respondents show general weighted mean of 3.41, 3.20, 3.20 and 3.69 for the respective levels of



mathematical proficiency which falls neural and agree.

### 3.3 Significant Test (ANOVA TEST)

Main Challenges in Mathematics	F-value	p-value	Decision
Achieving Mathematical Proficiency	3.612	0.0076	Reject Ho
Understanding Mathematical Concepts:	0.773	0.544	Failed to Reject Ho
Applying Problem-Solving Skills:	0.791	0.533	Failed to Reject Ho
Mathematical Knowledge in Real-Life Situations	1.521	0.199	Failed to Reject Ho

Fig. 6. Significant Test for the Main Challenges in Math when Grouped according to Age

Main Challenges in Mathematics	F-value	p-value	Decision
Achieving Mathematical Proficiency	0.791	0.533	Failed to Reject Ho
Understanding Mathematical Concepts:	2.350	0.127	Failed to Reject Ho
Applying Problem-Solving Skills:	0.254	0.615	Failed to Reject Ho
Mathematical Knowledge in Real-Life Situations	0.042	0.838	Failed to Reject Ho

Fig. 7. Significant Test for the Main Challenges in Math when Grouped according to Sex

Main Challenges in Mathematics	F-value	p-value	Decision
Achieving Mathematical Proficiency	10.1998	0.0017	Reject Ho
Understanding Mathematical Concepts:	14.653	0.000184	Reject Ho
Applying Problem-Solving Skills:	3.946	0.0484	Reject Ho
Mathematical Knowledge in Real-Life Situations	1.815	0.179	Failed to Reject Ho

Fig. 8. Significant Test for the Main Challenges in Math when Grouped according to Location

Main Challenges in Mathematics	F-value	p-value	Decision
Achieving Mathematical Proficiency	3.419	0.0351	Reject Ho
Understanding Mathematical Concepts	10.302	$6.165 \times 10^{-5}$	Reject Ho
Applying Problem-Solving Skills:	11.005	$3.313 \times 10^{-5}$	Reject Ho
Mathematical Knowledge in Real-Life Situations	4.927	0.0084	Reject Ho

Fig. 9. Significant Test for the Main Challenges in Math when Grouped according to Grade Level

Main Challenges in Mathematics	F-value	p-value	Decision
Achieving Mathematical Proficiency	5.334	0.022	Reject Ho
Understanding Mathematical Concepts	4.685	0.032	Reject Ho
Applying Problem-Solving Skills	6.367	0.013	Reject Ho
Mathematical Knowledge in Real-Life Situations	8.088	0.005	Reject Ho

Fig. 10. Significant Test for the Main Challenges in Math when Grouped according to Service

The figure 6 to 10 shows the ANOVA Test for each demographic profile to the mathematics challenge to the teachers from their students. When the p-value is less than 0.05, this indicates that there is significant difference or relationship between the

groups to the challenges. Then, it may be used as a decision to reject the null hypothesis Ho.

## 4. CONCLUSIONS

The results determined that the math teachers agreed that the students achieved a sufficient mathematical proficiency and applying in real life situations. On the other hand, it is also verified that the students have an equitable and fair understanding of mathematical concepts and application to problem-solving skills. This highly suggests that the SDO Manila City prepare the schools to improve and enhance the teaching capacity and methods by the mathematics teacher that can greatly improve the main challenges of the students. Apply policy and guidelines to the lesson plans and syllabus. Benchmark other schools or university with higher PISA rating to catch up with the current trend in mathematics. Create more classrooms and well-equipped laboratories will provide students real, hands-on experiences that will spark their interest in mathematics. Create an atmosphere that encourages active engagement in learning is an important investment in the future of mathematics education. Another part of the strategy is that stressing how mathematical ideas are applied in the actual world is essential for awakening students' interest in mathematics. Making math approachable by tying it to daily situations cultivates interest and problem-solving abilities. The integration of project-based learning and interactive exercises facilitates students' comprehension of the real-world applications of mathematics. In this sense, ongoing teacher preparation is equally crucial. In the results of the significance test in age to the mathematical challenges, it is concluded that there is a significant difference in achieving mathematical proficiency, there is no significant impact in understanding mathematical concepts, in applying problem-solving skills and mathematical knowledge in real-life situations. In the result of the significance test in sex to the mathematical challenges, it is concluded that there was no significant impact between the sex in any of the main challenges in mathematics. In the result from the significant test between the location and the

main challenges, it is concluded that there was a significant impact in the achieving mathematical proficiency, understanding mathematical concepts, and applying problem-solving skills. On the other hand, there was no significant impact of the location to the application of mathematics to real life situations. In the results from the significant test between the grade level to the main challenges faced by the students, it was concluded that four challenges mention were significant to each grade level. And last, from the result of the significant test between the services to the main challenges faced by the students, it was also concluded that the four challenges mention were significant to the teachers who teaching math that are math major and not. Overall, this means and indicates that mathematics challenges faced by the students have a significant effect and impact to their skill based on the service of the math teachers, location, grade level, apart from the age. The researchers suggest that the SDO Manila City invest on professional development of the teachers. The SDO Manila City must propose more trainings to the math teachers on mathematical skills capability. This can be done through partnerships to other schools in different cities and partnerships between educational institutions and the private sector can drive transformative change. The corporate community may help by sponsoring programs, mentoring efforts, and scholarships that provide students and instructors with more tools and chances to improve their mathematics skills. Age also matters to the mathematics proficiency. Create a training and seminar that help the teachers to catch up with the current generation of the students and lead the way to their mathematics upskill. MTAP and other Math quiz bee held by the different schools is not enough. Plan new innovative programs that upskill mathematics capability to enhance proficiency, understand more of the concepts, apply problem solving and in real life situations. Another action plan is that with fewer students in each session, teachers can give more individual attention, allowing students to get a better knowledge of mathematics subjects. Additionally, investing in teacher training and giving attractive compensation will attract highly skilled educators who are committed to improving math education. Teachers must be equipped with creative

teaching approaches and given the appropriate support. Math teachers must adapt to the evolving trend in mathematics especially to the current generation of students today.

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