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Problem-Solving Performance and Skills of Prospective Elementary Teachers in Northern Philippines

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Abstract: The study determined the problem-solving performance and skills of prospective elementary teachers (PETs) in the Northern Philippines. Specifically, it defined the PETs' level of problem-solving performance in number sense, measurement, geometry, algebra, and probability; significant predictors of their problem-solving performance in terms of sex, socio-economic status, parents' educational attainment, high school graduated from and subject preference; and their problem-solving skills. The PETs' problem-solving performance was determined by a problem set consisting of word problems with number sense, measurement, geometry, algebra, and probability. A mixed-method research design was employed. Senior PETs purposively served as a sample where they mostly preferred to teach other subjects than mathematics. PETs who preferred math performed satisfactorily, while prospective teachers who opted for other subjects performed unsatisfactorily. The PETs' unsatisfactory output indicates the need for remediation to advance the mathematical material skills and enrich the problem-solving abilities of these primary schools' potential teachers. Besides, results showed that subject preference strongly affected and predicted the problem-solving success of the PETs. PETs who preferred to teach mathematics performed significantly better than their counterparts; hence, mathematics as a field of specialization in the Bachelor of Elementary Education program may be considered by teacher education institutions. Further, most PETs displayed lack of problem-solving skills; thus, a Problem-Solving course is recommended for them.

Keywords: elementary education, prospective elementary teachers (PETs), mathematics, problem-solving, teacher education institutions

菲律宾北部准小学教师的问题解决能力和技能

摘要：该研究确定了菲律宾北部的准小学教师（聚酯）解决问题的表现和技能。具体来说，它定义了聚酯在问题，绩效，几何，代数和概率方面的解决水平。从性别，社会经济地位，父母

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的受教育程度，高中毕业和学科偏好等方面来看，解决问题表现的重要预测指标；及其解决问题的能力。聚酯的解决问题能力由一个问题集决定，该问题集包括具有数字意义，度量，几何，代数和概率的单词问题。采用了一种混合方法研究设计。高级聚酯的目的是作为样本，他们最喜欢教数学以外的其他学科。偏爱数学的体育教师的表现令人满意，而选择其他科目的准教师的表现却不尽人意。聚酯的成绩不令人满意，表明需要进行补救以提高数学材料技能并丰富这些小学潜在教师的解决问题的能力。此外，结果表明，受试者的偏好强烈影响并预测了聚酯解决问题的成功。倾向于教数学的聚酯的表现明显优于同行。因此，教师教育机构可以考虑将数学作为基础教育学士课程的专业领域。此外，大多数聚酯都表现出缺乏解决问题的能力。因此，为他们推荐了一个解决问题的课程。

关键词：基础教育，准基础教师（聚酯），数学，解决问题的方法，师范教育机构。

1. Introduction

The problem-solving skills of elementary teachers serve a major role in improving young Filipino learners' performance in mathematics and the quality of Philippine Mathematics Education. Teacher education institutions have a multi-faceted role in providing the best services to provide the holistic preparation and training required for future elementary teachers to achieve the goal of the Mathematics Curriculum for each learner to develop problem-solving skills with the implementation of the K-12 Basic Education Program. Students of the prospective training program must understand concepts and principles in mathematics, must be able to derive the formulas in mathematics, prove the theorem, solve a mathematical problem, and know how to teach mathematics [1].

Teachers' problem-solving skills are necessary nowadays in mathematics instruction as it influences the students' performance in problem-solving [2, 3]. It enables the students to achieve the expected mathematics competency defined by the K-12 content standards as a requisite for a college degree and employment. Additionally, teachers' problem-solving skills were held to answer the low achievement of Filipino students in mathematics. Teachers' problem-solving skills play an important role in Mathematics and have a prominent role in the Mathematics education of K-12 students [4].

Part of the twin goals of the Mathematics Curriculum in the Philippine Basic Education level is problem-solving skill. Thus, this study was carried out to determine the level of problem-solving performance and skills of prospective elementary teachers (PETs) - the primary [5] molders of young Filipinos' knowledge, skills, and attitude towards mathematics and problem-solving. Teachers' problem-solving skills enable their students to achieve the expected mathematics competency defined by the K-12 content standards [6] as a requisite for a college degree and employment. With the great demand for mathematics teachers in elementary schools with the implementation of the K-12 Curriculum [7], this study was taken into account fourth-year Bachelor of Elementary Education students to assess their preparedness as models of problem-solving skills. The study results are now being popularized to teacher education institutions in the Philippines to achieve excellence in offering teacher education programs in mathematics to deal with trends and problems related to PETs' poor performance in mathematics and problem-solving.

2. Methods

The sequential-explanatory mixed-method research design was used. This method is a two-phase design where the quantitative data are collected first, followed by qualitative data collection. It is a research design that involves inquiry and philosophical assumptions that guide collecting and analyzing data and the mixture of qualitative and quantitative data in a single study or series of studies [8]. The quantitative phase of the study determined the (a) problem-solving performance of the PETs in number sense, measurement, geometry, algebra, and probability, and (b) significant predictors of the

problem-solving performance of the PETs. The qualitative phase was designed to explain the findings obtained from the quantitative study. The qualitative design explained significant findings from the quantitative analysis.

Further, the qualitative design through content data analysis described the problem-solving skills of the PETs. In mathematics education, Ross and Onwuegbuzie [9] researched the prevalence of mixed methods study where subjects include mathematical thinking processes, problem-solving, mental actions, attitudes, and other mathematical comprehension occurrences. They concluded that qualitative and quantitative data are complementary and show connections between observations and mathematical achievement.

The PETs' answer sheets were utilized in the content data analysis. Purposive total population sampling was considered to gain a deeper understanding of the objectives of the study. One hundred thirty-one PETs from Northern Philippines participated in the study in 2019. The problem set included elementary topics in number sense, measurement, geometry, algebra, and probability from the Mathematics Framework for Philippine Basic Education developed by Science Education Institute, Department of Science and Technology & Philippine Council of Mathematics Teacher Education, Inc. [10]. The study adopted the Problem-Solving Model of Verschaffel, Greer, and De Corte [11] to understand the PETs problem-solving skills (Figure 1). The Problem-Solving Model characterizes the effective and efficient approach in solving the problem set. The respondents were expected to utilize the following problem-solving skills, namely (a) understanding the text, (b) situation modeling, (c) mathematical modeling, (d) analysis and derivation, (e) interpretation and evaluation of results, and (f) reporting final answer.

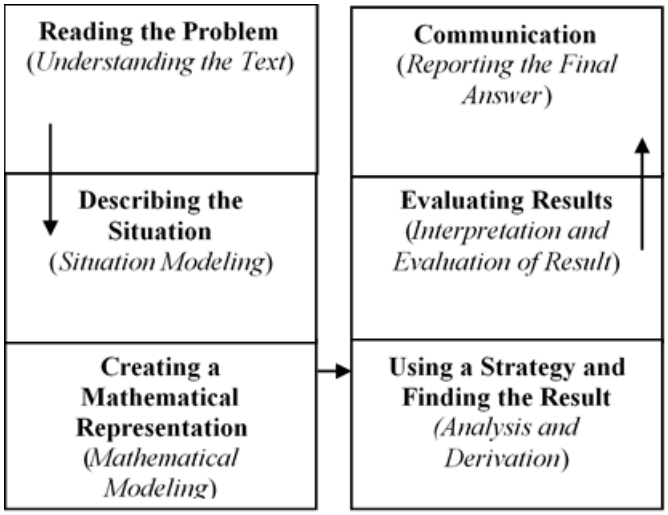

Fig. 1 Verschaffel, Greer and De Corte's problem-solving model [10]

A multiple linear regression analysis was conducted to determine the predictors of PETs' problem-solving performance based on sex, socio-economic status, father's educational attainment, mother's educational attainment, high school graduated from, and subject preference. Meanwhile, the qualitative phase employed content data analysis on the PETs' answer sheets to describe their problem-solving skills. The qualitative phase was supported by [12], "to understand why someone is successful or unsuccessful in an attempt to solve a mathematical problem, one must examine the person's knowledge base and use of problem-solving strategies". Further, the qualitative design tried to explain significant outputs from the quantitative analysis. Further, the qualitative design through content data analysis described the problem-solving skills of the prospective elementary teachers. The respondents' answer sheets were utilized in the content data analysis.

3. Results and Discussion

3.1. PETs' Problem-Solving Performance Level

In sum, the PETs achieved unsatisfactory problem-solving performance (Mean= 1.06, SD = ±.26). As shown in Table 1, the overall mean obtained is far behind the expected 2.41 to 3.00, which denotes excellent performance. This result indicates the unpreparedness of these PETs concerning math classes in their ongoing teaching practice and future teaching careers. This research was parallel to the cross-national study of Tatto and Senk [13], which recorded the poor performance of Filipino's future primary school mathematics teachers. PETs in the Philippines had the lowest mathematical content knowledge score compared to Chinese Taipei, Singapore, Spain, Switzerland, and United States [13], which supported the statement that mathematics teacher education in the Philippines is in its most precarious state [9]. Besides, the result is different from [1], where teacher candidates showed competency in solving problems; understood the concepts of definite integral and the procedures in using definite integral to compute the volume of solid; communicated mathematically and worked accurately; and were able to display mathematical creativity that consists of fluency, flexibility, and novelty aspect.

Table 1 Respondent's level of problem-solving performance

Content Area	Mean	SD	Description
Number Sense	**1.68**	**.45**	**Satisfactory**
1. Addition, subtraction and whole numbers.[a]	2.50	.64	Excellent
2. Multiplication, division, ratio and proportion.[b]	1.89	.97	Very Satisfactory
3. Fraction, percentage	.66	.52	Unsatisfactory

and multiple operations.[c]			
Measurement	**.82**	**.39**	**Unsatisfactory**
4. Perimeter of a square, conversion from inches to feet.[a]	1.20	.86	Unsatisfactory
5. Area of a rectangle, conversion from kilometer to meter.[b]	.81 .44	.54 .50	Unsatisfactory Poor
6. Volume of a prism, conversion from hectares to square meters.[c]			
Geometry	**.90**	**.37**	**Unsatisfactory**
7. Hypotenuse of a right triangle.[a]	1.02	.51	Unsatisfactory
8. Area of a plane inscribed in a solid. [b]	.92	.45	Unsatisfactory
9. Diagonal of a plane and solid figure.[c]	.76	.48	Unsatisfactory
Algebra	**1.22**	**.46**	**Satisfactory**
10. Representing and solving equations in one unknown.[a]	1.47	.81	Satisfactory
11. Analyzing mathematical situations in one unknown.[b]	1.16 1.02	.64 .61	Unsatisfactory Unsatisfactory
12. Solving mathematical relationships in one unknown.[c]			
Probability	**.68**	**.48**	**Satisfactory**
13. Using the language of chance in estimating probabilities.[a]	.92	.88	Satisfactory
14. Determining probabilities applying an empirical formula.[b]	.63 .50	.55 .53	Unsatisfactory Unsatisfactory
15. Making predictions and using theories of probability.[c]			
Overall Performance	**1.06**	**.26**	**Unsatisfactory**

Legend:

2.41-3.00 = Excellent	SD = Standard Deviation
1.81-2.40 = Very Satisfactory	a = Easy Item
1.21-1.80 = Satisfactory	b = Average Item
0.61-1.20 = Unsatisfactory	c = Difficult Item
0.00-0.60 = Poor	

The result suggested the need for PETs' deeper understanding of mathematics and the application of its concepts in problem-solving. As prospective teachers, this is deemed necessary for them to achieve the twin goals of the mathematics curriculum, which is to develop problem-solving and critical thinking skills in full among Filipino students. As pointed out in [9], "the Philippine mathematics education program at the elementary and secondary levels aims to teach the most fundamental and useful contents of mathematics which included Numbers and Number Sense; Measurement; Geometry; Patterns, Functions and Algebra; and Data, Analysis, and Probability". This organization of the contents was influenced by the results of the Trends in International Mathematics and Science Study, where Filipino students recorded low mathematical performance.

Number Sense: Table 1 presented that the PETs performed satisfactorily in number sense with a pooled mean of 1.68 and a standard deviation of .45. It can be understood that these PETs know real numbers and operations. The obtained mean can justify that these future teachers could impart number sense concepts to their students. Specifically, the PETs performed excellently in the easy item (Mean= 2.50) and very satisfactorily in the average item (Mean= 1.89). This means that prospective teachers have successfully solved problems relating to the *addition and subtraction of whole numbers and multiplication, division, ratio, and proportion*. However, they performed unsatisfactory (Mean= .66) in the difficult item. This result denotes that these PETs were unsuccessful in dealing with *fraction, percentage, and multiple operations*. This conclusion contradicted [14], who revealed PETs misconception and incompetency in numbers, operations, fractions, and decimals. These PETs could somehow model competency in a number sense to their students. "Stu

dents at the elementary grades must be able to demonstrate an understanding of concepts and show mastery of the operations of whole numbers, decimals, fractions, ratio and proportion, percent and integers. They must be able to apply these concepts and operations to a variety of real-life problems" [10]. Hence, PETs low performance concerning fractions and decimals and problems involving multiple operations must be given importance.

Measurement: The PETs performed unsatisfactorily in measurement. As displayed in Table 1, they attained a pooled mean of .82 with a standard deviation of .39. It showed inadequate knowledge in converting units and the inability to solve problems with perimeter, area, and volume. They did not apply basic conversion properties and were not able to recall common formulas. In particular, the PETs performed both unsatisfactory in the easy (Mean= 1.20) and average items (Mean= .81), respectively. These connote PETs limited competency in *finding the perimeter of a square and conversion from inches to feet* and *determining a rectangle area with the conversion from kilometer to the meter*. More so, they performed poorly in the difficult item (Mean= .44). This outcome signifies PETs incompetency in *determining the volume of a regular prism plus conversion from hectares to square meters*. The results inferred that the PETs

might not possibly transfer competency in measurement towards their students. According to [9] asserted that "elementary students must be able to make calculations and measure amounts involving decimals and convert from one unit of measure to another. Students must be able to read maps and charts with scaled measures and explore the relationship between perimeter and area of plane figures, the circumference and diameter of circles, and discover the formulas used in finding perimeter, area, and volume. Besides, they must be able to solve real-life problems involving measure and investigate measurements used in different areas". Consequently, PETs poor performance could hinder their pedagogical performance in the measurement strand. As ascertained in [15], "the seemingly obvious misconceptions could be an indication of inadequate knowledge expected among the pre-service teachers to teach area and perimeter in the future".

Geometry: Table 1 displayed PETs' unsatisfactory performance in geometry with a pooled mean and standard deviation of .90 and .37. This outcome demonstrates PETs' insufficient understanding between geometric shapes and relationships. Also, these demonstrate future teachers' little knowledge about the Pythagorean Theorem and its applications. The PETs unanimously have unsatisfactory performance in all items. They achieved unsatisfactory mean score in the easy (Mean= 1.02), average (Mean= .92) and difficult items (Mean= .76). These findings manifest that PETs have difficulties dealing with *a hypotenuse of a right triangle*, *area of a plane inscribed in figures*, *solid figure*, and *plane diagonal and solid figure*. These findings confirmed with the authors in [13,16], who revealed prospective teachers' lacking comprehension in geometry. These revelations about PETs low achievement in geometry could lead to an unhealthy experience with their students. According to [9], "elementary pupils must be able to explore the characteristics and properties of two- and three-dimensional geometric shapes and formulate significant geometric relationships; use coordinate geometry to specify locations and describe spatial relationships; apply transformations and symmetry to analyze mathematical situations; and employ spatial visualization, reasoning, and geometric modeling to solve routine and non-routine problems". In this regard, PETs who have troubles with this strand are suggested to recollect their experiences with the foundational topics in geometry.

Algebra: In the algebra strand, the PETs performed satisfactorily with a pooled mean score of 1.22 and .46 standard deviation. This result implies that these future teachers suitably addressed algebraic expressions and equations with one variable. They have a background in using algebraic symbols and notations. Particularly, the PETs performed satisfactorily in the easy item (Mean = 1.47). This outcome expresses PETs competency in *representing and solving equations in one unknown*. Whereas, in the average (Mean= 1.16) and difficult items (Mean= 1.02), the PETs showed unsatisfactory performance. This result reveals that these future teachers struggled *to analyze mathematical situations* and *solve mathematical relationships*, considering one unknown. In total, this result was comparable with [13], where PETs were able to solve problems on algebra. Even so, this finding argued with [17], where they found that the PETs' understanding of algebra suggested that prospective teachers were challenged across many topics within this area. PETs partly showed content knowledge in this strand. Elementary students were steered to be able to "use algebraic symbols to represent and analyze mathematical situations and represent and understand quantitative relationships using mathematical models" [9]. PETs will not mislead their young students if they have acquired the necessary competency in algebra.

Probability: It can be gleaned in Table 1 that PETs acquired unsatisfactory performance in probability given by the .68 pooled mean and .48 standard deviation. This result shows that these PETs lack the knowledge to determine the probability of events. They are not familiar with that probability ranges from 0 to 1. Among the five content areas, the PETs recorded the lowest score under probability. Specifically, the PETs performed both unsatisfactory in the easy (Mean= .92) and average items (Mean = .63), respectively. This finding demonstrated the PETs' failure *to use the language of chance in estimating probabilities and using the empirical formula to calculate probabilities.*

Further, they performed poorly in the difficult item (Mean = .50). This outcome suggests that PETs are incapable of *making predictions and using probability* theories, which supports the study of [18] where prospective elementary mathematics teachers did not have enough probability competencies. PETs recorded the need to enhance performance in probability. Primary school students should "use the language of chance in carrying out simple experiments or simulations; construct a sample space and identify probabilities of events; determine probabilities based on the sample space, and make predictions based on experiments and using basic theories of probability" [9]. In this view, the PETs are encouraged to exert more effort in acquiring knowledge and skills under this strand.

Most of the PETs displayed math avoidance. Pries and Biggs [25] described a cycle of mathematics avoidance in four phases. In phase one, the person experiences negative reactions to mathematics situations, probably due to past negative experiences with mathematics. In phase two, the person avoids

mathematics situations. This avoidance leads to phase three, poor mathematics preparation, which leads to phase four, poor mathematics performance. Math avoidance of these future elementary teachers may hinder their role in developing the problem-solving skills in young Filipino learners. Literatures [25, 26] attributed this observable fact to a high level of anxiety and low self-efficacy with mathematics and teaching mathematics

3.2. Predictors of the PETs' Problem-Solving Performance

Multiple linear regression analysis was used to determine the predictors of the PETs' problem-solving performance based on sex, socio-economic status, father's educational attainment, mother's educational attainment, high school graduated from, and subject preference (Table 2). The analysis found a linear relationship among the variables implied by the Multiple R-value of .43, indicating a marked positive correlation. The R^2 of .18 suggests that the predictor variables explain 18 percent of the variation in problem-solving performance. Further, a highly significant regression equation was found, $F_{(6,124)} = 4.66$, $p < .001$. Subject preference is a strong negative predictor of performance, $\beta = -.37$, $t = -4.41$, $p < .001$, indicating that PETs who preferred to teach math (coded as 1) performed .32 mean score higher than those who have chosen other subjects (coded as 2). However, sex, socio-economic status, parents' educational attainment, and the high school diploma do not predict the PETs' performance. Regression analysis showed that among all factors, only subject preference predicted the PETs problem-solving performance. This result, concerning the previous outcome of the study of profile variables affecting PETs' problem-solving performance, may serve as an avenue for policymakers and curriculum developers of the Bachelor of Elementary Education (BEEd) to implement the specialization program similar to the Bachelor of Secondary Education. PETs who preferred math over other subjects acquired a significantly higher mean score. These PETs would be soon deployed for out-campus practice teaching and will be future teachers of elementary schools. Without a doubt, some of them will be handling mathematics. Hence, the result suggests offering a field of specialization for future elementary teachers. There is a possibility that teacher candidates will take mathematics from the confidence they have with their knowledge of mathematical and pedagogical content. A lot of other reasons may be attributed to this proposal. PETs who would choose to teach math to young students manifest their positive beliefs and attitudes and high self-efficacy towards mathematics and teaching mathematics.

Table 2 Multiple linear regression analysis for variables predicting the PETs' problem-solving performance

Predictors	Unstandardized Coefficients		Standardized Coefficients	t-value	p-value
Sex	-.03	.06	-.04	-.51	.611
Socio-economic Status	.06	.03	.15	1.72	.089
Father's Educational Attainment	-.06	.03	-.17	-1.84	.068
Mother's Educational Attainment	.05	.03	.14	1.50	.137
High School Graduated from	-.01	.07	-.01	-.07	.947
Subject Preference	-.32	.07	-.37	-4.41*	.000

Note:
Multiple R = .43 R^2 = .18 Adjusted R^2 = .15
F (6,124) = 4.66 p = .000
Subject Preference: 1 - Math; 2 - Other Subjects
Legend: * = highly significant at .01 significance level

Another implication is the need to offer a problem-solving subject for PETs. Currently, several math courses are offered. However, unlike other teacher education institutions offering the BEEd program, a problem-solving course is not yet implemented. The inclusion of this subject could train these future elementary teachers as agents of change in the declining status of Philippine mathematics education. As these PETs increase their mathematical understanding and problem-solving skills, they will be more interested in school problems, seek different ways to solve these problems, try different student learning methods, and think critically about their work [19] emphasized. These recommendations are based on the proposition that PETs who solve problems more efficiently believe in mathematics value [20]. Problem-solving is an essential competency for teachers and teacher candidates. Students of pre-service training programs must understand concepts and principles in mathematics, must be able to derive the formulas in mathematics, prove theorems, solve mathematical problems, and know how to teach mathematics [1].

3.3. PETs' Problem-Solving Skills

3.3.1. Adequacy in Understanding the Text Skills

PETs who preferred to teach mathematics showed *adequacy in understanding the text skill*. This implies that these PETs have read the problem carefully and were

able to identify the situation to be solved. Accordingly, these future teachers' satisfactory performance is attributed to their adequate understanding of the problem text. This result complemented [1, 20], stating that teacher candidates who can solve problems are more successful than teacher candidates able to understand the problem. Understanding includes decoding the text into more manageable chunks to create a situation model [10]. This toat these future teachers who opt to handle mathematics have the required ability to understand word problems. They were able to reconcile with the given problem set, which also demonstrates their reading and comprehending skills; on the other hand, PETs who preferred to handle other subjects displayed *inadequacy in understanding the text skill*. This finding showed PETs limited understanding of the underlying situation within the problems given. It can be derived that the future teachers' misunderstanding of the problem explains their unsatisfactory performance. This finding aligned with [15]. They revealed that pre-service teachers who were unable to solve the problem correctly seemed to use limited and incorrect mathematical terminology, lack understanding of the problem, lack some basic knowledge, and had misconceptions regarding the problem. The result shows that majority of the PETs were not able to understand the given facts and the situation to be answered. Therefore, as potential problem-solving models in elementary mathematics, these prospective teachers need to develop more abilities to grasp the meaning of a word problem by enriching their reading skills. As future models of problem-solving in elementary mathematics, these prospective teachers need to cultivate more skill in understanding the context embedded in a word problem by enriching their reading skills.

3.3.2. Deficiency in Situation Modeling Skills

Both PETs, regardless of subject preference, have *a deficiency in situation modeling skill*s. This result was akin to [20], where they found that prospective teachers were unable to make representations of the word problems and eventually did not solve the problem correctly. PETs, who preferred to teach mathematics with satisfactory performance and other subjects with unsatisfactory performance, were unable to construct suitable representations. This indicates that these PETs did not create situation models where some used irrelevant tables, graphs, and illustrations to describe the problem, which led them to a wrong solution. This finding could be dismal in the mathematics experience of young learners. Elementary pupils have fun learning with math through models or representations used by teachers. If these future teachers were unable to represent the situation within a problem, it could steer misunderstanding and misconception on the students' part. This situation may also lead to a drastic impact on the student's math achievement and problem-solving competency. Accordingly, these prospective teachers of elementary students also recorded inadequate skill in interpretation and evaluation of results. Subsequently, PETs' insufficiency in modeling the situation led them to conclude that the derivation from the analysis was the final answer; at the same time, some incorrectly interpreted and evaluated the result and arrive at a wrong conclusion. As long as these PETs who preferred mathematics and other subjects were able to self-monitor their mathematical thought, they considered whether the outcome matched the situation model and reassessed their work if not returned to this problem-solving stage [10], they might theoretically increase their performance. These findings deem heightened preparation for PETs before deployment if these future primary teachers are poor in situation modeling, whether they will skip or not model this skill aptly to their students.

3.3.3. Proficiency in Mathematical Modeling Skills

PETs who preferred to teach mathematics recorded *proficiency in mathematical modeling skill*s. It can be indicated that these future teachers did mathematical modeling to guide them to analyze the problem set. They decode the situation mathematically. Despite that, some did not define what property to be utilized.

Conversely, PETs who chose to teach other subjects demonstrated *low proficiency in mathematical modeling skill*s. It can be concluded that these PETs were unable to model the situation mentioned in the given problems mathematically. The result showed that these future teachers have insufficiency in crafting equations to solve the problem and recall formulas and properties that must be applied. The prospective teachers did not identify the math concept correctly, and others employed ideas that do not fit the situation. This conclusion supports the prior finding where these PETs performed unsatisfactorily in solving the problem set. This finding substantiated [21], who also found low proficiency of prospective teachers in mathematical modeling. They revealed that future teachers faced difficulties in mathematical modeling since they could not connect the word-problem context into a meaningful mathematical representation. Simply crafting mathematical models and using representations without reflecting often misinterpret a task goal or create insufficient mathematical models that fail to account for the key components of the problem [10]. Since most of these future teachers did not demonstrate knowledge of the text and were unable to portray the situation, it follows that they did not mathematically model the problem skillfully. In this lieu, future elementary math

teachers must master this skill to pave the way to successful problem-solving.

3.3.4. Sufficiency in Analysis and Derivation Skills

PETs who preferred mathematics displayed *sufficient skill in mathematical analysis and deriving results*. Those future teachers who performed satisfactorily exemplified their competency in carrying out procedures to determine what is asked by the problem. The answer sheets revealed that these future teachers did their unique solution resulting in varied answers from one problem to another. Similarly, authors in [22] did not find any general pattern in the procedures carried out by prospective teachers to solve several problems. Besides, the solutions presented by these PETs reveal accuracy in operating formulas and using properties.

The further result agrees with [10], claiming that the analysis procedures depended on the mathematical model's representation. These observations suggest that these PETs successfully recalled the concepts and experiences they previously acquired. These PETs who effectively analyzed the situation and derived results were successful in mathematical modeling. On the contrary, PETs who selected other subjects to handle showed *insufficient skill in analysis and derivation*. These future teachers who analyzed the situation incompetently recorded unsatisfactory problem-solving performance. It can be inferred that since these PETs were unable to model the situation mathematically, they encountered inconveniences in dealing with the problem set, which displayed PETs' low ability to work with numbers, operations, formulas, and properties.

Additionally, PETs who failed in their first attempts did not try to show another solution. This finding suggests augmentation to these PETs to obtain sufficiency. As their output reflect, they were not able to exert more effort to determine the final answer. They ended their solution after obtaining preliminary results. Equally, Pape [23] affirmed that "a common error is not devoting the necessary cognitive energy to each stage of the problem-solving process". As these PETs who preferred to teach math and other subjects have insufficient skill in analysis and derivation, it follows that they have insufficiently reported their results as final answers. It can be inferred that this group of prospective teachers who obtained unsatisfactory and satisfactory performance did not give importance in communicating their results. These PETs could not report accurate values and labels/units, while those who found the correct answers failed to communicate their results properly. The analysis generally revealed that these future teachers could not write their output into a convenient statement for solving the problem. This result agreed with the study of [24] in promoting writing in mathematics where prospective elementary teachers struggled with writing their explanations. If these PETs have this skill, there is no doubt that they can achieve excellent problem-solving performance. Results need to be communicated by writing a summary statement consistent with the goal or circumstances in which the problem arose [10].

3. Conclusions and Recommendations

1. Since a high level of anxiety and low self-efficacy with mathematics and teaching mathematics can be caused by numerous factors associated with mathematics, Teacher Education Institutions and mathematics teacher educators are recommended to implement programs and activities to boost confidence and positive beliefs in these PETs' mathematics.

2. The PETs exhibited low performance in the given problem set, which can be attributed to their poor math content knowledge and inadequate problem-solving skill. Findings suggested the need for intensive mathematics remediation classes and comprehensive course audits to PETs to prepare them for their off-campus practice teaching and licensure examination and as nation builders in the field of mathematics education. Also, regimented instruction may be applied specially to PETs who poorly perform in their math subjects to advance their conceptual understanding and deepen their ability to apply these concepts with several non-routine word problems.

3. PETs preferring to teach math achieve significantly higher results than those who opted to teach other subjects. It was indicated that future teachers with high regard to mathematics and teaching mathematics showed commendable mathematical content knowledge and problem-solving performance. These PETs outperformed other PETs who did not signify confidence in taking the challenge of handling mathematics. This finding could serve as an avenue for the Bachelor of Elementary Education policymakers and curriculum developers to adopt the specialization program. Future teachers who may choose math as their major field denotes their positive beliefs and attitude towards mathematics. Also, these teachers show their self-efficacy with their mathematical and pedagogical content knowledge.

4. Subject preference predicted the problem-solving performance of the PETs. This implicated that subject preference could serve as a factor in forecasting PETs'

performance in mathematical problem-solving, considering that future teachers who chose mathematics exhibited remarkable problem-solving abilities. Thus, subject preference could be a measure in assessing the preparedness of future elementary math teachers. Teacher Education Institutions and mathematics teacher educators may be guided with this result in providing opportunities for students in the Bachelor of Elementary Education program to learn and experience more about mathematics context and the idea of solving problems. Teacher educators are recommended to be mindful in addressing the gaps concerning the PETs' mathematical problem-solving performance and skills.

5. PETs showed insufficient problem-solving skills. Their insufficiency in describing the situation, crafting mathematical models, using strategies to find results, and evaluating, interpreting, and reporting final answers could explain their low problem-solving performance in number sense, measurement, geometry, algebra, and probability. Hence, this proposes offering a problem-solving course for the PETs. Incorporating this course may improve PETs' performance and enhance their preparation as agents of change of the declining status of Philippine mathematics education. Discovering numerous ways of solving many problems will lead PETs to become effective and productive problem-solving models.

6. This study can be extended to prospective secondary teachers and active mathematics teachers. Researchers may replicate this study by adding more variables like an academic profile in terms of high school and college grades in mathematics, levels of mathematics anxiety and self-efficacy, and motivational frameworks in mathematics to determine factors that influence and predict the problem-solving performance of prospective teachers. An interview or focused group discussion may also take place to gain a deeper understanding of the prospective teachers' problem-solving skills and performance. Further, a triangulation may also be done by involving the PETs' supervising instructors to determine future teachers' problem-solving performance and skills.

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