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ENHANCING MOTIVATION, PROBLEM-SOLVING SKILLS AND PERFORMANCE OF GRADE 2 LEARNERS IN MATHEMATICS

LEIZEL ANN M. COLUMBINO
0009-0002-064-3296
https://doi.org/10.69502/mddl7834
meluzhel2@gmail.com
Potol Elementary School
Potol, Infanta, Pangasinan

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Abstract: *This study investigates the variables influencing motivation and problem-solving skills in mathematics among Grade 2 learners in elementary schools across the 1st Congressional District of Pangasinan, Philippines, during the 2023-2024 school year. A mixed methods design was employed to collect and analyze quantitative and qualitative data. A checklist questionnaire measured student motivation, while 120 students completed a problem-solving performance test. Additionally, semi-structured interviews were conducted with 10 Grade 2 teachers. The Mathematics Motivation Questionnaire (MMQ) by Logan Fiorella assessed student mathematics-related motivation. Data analysis involved frequency counts, means, percentages, t-tests for independent samples, and Pearson Product-Moment Correlation Coefficients. Results indicated that over half of the students struggled to identify relevant values in the problem-solving tasks, suggesting an average level of problem-solving ability and difficulty in determining necessary information. Furthermore, a significant positive correlation was found between students' problem-solving skills and intrinsic motivation. These findings inform the development of a mathematics instructional strategy utilizing cooperative learning to support students with special needs and typically developing classmates. The intervention incorporated mathematical models for addition, subtraction, multiplication, and division within a collaborative learning framework. Future research is recommended to include a broader representation of primary school learners across Grades 1-4, acknowledging potential differences in thinking styles between these grade levels.*

Keywords: *motivation, problem-solving skills, performance, mixed method, SDO I Pangasinan, Philippines.*

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INTRODUCTION

The science of thinking and computation is known as mathematics. It is the study or science of numbers, amounts, or shapes. Kitta (2014) defined mathematics as a language that enables us to articulate concepts and relationships derived from our surroundings. Mathematics allows one to make an invisible appearance, solving otherwise impossible issues. Lambdin (2019) states that pupils' mathematical expectations increase as they advance through school and begin their adult lives at home and work. Pupils must have a strong mathematical foundation to function mathematically literate in the future. A solid foundation entails far more than the rote application of procedural knowledge. According to a 2004 Ontario Ministry of Education report, all pupils should be able to understand, make sense of, and apply mathematics, create connections between concepts, and see patterns throughout mathematics. Mathematics develops understudies' knowledge and abilities, enabling them to deal with day-to-day challenges, pursue additional education, and fill in as a formidable labor force. Pupils require substantial mathematical achievement to advance in their education and the future. Good mathematics success is necessary for a country to develop a workforce capable of contributing to science and technology. However, current mathematical accomplishments could be more encouraging. This is demonstrated through the International Large-Scale Assessment (ILSA) as part of the 2018 Programme for International Student Assessment (PISA). According to the findings, just 27 of the 78 countries are statistically above the Organization for Economic Cooperation and Development (OECD) average, five are not statistically significantly different from the OECD average, and 46 are considerably below the OECD average. Thien (2016), Mundia, and Metussin (2018) mentioned this issue. However, according to the Trends in International Mathematics and Science Study (TIMSS), Filipino pupils need help understanding problems that differ from those in textbooks.

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Based on research published in Trends in International Mathematics and in the Science (TIMSS) 2008 study, the cognitive element focused on critical thinking and problem-solving, whereas Malaysian respondents fared the worst. Skills may be broken down into three categories: knowing, doing, and thinking. Students' apparent lack of command of essential mathematical abilities, especially problem-solving, was implied by this comment. Many are still suffering, and this fact should not be disregarded. Having a firm grasp of this material is crucial. One of the most important aspects of mathematics education is cultivating transferable critical thinking and problem-solving skills. If the barriers preventing pupils from gaining mathematical skills could be removed, more effective programs might be developed to help pupils with arithmetic difficulties.

This is especially critical for emerging countries like the Association of Southeast Asian Nations (ASEAN). Mathematics is genuinely at the heart of science, technology, and engineering, which propels a country forward. ASEAN is a ten-country alliance comprising Indonesia, Malaysia, the Philippines, Singapore, Thailand, Brunei, Laos, Myanmar, Cambodia, and Vietnam. Pupil motivation could be one solution to this mathematics achievement challenge. Several studies have found a direct link between motivation and general academic achievement, but there is a study void for middle-level pupils.

Many ASEAN countries (except Singapore) perform below the OECD average in PISA math assessments (2018). Students in the Philippines struggle with problem-solving due to a lack of conceptual understanding (de Leon, 2015; Llamas, 2016).

Since pupils may need varying amounts of time to answer the question, it is essential to investigate these facts throughout the educational process when problem-solving is employed. The thorough literature review undertaken throughout the development of this study's framework assists the researcher in acquiring current knowledge on the research issue. Key factors, concepts, related theories relevant to the study, and gaps in the existing knowledge were noted. To help the researcher best describe the mathematics performance of Grade 2 pupils in mathematics, the literature also offers research parameters, methodology, and data-gathering methods.

FRAMEWORK

This study examines the factors influencing the mathematical problem-solving skills of second-grade pupils. It proposes a model where the input variables are: Profile of the Grade 2 Pupil, Which includes demographic information such as gender and socioeconomic status, which can potentially impact learning styles and access to resources; motivation of the Students in Learning Mathematics, This variable assesses students' intrinsic enjoyment and perceived value of math, which can influence their engagement and effort and Problems Encountered by the Grade 2 Pupils in Learning Mathematics, this explores specific difficulties students face, such as understanding word problems or applying formulas.

These input variables are hypothesized to influence the process variable, problem-solving skills. This will be measured by the students' assessment performance and ability to solve various math problems. Mathematical performance will be assessed using first- and second-quarter grades to capture potential growth.

The study will employ a mixed-methods approach to gather data. Checklist-type questionnaires will be used to collect quantitative data on student profiles and problem-solving skills. Frequency counts and percentages will describe the respondents' profiles, while average weighted means will summarize student performance. Pearson R product-moment correlation will determine the

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relationship between motivation and problem-solving skills. Additionally, semi-structured interviews will provide qualitative insights into the specific problems students encounter while learning math.

The study will propose an intervention program to enhance mathematical problem-solving skills through cooperative learning based on the research findings. This approach will leverage the power of collaboration and peer support to help students learn from each other and develop their problem-solving abilities.

In essence, this conceptual framework investigates how student background, motivation, and learning obstacles influence their problem-solving skills in mathematics. The study aims to use this knowledge to design an intervention that improves these skills through cooperative learning.

OBJECTIVES OF THE STUDY

The researchers' goal in this study is to examine the motivation, problem-solving abilities, and performance of Grade 2 pupils in Mathematics in elementary schools in Pangasinan's 1st Congressional District. The study will benefit and contribute significantly to providing knowledge on the factors influencing teaching and learning in primary education schools. First and foremost, as implementers of all research inputs relevant to school academic excellence. This study is helpful to other researchers as a reference for investigating student performance in mathematics. The researcher sincerely hopes that by completing this work, mathematics teachers will be inspired to help their students excel in mathematics. Teachers will assess students' cultural backgrounds before beginning classroom instruction to determine if pupils understand the fundamental ideas in a specific unit of study in mathematics. Teachers will then be able to improve their kids' math performance. The study will also assist future researchers in coming up with results on how school surroundings and instructor backgrounds are linked to kids' cultural backgrounds, which influence arithmetic performance.

METHODOLOGY

Research Design

This research employed a mixed method, sequential explanatory approach. Mixed-methods research combines the benefits of qualitative and quantitative approaches.

This research used a two-stage sequential explanatory mixed methods design (Creswell, 2002, 2003; Creswell et al., 2003) to explore student motivation in mathematics. In the first stage, a questionnaire gathered quantitative data on various factors. Using discriminant function analysis, this data was then analyzed to identify variables that might predict students' mathematical motivation. The goal was to use these findings to select students for in-depth interviews in the second stage. Here, a qualitative multiple-case study approach was employed. Semi-structured interviews with teachers provided rich textual data about their perceptions of Grade 2 students' problem-solving abilities.

Research Site

The research was carried out in some schools in Pangasinan's first congressional district, which included the nearby municipalities of Agno, Dasol, Infanta, Mabini, Sual, Anda, Bani, Bolinao, and Burgos.

Participants

This study's respondents were 120 Grade 2 pupils from different elementary schools in the 1st Congressional District of Pangasinan. All these participants are chosen using quota sampling. This

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sampling method is used in research where the researcher decides the number and characteristics of the respondents to include in the study.

Instrumentation

The researcher gathered data for this study using a checklist-type questionnaire, a performance test to evaluate the pupils' problem-solving ability, and a semi-structured interview.

Respondents answered freely. Content validity was established to ensure that items reflected knowledge, abilities, and other tested characteristics. The researcher obtained authorization from the supervisor to conduct a study and clearance from Columban College Inc. before submitting it to the Schools Division Office authorities. At the SDO Office, the researcher requested authorization to conduct research.

The first part of the survey questionnaire consists of the profile of the respondents, which includes sex, family monthly income, father's occupation, mother's occupation, father's educational attainment, and mother's educational attainment. The second part assessed the motivation of the Grade 2 pupils in learning mathematics. The mathematics motivation test is adapted from Logan Fiorella's Mathematics Motivation Questionnaire (MMQ), which was utilized in primary schools in seven states across the United States of America. A checklist-type questionnaire with a five-point Likert scale was constructed. The items are rated 5, 4,3, 2, and 1, these indicate that they are Strongly Agree, Agree, Moderately Agree, Slightly Disagree, and Strongly Disagree. The third part was conducting a performance test translated into Filipino to evaluate the pupils' problem-solving ability. A written test was used to gather data. A test of problem-solving skills typically includes four questions presented in a cube-shaped format.

Content validity was established to ensure that items reflect the knowledge, abilities, and other tested characteristics. The researcher also engaged with stakeholders to validate the tool in the assessment of Problem-solving skills in collaboration with Master Teachers and instructors with relevant experience in Instruction in Elementary Mathematics. The mathematics motivation test is adapted from Logan Fiorella's Mathematics Motivation Questionnaire (MMQ), which was utilized in primary schools in seven states across the United States of America. The Math-Mental Questionnaire (MMQ) assesses students' mathematical mindset, approach, beliefs, values, and anxieties (Fiorella et al., 2021). Since the content of the test in this study was drawn from the material in Mathematics 2, it met the criteria for content validity.

The researcher is sensitive to research ethics and values in obtaining the study population, collecting data, and disseminating the findings. This helps maintain the favorable image of research enterprises worldwide (Omari, 2011). The researcher gained authorization from the supervisor to conduct a study and obtained clearance from Columban College Inc. before submitting it to the Schools Division Office authorities. At the SDO Office, the researcher requested authorization to conduct research. These letters can be found in the work's appendices. By adhering to the principles of informed consent, the researcher safeguarded the independence of participants.

The researcher assures that participants understand the study's goal so that they can participate freely. The respondents were advised of the research purpose, potential dangers or discomforts, potential benefits, and anonymity. The researcher promises not to expose their name to anyone other than the researcher and their team. These findings were stored in the researcher's computer with a password that was only accessible for study purposes.

Data Collection

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Before floating the questionnaires to the respective locales of the study, the researchers secured permits from the Schools Division Office of Pangasinan I. The researcher sought an Endorsement to coordinate with the school principals of the different schools to identify respondents. The researcher then guided the pupils in answering the questionnaire. The significance of the respondents' participation in the study was explained to them by the researcher. As part of their role as research subjects, respondents are given definitions of key concepts and phrases by the researcher. The researcher counted the responses and analyzed the results based on the questions. The researcher consulted a statistician to help choose suitable statistical methods to evaluate the data, draw conclusions, and make suggestions for the study.

The researchers used the following statistical tool to examine and assess the raw data collected. Frequency counts and percentages were employed in problem number one, which dealt with the profile of the Grade 2 students in terms of sex, family monthly income, parent's occupation, father's educational attainment, and mother's educational attainment. A percentage frequency distribution is a display of data that indicates the percentage of observations for each data point or grouping of data points. It is a commonly used method for expressing the relative frequency of survey responses and other data. The average weighted mean was utilized in problem number two, which described the motivation of pupils to learn mathematics. The weighted means is an average computed by giving different weights to some of the individual values. If all the weights are equal, the weighted meaning is the same as the arithmetic meaning. It represents the average of a given dataset.

A performance test was administered to the responders to assess the students' problem-solving abilities in Problem 3.

To test if there was a significant relationship between the significant correlations among motivations, problem-solving skills, and performance of pupils in Mathematics, the Pearson r product moment of correlation was utilized. Pearson’s product-moment correlation coefficient (PPMCC or PCC) measures the linear relationship between two variables measured on interval or ratio scales. It can only be used to calculate the relationship between two variables, which are both normally distributed. Lastly, the average weighted mean was utilized to determine the problems the pupils encountered in learning Mathematics.

RESULTS AND DISCUSSION

In terms of the profile of the respondents, there are more female Grade 2 students than males; Family Monthly Income- most respondents only earn 10,000 and below, the lowest indicator in this profile. These findings reveal that most respondents need to earn more to provide adequate basic needs for the family; Employment Status of the Parents- Employment Opportunities in the 1st Congressional District of Pangasinan are high, but the wages are low; Highest Educational Attainment of the Fathers- respondents' fathers are not college graduates, so there is a slim chance for them to land stable, high-income employment; The Highest Educational Attainment of the Mothers reveals that if the mothers are high school undergraduates and below, they are significantly more likely not to be able to assist their children in their lessons at home due to a lack of knowledge. This would result in lower academic achievement for the students.

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In the motivation of students in learning Math, in terms of Intrinsic Value, Self-regulation, and Self-Efficacy, the average weighted mean of 4.13 states that the students agree that they are motivated to learn mathematics.

In The Problem-Solving Ability in Mathematics of the Grade 2 Students in terms of Overall Score, the Grade 2 students garnered an overall average score of 4.74 out of 40 items, indicating average problem-solving skills. This suggests that the summation of the total scores of the students in understanding the problem, Planning, and Computation was not even able to get half of the total score.

In Significant Correlations between Motivations and Problem-Solving Ability of the Grade 2 Students in Mathematics, in terms of Intrinsic Motivation: There is a weak negative correlation (r = -.212) between intrinsic motivation (enjoyment of math) and problem-solving ability. These are some of the reasons: Fear of Failure- Intrinsic motivation often thrives in environments where failure is seen as a learning opportunity. However, if failure is stigmatized or heavily penalized, individuals may avoid challenging problems to protect their self-esteem or avoid negative consequences. This avoidance can hinder the development of problem-solving skills; Lack of Autonomy- Intrinsic motivation is closely tied to autonomy—the sense of having control over one's actions and decisions. When individuals feel micromanaged or forced into solving problems in specific ways, their intrinsic motivation can diminish. This reduced motivation may manifest in lower persistence or creativity in problem-solving tasks, and Perceived Competence- Intrinsic motivation is also influenced by individuals' beliefs about their own competence. Intrinsic motivation may decrease if a problem-solving task is perceived as too difficult or beyond one's abilities. This perception can lead individuals to approach problem-solving tasks with less enthusiasm or confidence, impacting their ability to engage with the task effectively. This is statistically significant, meaning it is unlikely due to chance. However, the negative sign indicates that higher intrinsic motivation is associated with slightly lower problem-solving scores, possibly due to other factors in Self-Regulated Learning and Self-Efficacy Motivation. No correlations were found between self-regulated learning motivation (managing study habits) or self-efficacy motivation (confidence in math skills) and problem-solving ability.

In the Problems Encountered by the Students in Learning Mathematics the problems they encounter in mathematics, the Grade 2 students rated the following as moderately severe: "I become anxious when it is time to take a math test (3.04), I am nervous about how I will do on the math tests (2.85), I worry about failing math tests(3.09), I am concerned that the other students are better in math(2.97), and I am not interested in Math Subjects (2.95)."The average weighted mean of 2.98 reflects that the problems encountered by students in learning mathematics are moderately severe.

According to the results of the mathematics teacher's interview, the following are some reasons why students struggle with mathematical problems: They have trouble understanding the problem. They cannot translate it into symbols; they must constantly understand the problem. They guess the answer if they do not understand it. They do not want to find a solution; they need help understanding the problem and cannot correctly interpret it.

CONCLUSION

This study identified areas where second-grade pupils in the 1st Congressional District of Pangasinan require additional math support. While students generally expressed positive motivation towards the subject, their problem-solving skills needed improvement, particularly in areas like interpreting word problems, selecting solutions, and performing calculations. The positive correlation between intrinsic motivation and problem-solving achievement suggests that fostering a love of learning math can be beneficial.

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To improve learning outcomes, future interventions could focus on developing problem-solving strategies and providing additional support for students who struggle with specific concepts. Further research exploring the influence of understanding on individual problem-solving indicators and including students from a broader range of grade levels would provide a more comprehensive picture of math education in the Philippines.

The findings and results of this study have become a springboard for developing instructional strategies that help students acquire mathematical problem-solving, as this is a crucial part of mathematics education. This intervention focuses on mathematical problem-solving in second grade, which employs a cooperative learning strategy to help kids with special needs study alongside their typically developing classmates. Mathematical models of addition, subtraction, multiplication, and division were part of the intervention's problem-solving tactics, which included a cooperative learning approach.

TRANSLATIONAL RESEARCH

This research can be translated to improve second graders' math performance through various engaging and accessible media formats. Imagine a series of colorful, illustrated storybooks that follow a group of students tackling fun math problems together. These stories could highlight the importance of perseverance and different problem-solving strategies, sparking intrinsic motivation in young learners. Similarly, catchy songs or short video clips featuring animated characters could introduce math concepts in a rhythmic and visually stimulating way. For parents and educators, informative brochures or posters could offer practical tips on fostering a love of math at home and in the classroom. Radio broadcasts or short plays performed in schools could present the research findings in a way that resonates with the local community. By translating the research into these diverse mediums, we can empower parents, educators, and students to work together to create a more engaging and successful learning experience for second graders in mathematics.

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