# Challenges faced by the university students and their cognitive skills in learning basic mathematics

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**ABSTRACT**

This study recognized the relationship between the students'cognitive skills and challenges in learning basic mathematics with all first-year students in Cebu Technological University Tuburan -Campus. Employ,using modified survey questionnaires among the 304 first -year students, most are aged 19-20 (73.03%)and have completed 13-14 years of schooling.Financially, 73.68% of their parentsfall into a low- income, with varied educational backgrounds, predominantly at the high school and elementary levels. Math assessments show that 40.13% of students scored above average in " Number Sense," 19.14% in "Problem- Solving,"23.36% in "Seriation," and 52.63% in "Logical Multiplication." Key challenges include short retention spans (mean =2.47), inattentiveness (mean =2.16), and insufficient lesson planning (mean =2.26). School – related issues, such as a lack of educational materials (mean = 2.30), also impact learning. Significant correlations were found between these challenges and cognitive skills, particularly in problem – solving ($r = -.352$, $p<0.01$), seriation ($r = -.348$, $p<0.01$), and logical multiplication ($r= -.359$, $p<0.01$). Gender and age also play key roles, with notable correlations between family- related challenges and gender ($r = -0.220$, $p<0.01$), and between cognitive skills and age ($r = -.250$ to $-.407$, $p<0.01$). The findings revealed that most students found difficult in answering towards problem – solving. This suggests that learning enhancement activity program should be implemented to facilitate the students' cognitive skills, particularly problem- solving, and to address the challenges affecting their mathematical performance. Such interventions are essential for improving academic outcomes and ensuring that students are better prepared to tackle mathematical concepts.

## 1. Introduction

Mathematics is an essential part of our everyday lives, influencing various aspects such as civic duties, professional pursuits, and cultural activities. However, many students

find mathematics to be a daunting subject, which discourages them from pursuing it as a degree. In recent times, there has been a noticeable decline in students choosing mathematics as a career path. Research indicates that challenges with math often begin in elementary school and persist into higher education. Mathematics is essential for cultivating mental discipline, enhancing logical reasoning, and fostering analytical skills (Ramya et al., 2023).

Cognitive skills and mathematical performance among first-year students have a positive correlation. Logical reasoning, spatial visualization, and mathematical achievement are contributing factors in cognitive skills and mathematical performance (Smith et al., 2017). According to Hun (2022), cognitive skills predict academic performance; schools that aim to raise academic achievement also raise cognitive skills. Perhaps the basic source of trouble in problem solving is that students cannot actively observe, check, and regulate their cognitive process when solving a problem.

Achievement in mathematics depends on an individual's capability to comprehend and solve complex problems that possess an underlying logic, subsequently raising cognitive demands within this specific area of study. General cognitive abilities, which have been repeatedly linked to mathematical success, appear to contribute further, while mathematics anxiety manifests as a sense of fear that numerous individuals encounter when faced with mathematical tasks (Lipnevich et al., 2016).

Globally, problem-solving skills are a vital component of the cognitive domains evaluated in international educational assessments. For instance, exams like the Trends in International Mathematics and Science Survey (TIMSS) and the Programme for International Student Assessment (PISA) incorporate challenges that necessitate students to apply mathematical concepts and utilize mathematical reasoning to substantiate and validate their responses (Kliziene et al., 2022). The link between students' cognitive skills and the challenges of mastering basic mathematics has always garnered significant attention in educational institutions due to mathematics interdisciplinary nature. This study was carried out by Wolters (2020), posits that there has often been a particular emphasis on students' mathematical performance, which is considered a critical global concern in many countries.

In the Philippines, first-year students from various state universities demonstrate cognitive skills that align with the late concrete operational stage. At this age, they are anticipated to be in the formal operational stage according to Piaget’s theory of cognitive development. Consequently, these students struggle to perform the logical operational skills that are expected for their age group. Their ability to apply Piaget’s logical operations is not fully developed, as shown by their difficulties in solving word problems that require the seven logical operations. While students exhibit a sufficient understanding of logical multiplication, their overall cognitive skills performance is still deemed insufficient. This lack of understanding across all seven logical operations can be attributed to misconceptions about certain mathematical terms, misinterpretation of problems, and inadequate language comprehension skills (Gamit, 2022).

At Cebu Technological University- Argao Campus, students often encounter difficulties while studying mathematics. This suggests that various issues have impacted students' understanding of mathematical concepts. The challenges in problem-solving and reading comprehension could hinder learners’ ability to tackle mathematical problems. It emphasizes that students must employ cognitive strategies involving goals and sequential mental processes to effectively learn and solve word problems alongside the challenges they face (Dayaganon et al., 2022). Cognitive strategies remain integral to the educational framework, and applying this theory in math instruction can enhance problem-solving skills,

ultimately improving student performance, competence, and reasoning abilities, which can be beneficial in addressing real-life issues (Muhammad et al., 2019). Additionally, the research conducted by Peteros et al. (2022) examined student performance in mathematics in Balamban, Cebu, Philippines, revealing that a failure to adapt the nature of math can lead to difficulties in learning the subject.

The study of cognitive skills in learning basic mathematics reveals a significant gap in understanding how individual cognitive processes impact mathematical learning. While some students may grasp mathematical concepts easily, others struggle due to various cognitive challenges such as working memory limitations, attention difficulties, or difficulties in abstract reasoning. By bridging this gap, educators can develop relevant strategies to support students with different cognitive profiles, ultimately promoting more inclusive and effective mathematics education for all learners.

The purpose of this study is to assess challenges and cognitive skills performance in basic mathematics of the first-year students in Cebu Technological University- Tuburan Campus for the academic year 2023-2024. It aims to propose an extension program for students to improve their cognitive skills and address their challenges in learning basic mathematics. This research goal aims to improve and enhance the students' cognitive skills towards solving mathematical problems, particularly in word problems involving real numbers, sets, and algebraic expressions. Ultimately, the study aims to leverage mastery of cognitive skills in learning basic mathematics to create a strong foundation for lifelong learning.

## 2. Theoretical basis

This section indicates a summary of theories and empirical literature that served as the basis of this research.

According to Piaget (1950), people go through many phases of cognitive development, each of which is distinguished by cognitive capacities. During the concrete operational stage, which spans from ages 7 to 11, children acquire the capacity to reason rationally and manipulate tangible objects mentally. When Piaget proposed that intelligence is the fundamental mechanism for maintaining equilibrium in the relationships between an individual and his environment, the theory of constructivism found significance and continuity in the idea of cognitive development. Piaget further emphasized that reflecting abstraction is the mechanism behind this process of growing interiorization, coordination, and abstraction. With the use of these skills, students are able to classify novel problems into cognitive schema and then apply procedural and content knowledge from existing schema to novel problems.

In Piaget's theory, both assimilation and accommodation necessitate an active learner, as individuals must discover problem-solving skills rather than being passively taught. In the classroom, learning should prioritize students and be achieved through hands-on discovery learning. The teacher's role is to support learning instead of providing direct instruction (Pakpahan & Saragih, 2022). Piaget's theory can provide a framework for understanding the cognitive growth of first-year college students at CTU Tuburan Cebu, in the context of their mathematical foundational skills. This study can assess first-year college students' mental capabilities in basic mathematics and analyze how their cognitive skills align with the different stages of development as outlined by Piaget's theory. This insight can be utilized to identify both strengths and areas that may require further support or training.

As stated by Korimpes (2023), Piaget's theory proves to be beneficial in mathematics education, particularly in relation to the conservation component of the theory. This means that the progress students make in their learning before participating in lessons aligned with the conservation aspects of Piaget's theory greatly influences their academic success following those lessons.

Another key theory in this research is Richard Skemp's Cognitive Theory of Mathematics Learning (2017), which suggests that learners build their mathematical understanding by linking new information to concepts they have already learned. This theory highlights the crucial role of cognitive abilities in the process of learning mathematics. Richard Skemp's Cognitive Theory of Mathematics Learning centers on how individuals grasp and acquire mathematical concepts and skills. In his influential study, "The Cognitive Theory of Mathematics Learning," Skemp explores the cognitive processes that are part of mathematical learning. Skemp's theory delineates how individuals learn mathematics and the role cognitive structures play in that learning process. He categorizes mathematical understanding into two types: relational understanding and instrumental understanding.

In constructivist theory, mathematics education revolves around the idea that students generate their own understanding of mathematics based on their experiences (Rahim et al., 2021). Rather than being passive receivers of information from instructors, students actively participate in the learning process and build their own knowledge through their experiences. Within a constructivist framework, the teacher serves as a facilitator who helps students in forming their understanding of mathematics through various activities and discussions. Consequently, students are allowed the opportunity to explore and develop their own mathematical ideas, which can aid them in grasping more intricate mathematical concepts.

The constructivist approach to teaching mathematics highlights the necessity of engaging students actively in the learning process. In this perspective, students are seen as active creators of knowledge who engage in their mathematics education and build their comprehension of mathematical concepts based on their own experiences (Sugrah, 2019; Wibowo, 2020). Constructivism also emphasizes the importance of recognizing students' individual contexts and backgrounds in mathematics education (Umbara, 2017). In this framework, students are viewed as having varied knowledge related to mathematics, indicating that diverse strategies and methods should be used to help them grasp mathematical concepts (Hanggara et al., 2023).

Social learning theory, proposed by Lev Vygotsky, serves as a foundational theory for this study. Vygotsky posited that various factors, including parents, caregivers, peers, and the surrounding culture, contribute to the development of children's cognitive functions. He asserted that children's minds are initially limited by basic biological constraints. According to Vygotsky's sociocultural theory of learning, knowledge acquisition occurs through social interactions. Educational approaches informed by this theory promote social engagement and active participation in learning activities through the relationships that are formed. Students acquire knowledge by observing, listening, and discussing as they navigate their tasks. Vygotsky's theory seeks to understand consciousness as a product of socialization. Additionally, he emphasized that social interaction is crucial for cognitive development in children. Vygotsky believed that social engagement plays a key role in enhancing cognitive growth (Yusof, 2021).

Vygotskian concepts can be applied to investigate the growth of students' mathematical reasoning. In line with Vygotsky's principal argument, the following

exploration uses activity as the key analytical unit, with understanding and transformation as the main goals. This investigation revolves around the notion that every social action undertaken by the teacher, ranging from setting up the environment to providing explanations, among other practices has the potential to either promote or obstruct students' conceptual understanding (Walshaw, 2017).

The challenges and successes in learning basic mathematics are closely tied to cognitive processes, constructivist principles, and social interactions. Cognitive theory highlights the vital role of attention, memory, and problem-solving skills in understanding math. Constructivism stresses the importance of building on prior knowledge and actively creating meaning through experience and reflection. This explains why a student's existing knowledge greatly affects their ability to understand new math concepts. Finally, social learning theory underscores the influence of social interaction, collaboration, and the guidance of more knowledgeable others in facilitating learning and overcoming challenges. Addressing the difficulties faced by students in basic mathematics necessitates a pedagogical approach that integrates these three perspectives, fostering active engagement, collaborative learning, and the development of essential cognitive skills within a supportive social context.

## 3. Methodology

This study employed the descriptive method utilizing a survey questionnaire. The first part contains the cognitive skills performance of students in the group of respondents, as assessed by the Test on Logical Operation, involves evaluating abilities like number sense, problem-solving, seriation, and logical multiplication. The instrument used for this assessment is a questionnaire developed by Gamit in 2022. This questionnaire likely includes various questions and scenarios to gauge the students' proficiency in these areas. And the second part concerns the challenges faced by students in learning basic mathematics, such as those related to students, teachers, schools, and families. The instrument used is a questionnaire developed by (Mohd, 2016). These challenges encompassed difficulties stemming from the students themselves, their teachers, the school environment, and even their families.

The researcher utilized the sample size calculator to determine the respondents of the study.

The researchers at Cebu Technological University – Tuburan Campus sought permission from the campus director to conduct their study, and the permission was granted.

The researchers began the investigation and collected the data after securing the acceptance of the letter of authorization. The survey questionnaires provided the data for this investigation. And to the facilitate analysis and interpretation, the answers were ranked, totaled, and compiled in the table.

## 4. Result and discussion

The data acquired, the statistical analysis, results, findings, and interpretation are all presented here. These are arranged logically in tables according to the chronology of the specific research problem, which is to assess challenges and cognitive skills performance in basic mathematics of the first-year students in Cebu Technological University- Tuburan Campus for the academic year 2023-2024.

### *4.1. Result*

Table 1 presents the cognitive skills of first-year college students in solving basic mathematics problems.

Table 1

Students' Cognitive Skills in Learning Basic Mathematics

| Category | Above Average | | Average | | Below Average | | Total | |
|---|---|---|---|---|---|---|---|---|
| | f | % | f | % | f | % | f | % |
| Number Sense | 122 | 40.13 | 171 | 56.25 | 11 | 3.62 | 304 | **100** |
| Problem-Solving | 59 | 19.41 | 179 | 58.88 | 68 | 22.37 | 304 | **100** |
| Seriation | 71 | 23.36 | 193 | 63.49 | 43 | 14.14 | 304 | **100** |
| Logical Multiplication | 160 | 52.63 | 99 | 32.57 | 45 | 14.80 | 304 | **100** |

***Legend for Number Sense, Problem-Solving and Seriation:***

*8.00 – 10.00 – Above Average (AA): 4.00– 7.99 – Average (A): 0.00– 3.99 – Below Average (BA)*

***Legend for Logical Multiplication:***

*4.00 - 5.00 – Above Average (AA): 2.00 - 3.99 – Average (A): 0.00– 1.99 – Below Average (BA)*

Source: Data analysis result of the research

Table 1 presents the cognitive skills of first-year college students in solving basic mathematics problems. In the Number Sense cognitive skill, 122 out of 304 respondents (40.13%) scored above average, 171 respondents (56.25%) scored at an average level, and 11 respondents (3.62%) scored below average. For Problem-Solving, 59 out of 304 respondents (19.14%) scored above average, 179 respondents (58.88%) scored at an average level, and 68 respondents (22.37%) scored below average. In the Seriation cognitive skill, 71 out of 304 respondents (23.36%) scored above average, 193 respondents (63.49%) scored at an average level, and 43 respondents (14.14%) scored below average. Lastly, in Logical Multiplication, 160 out of 304 respondents (52.63%) scored above average, 99 respondents (32.57%) scored at an average level, and 45 respondents (14.80%) scored below average.

Table 2 shows the student–related challenges.

Table 2

Student–Related Challenges

| | Statements | Mean | VD |
|---|---|---|---|
| 1. | Lack of analytical skill- Students have a hard time analyzing mathematical problems. | 2.39 | ME |
| 2. | Lack of comprehension skills- Students have difficulty understanding mathematics in the English language. | 2.34 | ME |
| 3. | Short retention span- Students tend to forget the previous lesson and do not remember the algorithms. | 2.47 | ME |
| 4. | Lack of pre-requisite skills—Students have difficulty solving basic concepts in mathematics, including the four fundamental operations and computational skills involving real numbers. | 2.32 | ME |
| 5. | Lack of problem-solving skills- Students have a hard time solving word problems. | 2.30 | ME |
| 6. | Inattentiveness—Students need to pay more attention to the lesson during mathematics class. They are busy doing other things. | 2.16 | ME |
| 7. | Negative attitude towards mathematics—Students perceived mathematics to be difficult and developed a dislike for it. | 2.18 | ME |
| 8. | Lack of study habits—Students' attention is diverted to technology. They spend more time watching TV, playing mobile games, focusing on social media, etc., and have little time left to study. | 2.22 | ME |
| 9. | Absenteeism and tardiness- Students' non-attendance and lateness in math class. | 2.24 | ME |
| 10. | Shyness and lack of self-confidence- Students are shy because they are anxious that they will be bullied if their answers are wrong. There is uncertainty in the answers to problems. | 2.28 | ME |
| | **Average Weighted Mean** | **2.29** | **ME** |

***Legend:*** *3.01 – 4.00 – Very Much Evident (VME): 2.01 – 3.00 – Much Evident (ME): 1.01 – 2.00 – Less Evident (LE): 0.0– 1.00 – Not Evident (NE)*
Source: Data analysis result of the research

Table 3 shows the teacher-related challenges.

Table 3
Teacher–Related Challenges

| | Statements | Mean | VD |
|---|---|---|---|
| 1. | Specialization – Non-mathematics major teacher handles mathematics subjects. | 2.19 | ME |
| 2. | Teacher absenteeism and tardiness—The teacher's non-attendance in class deteriorates the students' interest in mathematics class, implying leniency and disinterest in teaching. | 2.14 | ME |
| 3. | Poor command of language - Teachers cannot explain the lesson clearly. | 2.22 | ME |
| 4. | Inadequacy of instructional materials in teaching—A lack of instructional materials in teaching mathematics may fail to cater to the needs of diverse learners in math class. | 2.25 | ME |
| 5. | Classroom management – Being unable to handle disciplinary problems in mathematics class. | 2.21 | ME |
| 6. | Learning Competency - Non-completion of the learning competency in the curriculum guide for the intended quarter. Topics not covered, which is a pre-requisite to higher level mathematics, could affect the student's performance. | 2.21 | ME |
| 7. | Lesson Planning—Teachers who are unprepared for their lessons may lose the learners' interest in learning the topic. | 2.26 | ME |
| 8. | Training attended in mathematics—Teachers said that they lack training or updates in mathematics since they are seldom sent to mathematics training. | 2.24 | ME |
| 9. | Teaching method/strategy—The teacher may not be able to use an appropriate approach in teaching a specific mathematics topic, and the class may not be able to accommodate the needs of diverse learners. | 2.16 | ME |
| 10. | Teachers are not friendly in class. Teachers are too strict in class, which can cause students to develop anxiety and feel stressed. | 2.17 | ME |
| | **Average Weighted Mean** | **2.20** | **ME** |

***Legend:*** *3.01 – 4.00 – Very Much Evident (VME): 2.01 – 3.00 – Much Evident (ME): 1.01 – 2.00 – Less Evident (LE): 0.0– 1.00 – Not Evident (NE)*
Source: Data analysis result of the research

Table 4 shows the school-related challenges.

Table 4
School – Related Challenges

| | Statements | Mean | VD |
|---|---|---|---|
| 1. | Learner's material - There are lack or no books available in mathematics for learners. | 2.30 | ME |
| 2. | School Library – The school library had inadequate mathematics learning resources (updated and relevant). | 2.21 | ME |
| 3. | Class schedule—Mathematics subjects are scheduled in the last subject in the morning, when students are already hungry, at 1 p.m., when students tend to be sleepy, or in the previous period in the afternoon when they are anxious to go home. | 2.19 | ME |
| 4. | Lack of motivation – Some students may struggle with finding motivation to engage in their schoolwork, leading to decreased performance and disinterest in learning. | 2.23 | ME |
| 5. | Learning difficulties -Students with learning disabilities or problems may face challenges in keeping up with the curriculum and may require additional support and accommodations. | 2.20 | ME |
| | **Average Weighted Mean** | **2.23** | **ME** |

***Legend:*** *3.01 – 4.00 – Very Much Evident (VME): 2.01 – 3.00 – Much Evident (ME): 1.01 – 2.00 – Less Evident (LE): 0.0– 1.00 – Not Evident (NE)*
Source: Data analysis result of the research

Table 5 shows family-related challenges.

Table 5
Family – Related Challenges

| Statements | Mean | VD |
|---|---|---|

| | | | |
|---|---|---|---|
| 1. | Lack of parent support—Students who lack moral and financial support from parents are not inclined to develop study habits. | 2.15 | ME |
| 2. | Lack of assistance at home on requirements – Parents or other family members are not able to help or assist the student during study time or in dealing with school assignments and requirements. | 2.14 | ME |
| 3. | The non-availability of mathematics learning resources at home -Students do not have reference materials at home when faced with mathematics problems that they do not understand. | 2.16 | ME |
| 4. | Financial constraints—Parents sometimes request that students skip School to help them with their house chores or livelihood activities. | 2.11 | ME |
| 5. | Family problems—When confronted with problems at home, adolescents tend to be bothered and stressed, losing their focus on the lesson. | 2.02 | ME |
| | **Average Weighted Mean** | **2.12** | **ME** |

Legend: 3.01 – 4.00 – Very Much Evident (VME): 2.01 – 3.00 – Much Evident (ME): 1.01 – 2.00 – Less Evident (LE): 0.0– 1.00 – Not Evident (NE)
Source: Data analysis result of the research

Table 6 presents the significant relationship between challenges and cognitive skills in learning basic mathematics of first-year students.

Table 6
Significant Relationship Between the Challenges and Cognitive Skills

| | FAMILY-RELATED | STUDENT-RELATED | TEACHER-RELATED | SCHOOL-RELATED | NUMBER SENSE | PROBLEM-SOLVING | SERIATION | LOGICAL MULTIPLICATION |
|---|---|---|---|---|---|---|---|---|
| FAMILY-RELATED | 1 | | | | | | | |
| STUDENT-RELATED | .528** | 1 | | | | | | |
| TEACHER-RELATED | .579** | .606** | 1 | | | | | |
| SCHOOL-RELATED | .592** | .510** | .565** | 1 | | | | |
| NUMBER SENSE | -.074 | -.001 | -.087 | .004 | 1 | | | |
| PROBLEM-SOLVING | -.336** | -.352** | -.260** | -.287** | .295** | 1 | | |
| SERIATION | -.234** | -.252** | -.348** | -.217** | .361** | .424** | 1 | |
| LOGICAL MULTIPLICATION | -.303** | -.273** | -.359** | -.223** | .393** | .462** | .635** | 1 |

***. Correlation is significant at the 0.01 level (2-tailed).*
Source: Data analysis result of the research

Table 6 displays the findings of zero-ordered via Pearson correlation coefficient. The family's cognitive skills components, such as problem-solving ($r = -.336$, $p<0.01$), seriation ($r = -.234$, $p<0.01$), and logical multiplication ($r = -.303$, $p<0.01$), strongly correlate with each other. Next, there is a substantial correlation between student-related factors and cognitive skills including logical multiplication ($r = -.273$, $p<0.01$), problem-solving ($r = -.352$, $p<0.01$), and seriation ($r = -.252$, $p<0.01$). Additionally, factors in cognitive skills like problem-solving ($r = -.260$, $p<0.01$), seriation ($r = -.348$, $p<0.01$), and logical multiplication ($r = -.359$, $p<0.01$) substantially associated with teacher-related characteristics. Nonetheless, there is a substantial correlation between school-related characteristics and cognitive skills including logical multiplication ($r = -.223$, $p<0.01$), problem-solving ($r = -.287$, $p<0.01$), and seriation ($r = -.217$, $p<0.01$). Furthermore, the only cognitive abilities to number sense that do not significantly correlate with difficulties linked to family, students, teachers, or schools are those associated to cognitive abilities to number sense, with a p-value greater than 0.01.

Table 7 presents the significant relationship between challenges and cognitive skills in learning basic mathematics of first-year students.

Table 7
Significant Relationship Between Challenges and Age and Gender

| | FAMILY-RELATED | STUDENT-RELATED | TEACHER-RELATED | SCHOOL-RELATED | Age | Gender |
|---|---|---|---|---|---|---|
| FAMILY-RELATED | 1 | | | | | |
| STUDENT-RELATED | .528** | 1 | | | | |
| TEACHER-RELATED | .579** | .606** | 1 | | | |
| SCHOOL-RELATED | .592** | .510** | .565** | 1 | | |
| Age | .184** | .108 | .198** | .148** | 1 | |
| Gender | -.220** | -.134* | -.187** | -.209** | -.379** | 1 |

***. Correlation is significant at the 0.01 level (2-tailed).*
**. Correlation is significant at the 0.05 level (2-tailed).*
Source: Data analysis result of the research

The correlation analysis indicates a significant relationship between family-related challenges and gender ($r = -0.220$, $p < 0.01$). This suggests that family-related factors impact male and female students differently in their pursuit of learning basic mathematics. Student-related challenges also show a significant correlation with gender ($r = -0.134$, $p < 0.05$), highlighting that gender differences extend to challenges directly related to the students themselves.

Additionally, teacher-related challenges significantly correlate with gender as well ($r = -0.187$, $p < 0.01$), suggesting that the interaction and instructional methods employed by teachers might be perceived or received differently by male and female students. Furthermore, school-related challenges exhibit a significant correlation with gender ($r = -0.209$, $p < 0.01$), indicating that institutional factors and possibly the learning environment also have varying impacts based on gender. Lastly, age significantly correlates with gender ($r = -0.379$, $p < 0.01$), providing evidence that the impact of age on learning mathematics is also gender-dependent.

### *4.2. Discussion*

This study assessed the challenges and cognitive skills performance in basic mathematics of the first-year students in Cebu Technological University- Tuburan Campus for the academic year 2023-2024.

The students' problem-solving skills are not merely valued by their learning results but also by their understanding and learning activities for each of the problem-solving steps (Melawati, et al., 2022). This approach emphasizes the importance of process over product, encouraging students to engage deeply with each phase of problem-solving. By focusing on the steps involved, students develop a more robust framework for tackling complex issues, which can lead to improved critical thinking and adaptive learning skills.

The results imply that emphasizing early and consistent practice in logical multiplication can significantly enhance students' proficiency in this area. Additionally, addressing challenges in problem-solving through targeted strategies and interventions can help students overcome fears of failure and develop a growth mindset, ultimately improving their problem-solving abilities. These implications highlight the importance of tailored approaches to support students in both logical multiplication and problem-solving skills.

The student-related challenges in basic mathematics have a total average weighted mean of 2.29, equivalent to the Much Evident. The teacher-related difficulties in learning basic mathematics have a total average weighted mean of 2.20, equivalent to the Much Evident. The school-related challenges in learning basic mathematics have a total average weighted mean of 2.23, which corresponds to the evidence. The family-related difficulties in learning basic mathematics have a total average weighted mean of 2.12, which means that it is much More Evident.

Failure of doing so will affect students' motivation to learn and eventually might diminish their interest to learn. Motivation is a very important element in the learning process as it is an inducer and propeller for one to do a task successfully. Therefore, motivation is essential for an individual to successfully face challenges in academic setting. Moreover, motivation will be used by students as the attribution or determinant to their behavior in learning and performance. Behaviors that are related to academic motivation such as the desire to do difficult tasks and stay longer in difficult situations will be the determinant for students' ability in facing daily school life challenges (Masaali, 2017).

This claim implies that there are four major obstacles that students must overcome to master foundational mathematics. These obstacles can be divided into four categories: obstacles pertaining to students, obstacles pertaining to teachers, obstacles pertaining to schools, and obstacles pertaining to families. Each of these difficulties influences how well the pupils can comprehend and apply mathematics. Furthermore, inconsistent problem-solving skills and weaknesses in stages such as problem solving and rechecking can hinder students' performance. Teachers should also focus on optimizing problem solving skills through exercises and following structured problem-solving steps. Since mathematics is stressed just like language, most students believe it to be a challenging subject, according to Acharya (2017).

It appears that several factors, including the home and school environment, students' anxiety, their negative perceptions of mathematics, the state of the economy, the availability of physical resources, and the teaching-learning process, influence mathematics education. Parents need to be aware of how well their children are learning. Parents that take an interest in their kids' education will be able to support their kids when they run across learning obstacles (Sakilah, et al., 2018).

Hence, the null hypothesis of no significance is rejected in the significant relationship between the challenges in terms of family-related, student-related, teacher-related, and school-related as to cognitive skills in terms of problem-solving, seriation, and logical multiplication. However, we failed to reject the null hypothesis of no significant relationship between the challenges as to family-related, student-related, teacher-related, and school-related cognitive skills in terms of number sense.

These results suggest that there is a substantial correlation between the cognitive skills of problem-solving, reasoning, and logical multiplication and issues related to the family, students, teachers, and schools. Difficulties in learning fundamental mathematics might influence pupils' cognitive capacity by encouraging critical thinking and problem-solving skills. If they are controllable, they can also impede the development of fundamental math concepts and cause frustration. Students' cognitive capacities are strained when they come across challenging ideas, which makes it more difficult for them to comprehend and

remember knowledge. This may impede the growth and use of mental abilities like logical reasoning, problem-solving, and critical thinking. Challenges can also have an impact on students' motivation and self-esteem, which can lower engagement and lower the use of their cognitive capacities (Gilmore, 2023).

According to these results, there is a noteworthy correlation between gender and obstacles regarding family, student, teacher, and school-related aspects. Men exhibited greater confidence than women, and as task complexity increased, the difference in confidence between the sexes shrank. To solidify the findings, Xie, et al. (2023) stated that there is variation in the direction and amount of the gender gap in mathematics learning.

Similarly, the study (Amalina, 2023) demonstrates that there is no significant correlation between age and student-related issues. Based on their cognitive development, past knowledge, and learning experiences, different age groups may face different problems; nevertheless, the kind and significance of these challenges may differ throughout age groups.

## 5.Conclusions & recommendations

As a result, for further improvement and realization of the research study, the researchers recommend implementing an extension program for students to improve their cognitive skills and to address their challenges in learning basic mathematics, which is entitled "Leveraging Academic Mastery for Better Outcomes" or LAMBO. The LAMBO project which aims to improve and enhance the high school students' cognitive skills towards solving mathematical problems, particularly in word problems involving real numbers, sets, and algebraic expressions. Ultimately, the LAMBO project aims to empower students, boost their confidence, and create a strong foundation for lifelong learning and personal growth. The student's challenges and cognitive skills will be addressed and improved as a result of this transition.

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