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ASSESSMENT ON BASIC ARITHMETIC COMPUTATIONAL SKILLS TO ADDRESS UNDERLYING GAPS AMONG STUDENTS (ABACUS) OF DON MANUEL RIVERA MEMORIAL INTEGRATED NATIONAL HIGH SCHOOL

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ABSTRACT

This research aims to assess the basic arithmetic computational skills of students at Don Manuel Rivera Memorial Integrated National High School, emphasizing the importance of addressing foundational skill gaps early in students' academic careers. The study identifies a critical problem: a significant percentage of students perform at "Low" and "Very Low" levels in arithmetic, potentially hindering their success in more advanced mathematical subjects. Using a comprehensive assessment methodology, data were gathered from 2,150 students across Grades 7-11, with statistical analyses employed to evaluate performance levels. The results reveal that 1.72% of students are classified as "Very Low," and 3.44% (74 students) as "Low," accounting for 5.16% of the student body, with Grade 7 showing 15 students (0.70%) in the "Very Low" category, indicating a crucial intervention point. These findings highlight the immediate need for structured remedial interventions, such as targeted tutoring and individualized instruction, to improve students' arithmetic skills. The implications of this research extend to instructional practices reinforcing the need for continuous monitoring and early identification of struggling students. Recommendations include implementing targeted remedial programs, establishing peer tutoring initiatives, conducting regular assessments, and enhancing parental involvement in skill-building activities at home. By addressing these gaps, the school can create a more supportive learning environment, equipping all students with essential numeracy skills for future academic challenges.

I. INTRODUCTION AND RATIONALE

Proficiency in basic arithmetic operations (addition, subtraction, multiplication, and division) is crucial for building a solid foundation in mathematics, as it underpins more advanced concepts and problem-solving skills. However, evidence indicates that a significant number of students struggle with these core skills, potentially hindering their progress in higher-level mathematics and affecting their overall academic performance (Nelson & Powell, 2017). Studies highlight that difficulties in areas such as number sense (an understanding of numbers and their relationships) can lead to persistent challenges in developing computational fluency (Lee et al., 2017; Jordan et al., 2008).

In response to these challenges, DepEd Order No. 013, s. 2023, titled "Adoption of the National Learning Recovery Plan in the Department of Education," underscores the importance of assessing and enhancing learners' foundational skills in mathematics. Consequently, School Memorandum No. 033, s. 2024 mandates that all Junior High School and Senior High School learners undergo a Numeracy Test. This initiative aims to assess students' skills in the four basic operations, gather data on their numeracy levels, and support teachers in implementing targeted interventions based on identified learning needs.

This study, titled "Assessment on Basic Arithmetic Computational Skills to Address Underlying Gaps Among Students (ABACUS)," addresses a critical gap in understanding the specific areas where students lack proficiency in basic arithmetic operations. While general interventions are often employed, a focused assessment is necessary to identify specific skill deficiencies. The purpose of this research is to analyze the extent of these gaps within Don Manuel Rivera Memorial Integrated National High School, thereby enabling the development of more personalized instructional strategies to support students.

Through this study, the data gathered on arithmetic proficiency levels will inform action plans to enhance numeracy support at both the classroom and school levels. This research aims to contribute to improve policies and practices that address foundational mathematical skill gaps, ultimately supporting the educational goals outlined in the National Learning Recovery Plan.

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II. LITERATURE REVIEW

Proficiency in basic arithmetic computational skills is pivotal for students' success in higher-level mathematics and overall academic achievement. Numerous studies highlight key issues contributing to the difficulties many students face in mastering these fundamental skills. A significant body of research identifies number sense—the intuitive understanding of numbers and their relationships—as a foundational skill that supports computational fluency (Jordan et al., 2008; Lee & Kwon, 2017). Students lacking a strong number sense often struggle with basic operations, leading to ongoing difficulties with more complex mathematical concepts.

Research indicates that weaknesses in number sense can stem from various factors, including ineffective instructional strategies, inadequate assessment practices, and a lack of tailored interventions for students with specific learning needs. For instance, Powell and Nelson (2017) emphasize the necessity of fostering a strong mathematical foundation through explicit instruction in number sense and computational skills. In contrast, Fuchs and Fuchs (2006) advocate for a Response to Intervention (RTI) model, suggesting that early identification and support can mitigate learning gaps before they widen.

Despite these insights, controversies remain regarding the most effective methods for teaching arithmetic. Some studies advocate for traditional approaches emphasizing direct instruction, while others support inquiry-based learning, which promotes conceptual understanding over rote memorization. This divergence presents challenges for educators in selecting appropriate pedagogical strategies that align with students' diverse learning styles and needs.

The general consensus among researchers is that developing strong basic arithmetic skills is crucial for students' mathematical development. However, knowledge gaps persist regarding the specific instructional practices that yield the best outcomes across diverse student populations. While numerous studies have explored the relationship between number sense and computational fluency, fewer have addressed the effectiveness of various assessment methods in identifying students' specific needs. This study aims to fill this gap by examining the numeracy skills of students and providing data-driven recommendations for targeted interventions.

This research is grounded in Cognitive Development Theory, which posits that learning occurs in stages and that a solid foundation in basic skills is necessary for students to progress to more advanced levels of understanding (Piaget, 1970). This framework supports the premise that enhancing students' basic arithmetic computational skills will improve their performance in mathematics and contribute to their overall cognitive development.

The accompanying research model illustrates the relationships between number sense, instructional strategies, assessment practices, and student outcomes in basic arithmetic skills. By examining these interconnections, this study aims to contribute to a more nuanced understanding of how to effectively assess and improve students' basic arithmetic computational skills, thereby addressing the underlying gaps in their mathematical learning.

III. RESEARCH QUESTIONS

This study sought to answer the following questions:

1. What is the profile of the students in terms of:
   1.1 Gender;
   1.2 Grade Level?
2. How many students at each grade level were assessed as having very low, low, average, high, and very high levels of basic arithmetic computational skills in the pre-assessment?
3. What interventions can be proposed to address the underlying gaps in basic arithmetic computational skills among students?

IV. SCOPE AND LIMITATION

This study focuses on assessing basic arithmetic computational skills among students at Don Manuel Rivera Memorial Integrated National High School during the first quarter of the school year. The participants include Junior High School students (Grades 7-10) and Senior High School students (Grade 11 only). The primary objective is to evaluate students' proficiency in the four fundamental operations: addition, subtraction, multiplication, and division. The findings aim to identify specific gaps in computational skills and inform tailored interventions to support students' learning needs.

The research design employed in this study is descriptive research, which is appropriate for capturing the current state of students' arithmetic skills without manipulating variables or establishing causal relationships. This design facilitates a systematic evaluation of student performance through a Numeracy Test, providing a clear understanding of skill levels across different grade levels.

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However, the study has several limitations. Firstly, it is conducted within a single time frame, the first quarter of the school year, which restricts the ability to conduct longitudinal assessments of student progress or implement extensive interventions based on the initial findings. Additionally, variations in prior mathematics instruction and learning experiences among students may impact their performance on the Numeracy Test, potentially confounding the results.

Moreover, relying on a single assessment tool may not capture the full spectrum of students' understanding and computational fluency, leading to possible oversights in identifying specific areas of difficulty. External factors, such as classroom resources and instructional practices, which are beyond the researcher's control, may also influence students' performance.

Despite these limitations, the study aims to provide valuable insights into the foundational arithmetic skills of students at Don Manuel Rivera Memorial Integrated National High School, ultimately guiding the development of more effective teaching strategies and interventions.

V. RESEARCH METHODOLOGY

A. Sampling

This research involves a primary group of participants consisting of 2,150 students from Don Manuel Rivera Memorial Integrated National High School, specifically targeting those in Grades 7 to 11. All students from each grade level and section were assessed on their basic arithmetic computational skills through a Numeracy Test.

A convenience sampling procedure was utilized, encompassing all students from Grades 7 to 11 across all sections of the school. This method ensures that the assessment captures a comprehensive range of student abilities within the specified grades, while acknowledging the exclusion of Grade 12 students from this assessment.

The rationale for including all students from Grades 7 to 11 is to obtain a holistic view of arithmetic skills across the student body. This approach allows for a thorough analysis of strengths and weaknesses in basic computational skills, facilitating a more accurate identification of specific needs for intervention. By assessing all sections and grade levels, the study incorporates diverse academic backgrounds and capabilities.

Through this approach, the study aims to gather valuable data on the arithmetic computational skills of students at Don Manuel Rivera Memorial Integrated National High School, ultimately guiding instructional strategies and interventions to enhance student learning.

B. Data Collection

The data collection for this research involved systematic procedures designed to ensure accurate and reliable results. Math teachers administered the Numeracy Test during their classes for one day, creating a controlled environment that facilitated the participation of all students. This approach was well-suited to the study's nature, as it directly assessed students' arithmetic computational skills.

Data gathered included scores from the Numeracy Test, which evaluated students' proficiency in the four fundamental arithmetic operations: addition, subtraction, multiplication, and division. The assessment categorized students' numeracy levels based on their scores, providing quantitative data regarding their performance. Additionally, qualitative data concerning student profiles was collected to gain insights into their backgrounds and learning contexts. This dual approach aligns with the research questions focused on understanding students' arithmetic proficiency.

The research instrument used was a standardized Numeracy Test specifically designed to assess basic arithmetic computational skills. The test consisted of 40 fill-in-the-blank items, categorized as constructed response items, requiring students to formulate their answers instead of selecting from provided options. The assessment tool was adapted from the 2024 Intervention Mathematics Screening test for NLC which was issued by the Department of Education through a memorandum to ensure its suitability for measuring the targeted skills.

Ethical considerations were paramount during the data collection process. Informed consent was secured from the principal of the school, ensuring compliance with institutional policies. Throughout the study, confidentiality and anonymity were maintained, with all student data coded and securely stored to protect individual identities. After data collection, results were reported in aggregate form to further ensure anonymity.

Through these carefully executed procedures, the study aimed to gather reliable data that would inform instructional strategies and interventions to enhance students' arithmetic computational skills.

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C. Data Analysis

The research employed a quantitative method to analyze the data collected from the Numeracy Test administered to students. This approach was suitable for measuring students' proficiency in basic arithmetic operations, providing a clear numerical representation of their skills.

Data from the Numeracy Test were organized by compiling the scores of all participating students. Each student's performance was categorized based on their total score, allowing for an assessment of their numeracy levels across the four fundamental arithmetic operations: addition, subtraction, multiplication, and division. This organization facilitated the identification of patterns and gaps in students' computational skills.

Statistical tools were employed for the analysis. Frequency and percentage were used to determine the profile of the students in terms of gender and grade level. Additionally, these tools helped identify how many students at each grade level were assessed as having very low, low, average, high, and very high levels of basic arithmetic computational skills in the pre-assessment. The data results from this study also served as a basis for proposing interventions to address the underlying gaps in arithmetic skills among students.

Microsoft Excel was the statistical software utilized for data analysis. It enabled efficient calculations of various statistics and illustrate the findings clearly. It effectively communicated the results to stakeholders, including educators and administrators.

The selected method of data analysis was appropriate for addressing the research questions, as it provided a systematic way to evaluate the quantitative data collected. By employing descriptive and inferential statistics, the study presented a comprehensive overview of students' arithmetic computational skills, and recommended targeted interventions based on the findings.

VI. DISCUSSION OF RESULTS AND RECOMMENDATIONS

This section presents the results of the assessment on basic arithmetic computational skills among students at Don Manuel Rivera Memorial Integrated National High School. It follows the statement of the problem and includes the demographic profile of students, their proficiency levels in arithmetic operations, and the proposed interventions to address identified gaps. The results are organized in tabular and graphical forms, providing a clear representation of the data collected.

Table 1. Profile of the Students in terms of Gender

Gender	Frequency	Percentage
Male	1062	49.50%
Female	1088	50.60%
Total:	*2150*	*100%*

Table 1 presents the demographic profile of the students at Don Manuel Rivera Memorial Integrated National High School, focusing specifically on gender. The total number of students assessed was 2,150, with a slightly higher proportion of female students compared to male students. The frequency of male students is 1,062, representing 49.50% of the total student population. In contrast, the frequency of female students is 1,088, accounting for 50.60%. The percentages indicate a nearly balanced gender distribution among the student body, with females making up a marginally larger segment of the population.

This balanced representation is significant, as it suggests that gender does not appear to skew the sample in favor of one group over the other, allowing for a comprehensive assessment of basic arithmetic computational skills across both genders. The findings are consistent with research suggesting that gender parity in educational settings can contribute to a more equitable learning environment, potentially influencing instructional strategies and interventions tailored to the diverse needs of the student body. Overall, the data indicates a slight majority of female students, which may be relevant for interpreting any differences in academic performance or skill levels in subsequent analyses.

Table 2. Profile of the Students in terms of Grade Level

Grade level	Frequency	Percentage
7	556	25.86%
8	426	19.81%
9	524	24.37%
10	493	22.93%
11	151	7.02%
Total:	*2150*	*100%*

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Table 2 presents the distribution of students by grade level at Don Manuel Rivera Memorial Integrated National High School. The largest group is Grade 7, comprising 556 students or 25.86% of the total sample. Grade 9 follows closely with 524 students, representing 24.37% of the total. Grade 10 includes 493 students, accounting for 22.93%, while Grade 8 consists of 426 students or 19.81%. Grade 11 has the smallest group, with 151 students, which is 7.02% of the total population. This grade-level breakdown illustrates a larger concentration of students in the lower grades, gradually decreasing in higher grades. This trend may reflect standard enrollment distribution patterns, where lower grade levels generally accommodate more students.

Table 3. Students' Level of Basic Arithmetic Computational Skills

Grade Level	Very Low		Low		Average		High		Very High		Total	
	f	%	f	%	f	%	f	%	f	%	f	%
7	15	0.70%	21	0.98%	56	2.62%	107	5.00%	357	16.69%	556	25.86%
8	2	0.09%	12	0.56%	46	2.16%	109	5.12%	257	12.07%	426	19.81%
9	8	0.37%	21	0.96%	95	4.35%	137	6.27%	263	12.05%	524	24.37%
10	11	0.51%	8	0.37%	45	2.10%	96	4.48%	333	15.54%	493	22.93%
11	1	0.05%	12	0.56%	27	1.25%	44	2.04%	67	3.11%	151	7.02%
Total	37	1.72%	74	3.44%	269	12.48%	493	22.91%	1277	59.45%	2150	100%

Legend:

Range		Level
0.00	8.00	Very Low
8.01	16.00	Low
16.01	24.00	Average
24.01	32.00	High
32.01	40.00	Very High

In Table 3, the pre-assessment results show that while most students perform well in basic arithmetic skills, a portion of the population demonstrates significant challenges. Specifically, 1.72% of students are classified in the "Very Low" level, and 3.44% or 74 in the "Low" level, collectively accounting for 5.16% of the student body. This group of students, spread across all grade levels, indicates a critical need for targeted interventions to address their foundational gaps in arithmetic.

Grade 7 has 15 students (0.70%) at the "Very Low" level and 21 students (0.98%) at the "Low" level, representing an early point at which skill-building support could prevent further academic struggles. Grade 9 also shows similar needs, with 8 students (0.37%) in "Very Low" and 21 students (0.96%) in "Low" levels. Notably, while Grade 11 students represent a smaller portion of the sample, 1 student (0.05%) remains at the "Very Low" level, and 12 students (0.56%) are at the "Low" level, signaling gaps that may persist without intervention.

These findings highlight an immediate need for structured interventions, such as additional practice, remedial instruction, or individualized tutoring, to help these students improve their arithmetic skills. The presence of struggling students across all grade levels suggests the importance of continuous monitoring and early identification efforts to support students in reaching essential competency levels in arithmetic.

Previous research underscores the impact of early skill gaps in mathematics, noting that basic arithmetic fluency forms the foundation for success in more complex mathematical areas, such as algebra and geometry. Studies have consistently shown that students who lack a solid grasp of basic computational skills often face obstacles in more advanced mathematics courses, affecting both their confidence and performance (Geary, 2011; Siegler et al., 2012). The high percentage of students demonstrating proficiency reinforces the importance of effective classroom practices, yet the presence of lower-performing students suggests that additional targeted support is necessary.

Theoretical frameworks in mathematics education emphasize that cumulative knowledge is essential for mathematical comprehension. According to Bruner's spiral curriculum theory, mastering foundational concepts allows students to build upon them with increasingly complex operations (Bruner, 1960). The findings of this study suggest that while many students have reached adequate levels of understanding, a small but significant group has not developed these critical foundations, potentially disrupting their ability to engage in the more advanced mathematical concepts awaiting them in higher grades.

Implications of these findings extend to both instructional practice and curriculum development. Teachers may consider implementing formative assessments early in the school year to identify students with arithmetic skill gaps. Early interventions,

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such as supplemental practice or peer tutoring, could be particularly beneficial for students in Grade 7, as addressing these gaps at the beginning of their secondary education may prevent future struggles.

Recommendations

1. Targeted Remedial Intervention Programs: Develop a structured remedial intervention specifically tailored for students scoring at "Low" and "Very Low" levels in arithmetic skills. These interventions could include small group tutoring sessions, targeted exercises on fundamental arithmetic operations, and individualized learning plans. Holding these sessions during after-school hours or incorporating them as part of regular math classes would provide consistent, focused support to students needing foundational reinforcement.
2. Peer Tutoring and Mentorship Programs: Establish peer tutoring programs where higher-performing students mentor those identified as struggling. Research supports the effectiveness of peer-assisted learning strategies in improving mathematical skills. This approach would not only give lower-performing students additional practice but also foster a collaborative learning environment.
3. Regular Diagnostic Assessments and Progress Monitoring: Conduct periodic diagnostic assessments to monitor students' progress in arithmetic skills. These assessments will help teachers identify early signs of difficulty in foundational areas, enabling timely interventions. Progress-monitoring tools, administered monthly or quarterly, can be used to evaluate the effectiveness of interventions and make adjustments as needed.
4. Differentiated Instructional Materials: Equip teachers with specialized instructional resources designed for remedial purposes. For instance, hands-on arithmetic games, interactive digital tools, and visual aids focused on basic operations (addition, subtraction, multiplication, and division) can make learning more accessible. Differentiated instruction would allow teachers to meet students at their current level of proficiency and help them improve progressively.
5. Parental Involvement and Home-Based Practice: Engage parents by providing guidance on how they can support arithmetic skill-building at home. Workshops or informational materials for parents could include simple arithmetic exercises, daily practice tips, and online resources that parents can use with their children. Home-based reinforcement is a powerful supplement to classroom interventions and can significantly enhance skill retention.

   By implementing these targeted intervention programs, Don Manuel Rivera Memorial Integrated National High School can address gaps in arithmetic computational skills more effectively, helping all students achieve essential numeracy levels and build confidence for future academic challenges.

VII. DISSEMINATION AND ADVOCACY PLAN

The following dissemination and advocacy strategies will be utilized:

1. Research output will be presented to the District Research conference.
2. Research findings will be presented to the Division Research Congress for school heads and teachers.
3. Research findings will be submitted to the international journal for multidisciplinary research, innovations, and development for publication.
4. Innovations and interventions based on the results will be implemented in school.

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