THE NUMERACY LEVEL AND SCIENCE COMPUTATIONAL SKILLS OF GRADE 7 PHYSICS INSTRUCTION

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Abstract:

In the context of growing concern over students' scientific literacy and mathematical competence, this study investigated the numeracy levels and science computational skills of Grade 7 learners in Physics instruction in a public secondary school in Sibulan District I. Utilizing a descriptive-correlational research design, the study assessed the performance of 74 randomly selected learners through the Enhanced Regional Unified Numeracy Test (ERUNT) and a researcher-made Science Computational Skills Test. The findings revealed that while learners demonstrated Highly Proficient performance in basic numeracy, their ability to apply these skills in Physics contexts was only Fairly Satisfactory. Statistical analysis showed no significant differences in performance based on sex or maternal educational attainment, and a weak, non-significant correlation between numeracy and science computational skills. These results highlight a disconnect between foundational arithmetic skills and their application in scientific problem-solving. In response, the study recommends instructional interventions such as Project PHYSICS—Pedagogical Help for Youth in Science Intervention for Computational Skills—to bridge the gap through contextualized, learner-centered approaches. The study contributes to ongoing efforts to improve STEM education in the Philippines by emphasizing the need for integrative pedagogy in junior high school science.

Keywords: *numeracy, science computational skills, Physics instruction, Grade 7 learners, intervention program, Project PHYSICS, STEM education, cognitive load theory, constructivist learning, secondary education Philippines.*

Introduction:

The global decline in science and mathematics proficiency, particularly among low-achieving students and marginalized populations, has emerged as a serious concern in education systems worldwide. These disparities, which often manifest in learner performance and long-term academic outcomes, call for targeted strategies that promote equity and strengthen foundational competencies in numeracy and scientific thinking (Gajderowicz et al., 2025; Gomez-Talal et al., 2025; Mendiola, 2025). Studies show that these educational gaps may stem from both internal factors such as learners' individual characteristics and external factors including socioeconomic conditions, school type, and parental involvement (Amalina & Vidákovich, 2023; González-Pizarro et al., 2024).

In the Philippines, numeracy remains a pressing challenge for basic education. National and international assessments have consistently highlighted that a significant proportion of Filipino learners lack proficiency in basic mathematical operations (Layug et al., 2021; Igcasama et al., 2023). These gaps affect learners' abilities to transition smoothly into secondary-level subjects such as Physics, where quantitative reasoning and problem-solving are integral. Poor numeracy skills not only hinder mathematics achievement but also limit students' scientific understanding and participation in higher-order STEM learning.

Curriculum-related issues further aggravate the situation. Overloaded content, insufficient instructional time, and weak vertical articulation between mathematics and science curricula contribute to learners' conceptual confusion (Ignacio & Bajet, 2025). In many classrooms, Physics is taught with minimal emphasis on computational reasoning, despite the fact that motion, speed, force, and acceleration are inherently mathematical. Teachers often lack adequate preparation to connect math concepts with physical phenomena, resulting in fragmented instruction (Frianeza et al., 2024; Galvez & Reyes, 2023).

The lack of basic computational skills in Physics is particularly alarming. Studies have shown that Filipino students struggle with scientific problem-solving tasks, especially when they require numerical manipulation and unit conversion (Huda & Rohaeti, 2024). Learners frequently experience confusion in applying formulas, interpreting motion graphs, and distinguishing between related concepts like speed and velocity. These difficulties point to a need for integrative approaches in instruction that reinforce numeracy within the science classroom.

Socioeconomic factors and family background also influence learners' academic performance. Notably, maternal education has been associated with children's academic success, as mothers often serve as the primary facilitators of learning at home (Weis et al., 2022; Cho & Lee, 2022). Higher maternal educational attainment often correlates with increased learner confidence, better study habits, and access to educational resources. However, studies also

caution against overgeneralizing this relationship, as effective parental engagement—regardless of formal schooling—remains a key determinant of student success (Yu, 2023).
Local data from the Sibulan District in Negros Oriental offer a concrete glimpse into this issue. The results of the Enhanced Regional Unified Numeracy Test (ERUNT) administered at the beginning of School Year 2024–2025 revealed that more than half of Grade 7 learners lacked the basic numerical skills required to succeed in secondary-level science. Only 48 out of 104 students were considered numerate. In a subsequent Physics test on motion and displacement, less than 45% of students achieved the minimum passing score of 75%. Such outcomes underscore the urgent need for remedial strategies that bridge numeracy gaps while supporting science learning.
These academic challenges are further compounded by systemic issues in public schools—crowded classrooms, lack of instructional materials, and rigid curriculum pacing guides. Teachers often struggle to individualize instruction, and learners have few opportunities to engage in hands-on or inquiry-based activities that could contextualize scientific concepts (Fabito et al., 2020; Garcia, 2024). Without adequate scaffolding, students face cognitive overload, which inhibits their ability to make sense of mathematical and physical relationships.

This study draws upon Cognitive Load Theory (Sweller & Chandler, 1994) and Constructivist Theory (Prakash Chand, 2023; Vygotsky & Cole, 1978) to guide the inquiry. Cognitive Load Theory posits that reducing unnecessary mental strain enables learners to devote cognitive resources to meaningful problem-solving. Constructivism emphasizes that learners actively build knowledge through experience and social interaction. Together, these frameworks advocate for learner-centered instruction that supports both conceptual and procedural learning in science and mathematics.

Recognizing these gaps and theoretical underpinnings, the researcher initiated an inquiry into the numeracy and science computational skills of Grade 7 learners in a public secondary school in Sibulan District I. The study investigates how variables such as sex and maternal educational attainment relate to performance and whether numeracy correlates with science computational skills. The results aim to inform the design of an intervention—Project PHYSICS (Pedagogical Help for Youth in Science Intervention for Computational Skills)—to support struggling learners.

This research seeks to contribute to efforts aimed at improving foundational learning outcomes in the Philippines by addressing the overlooked intersection between numeracy and science instruction. By exploring these relationships and proposing a practical classroom-based intervention, the study offers actionable insights for educators, curriculum planners, and policymakers committed to elevating the quality of STEM education in the country.

Methodology:

The study utilized a descriptive-correlational research design, combining descriptive, comparative, and correlational methods to achieve a comprehensive understanding of the learners' proficiency in numeracy and science computational skills. The descriptive aspect enabled the assessment of the learners' current performance levels without manipulating any variables. The comparative dimension examined differences in performance based on sex and maternal educational attainment. Finally, the correlational aspect analyzed the relationship between numeracy and science computational skills. This multifaceted approach was deemed appropriate to draw meaningful insights that inform intervention strategies in science education.

The research was conducted in a public secondary school located in Sibulan District I, Negros Oriental, Philippines. The school was selected based on its geographical accessibility, its willingness to participate, and the adequacy of its student population for statistical analysis. A total of 74 Grade 7 learners enrolled in the third quarter of School Year 2024–2025 participated in the study. These learners were chosen through simple random sampling, ensuring that each student had an equal chance of being selected, thereby reducing selection bias and enhancing the generalizability of the findings.

The sample size of 74 was determined using Yamane's formula at a 95% confidence level, based on the total population of Grade 7 learners across two shifts (morning and afternoon) in the selected school. Simple random sampling was employed to ensure representativeness and minimize sampling bias. This method aligns with Giri's (2024) assertion that random sampling strengthens external validity by reflecting the heterogeneity of the target population.

Two primary instruments were utilized. First, the Enhanced Regional Unified Numeracy Test (ERUNT) developed and institutionalized by the Department of Education Regional Office VIII through Memorandum No. 279, s. 2019. The ERUNT is a validated tool designed to measure learners' mastery of the four basic mathematical operations: addition, subtraction, multiplication, and division.

Second, a researcher-made Science Computational Skills Test was administered to assess learners' ability to solve numerical problems in Physics 7, specifically on motion, velocity, and displacement. This 40-point test followed the GRS format (Given, Required, Solution), guiding learners to demonstrate problem-solving through structured reasoning. The test focused on competencies such as differentiating between distance and displacement, and identifying the difference between speed and velocity using vector concepts.

The ERUNT, being a standardized assessment tool, has undergone extensive validity and reliability testing at the regional level. For the researcher-made test, content and face validity were established through expert evaluation by science educators and curriculum specialists. The validation results yielded a high face validity score of 4.71 based on Good and Scates (1972), indicating strong alignment with intended learning competencies.

To ensure reliability, the instrument was pilot-tested with a group of non-participant Grade 7 learners from a nearby school. The results produced a Cronbach's alpha reliability coefficient of 0.70, suggesting acceptable internal consistency. A certified statistician assisted in the validation process and provided the statistical verification certificate appended to this study.

The researcher first secured formal approval from the school principal and the Schools Division Office. Upon receiving consent, the researcher administered the ERUNT to the randomly selected learners, followed by the Science Computational Skills Test on a scheduled date within regular class hours. Clear instructions were provided, and the GRS rubric was explained to the learners prior to the test. All responses were collected and scored manually based on pre-established criteria, with assistance from a trained teacher-collaborator to ensure inter-rater reliability.

Data were analyzed using both descriptive and inferential statistics. Means and standard deviations were computed to determine overall proficiency levels. Mann-Whitney U Test was used to analyze differences in numeracy and science computational scores based on sex, while the Kruskal-Wallis Test assessed differences across groups based on maternal educational attainment. The Spearman's rank correlation coefficient was applied to determine the strength and direction of the relationship between numeracy and science computational skills. The threshold for statistical significance was set at $p < 0.05$.

The study adhered to ethical research standards as prescribed by the institution and the Data Privacy Act of 2012. Informed consent was obtained from all participants, with assurances that participation was voluntary and responses would be kept confidential. To preserve anonymity, learners were assigned codes in place of names. Data collected were stored securely and destroyed after the completion of the research through proper shredding. Moreover, the study ensured that no regular class time was disrupted and that learners experienced no undue pressure or risk as a result of their participation.

Results:

Findings revealed that, overall, the Grade 7 learners exhibited a high level of numeracy proficiency, with a mean percentage score (MPS) of 95.47%, categorizing them as Highly Proficient. Both male (MPS = 95.46%) and female learners (MPS = 95.49%) achieved similar scores, indicating no notable difference in performance by sex. Standard deviations were slightly higher for males (SD = 2.10) than females (SD = 1.79), suggesting greater consistency among female learners. When grouped according to maternal educational attainment, learners whose mothers were high school graduates achieved the highest MPS at 97.33%, followed closely by those whose mothers reached college level (95.42%) or were college graduates (95.83%). Despite this slight variation, all groups still demonstrated a high level of numeracy, underscoring the overall strong performance in basic arithmetic.

In contrast, learners' science computational skills were rated as Fairly Satisfactory, with an overall mean score of 23.92 out of 40. Compared to numeracy results, this indicated a substantial gap between learners' basic numerical proficiency and their ability to apply these skills in scientific contexts. Performance across sexes showed minimal variation, with males averaging 23.76 and females slightly higher at 24.12, yet both within the same interpretative range. A higher standard deviation for females (SD = 5.34) than males (SD = 5.01) reflected a wider spread of scores. When grouped by maternal education, learners whose mothers had college-level education performed best (mean = 26.50, Satisfactory), while those whose mothers attained only elementary education scored the lowest (means ranging from 21.13 to 21.57, Fairly Satisfactory), with greater performance variability in these groups.

Inferential tests confirmed that sex did not significantly influence learners' numeracy or science computational skills. The Mann-Whitney U test returned a p-value of 0.654 for numeracy and 0.526 for science computational skills, both exceeding the significance level of 0.05, leading to the acceptance of the null hypothesis. Likewise, maternal educational attainment was not significantly associated with learners' numeracy (Kruskal-Wallis test, $p = 0.565$) or science computational performance ($p = 0.241$), suggesting that while there may be slight score differences across maternal education groups, these are not statistically significant.

Lastly, correlation analysis between learners' numeracy level and their science computational skills using Spearman's rho revealed a weak and non-significant relationship ($\rho = 0.139$, $p = 0.238$). This suggests that high numeracy scores alone do not directly predict higher science computational performance. Despite learners' strong grasp of basic operations, they appeared to struggle when applying mathematical reasoning to physics problems involving motion, displacement, and velocity.

In summary, the results show that while Grade 7 learners possess strong foundational numeracy skills, their ability to apply these skills to scientific problem-solving remains underdeveloped. Neither sex nor maternal educational attainment showed a significant effect on performance, and no strong correlation was found between numeracy and science computational skills. These findings point to the need for instructional strategies that explicitly integrate computational reasoning within Physics education.

Discussion:

The findings of this study bring to light important insights into the proficiency of Grade 7 learners in numeracy and their ability to apply computational skills in Physics. The high numeracy scores indicate a solid foundation in basic mathematical operations, with most learners classified as Highly Proficient. This reflects the effectiveness of elementary-level instruction in mathematics and possibly the impact of interventions such as Project BIBO (Bridging Imperfections in Basic Operations), which has previously shown success in improving computation accuracy among Filipino learners (Reyes et al., 2024). The consistency of high performance across both male and female learners supports the growing body of literature that argues there is no innate difference in mathematical ability based on sex (Gaisey et al., 2024; Amoadu et al., 2024). The data also suggest that learners are entering secondary education well-prepared in terms of procedural mathematics.

However, the Fairly Satisfactory performance in science computational skills presents a significant contrast to the numeracy results. Despite their basic numerical competence, learners struggled to apply these skills in physics contexts such as calculating motion, displacement, and velocity. This disconnect between numeracy and applied science computation reinforces the idea that computational thinking in science requires more than arithmetic proficiency. It demands conceptual understanding, familiarity with physical quantities and units, and the ability to interpret data in problem-solving situations (Gambrell & Brewe, 2024; Huda & Rohaeti, 2024). The lack of significant correlation between numeracy and science computational skills found in this study ($\rho = 0.139$, $p = 0.238$) validates this assertion and supports findings by Singngoen and Thipchart (2024), who observed that mathematical fluency alone does not guarantee success in physics-related computations.

The absence of significant differences in performance by sex suggests that gender does not influence learners' ability in either domain, affirming studies by Ocampo et al. (2023) and Lin and Wong (2024) that show male and female students perform equally when provided with equitable learning environments. Similarly, maternal educational attainment, often cited as a strong predictor of academic success, did not show a statistically significant effect on learners' performance in this study. While learners with more educated mothers tended to score slightly higher, especially in science computational skills, the differences were not substantial. This supports the conclusions of Cheunget al. (2020) and Lara and Pasia (2022) that parental involvement and home learning support matter more than formal educational attainment, especially when schools provide inclusive instruction and supplemental support.

Another critical observation is the wide variation in science computational performance, as indicated by high standard deviations. This suggests inconsistent conceptual understanding among learners and highlights the need for differentiated instruction. The application of Cognitive Load Theory (Sweller & Chandler, 1994) is particularly relevant here. Learners may experience cognitive overload when required to integrate mathematical operations with unfamiliar physics concepts, especially in overcrowded classrooms with limited instructional scaffolding. Without carefully structured learning tasks, students may become overwhelmed, which limits both retention and application of knowledge.

Moreover, the findings resonate with Constructivist Theory (Prakash Chand, 2023; Vygotsky & Cole, 1978), which emphasizes the role of guided interaction and contextual learning. The weak performance in science computation could stem from the lack of hands-on, inquiry-based activities and insufficient opportunities to connect theory to real-life applications. Learners must engage in active problem-solving that allows them to construct meaning from their experiences—something that is often absent in traditional, lecture-based classrooms.

In sum, the findings suggest that while the learners possess strong basic numeracy skills, there exists a notable gap in their ability to transfer these skills to scientific problem-solving. This emphasizes the need to rethink instructional approaches in junior high school Physics. Teachers must create learning experiences that integrate numeracy with conceptual understanding through contextualized examples, visual representations, collaborative tasks, and consistent use of the GRS (Given, Required, Solution) problem-solving framework.

These results support the implementation of the proposed Project PHYSICS (Pedagogical Help for Youth in Science Intervention for Computational Skills), which aims to bridge the gap between theoretical numeracy and practical application in science contexts. By focusing on differentiated instruction, diagnostic assessments, and active learning strategies, the intervention can help learners overcome cognitive barriers and develop meaningful scientific computation skills.

Conclusion:

This study explored the numeracy levels and science computational skills of Grade 7 learners in a public secondary school in Sibulan District I, with particular attention to the effects of sex and maternal educational attainment, and the relationship between numeracy and science computation. The findings revealed that learners generally possessed a high level of numeracy, indicating strong foundational mathematical skills. However, their performance in science computational tasks—specifically in the context of Physics—was only fairly satisfactory, suggesting that numerical proficiency alone does not guarantee the ability to solve science-based problems involving motion, displacement, and velocity.

Statistical analysis showed that neither sex nor maternal educational attainment had a significant influence on learners' performance in either numeracy or science computational skills. Furthermore, the correlation between the two skill sets was found to be weak and not statistically significant. These findings highlight a disconnect between basic computation and its application in scientific contexts, underscoring the need for integrative and context-based learning strategies in science education.

The data suggest that while learners can perform routine mathematical operations, they face challenges when asked to apply those skills to real-life, physics-based problems. This gap may be due to instructional limitations, such as a lack of emphasis on conceptual understanding, insufficient scaffolding, and limited use of inquiry-based or differentiated approaches in classroom settings. The need to bridge this gap is urgent, particularly in public schools where overcrowding, limited resources, and time constraints present additional barriers to effective science instruction.

Recommendations:

Based on the findings of this study, several recommendations are proposed to improve the integration of numeracy and science computational skills in junior high school instruction.
For Mathematics Teachers, it is essential to incorporate diagnostic assessments in numeracy at the beginning of each school year. These assessments will help identify learners' strengths and weaknesses, enabling teachers to design appropriate interventions. To strengthen learners' readiness for scientific computation, teachers should embed contextualized problem-solving activities into daily instruction. Practical exercises grounded in real-life scenarios, alongside the use of visual aids and manipulatives, can make numerical concepts more relatable and meaningful. Such approaches will reinforce arithmetic skills while fostering the analytical thinking required for science subjects.

For Science Teachers, the focus should be on integrating numerical computation within Physics instruction, particularly in topics such as motion, force, and velocity. Teachers are encouraged to employ the GRS (Given, Required, Solution) method as a structured guide to help learners analyze and solve scientific problems step-by-step. Differentiated instruction must be adopted to address varying levels of ability, with peer collaboration, targeted exercises, and hands-on activities using low-cost simulations or everyday materials to help learners grasp abstract scientific concepts more effectively.

For Parents and Guardians, support from home remains critical, regardless of formal educational attainment. Parents should be encouraged to actively participate in their children's learning by establishing consistent study routines, monitoring progress, and creating a positive attitude toward mathematics and science. Simple strategies—such as asking children to explain what they learned or guiding them through practice problems—can enhance learning retention. Schools may also consider organizing parent orientations or workshops to equip families with tools and techniques to support learning at home.

For School Leaders and Administrators, there is a need to strengthen teacher training through professional development focused on interdisciplinary strategies that link mathematics and science. School administrators should promote collaboration between subject departments to co-design integrative lessons that reinforce both numerical fluency and scientific understanding. In addition, allocating resources for diagnostic instruments, enrichment activities, and intervention programs such as Project PHYSICS will help close the gap between numeracy and science application.

For Curriculum Planners and Policy Makers, a review of the current science curriculum is necessary to ensure that essential competencies are prioritized over the sheer volume of content. Streamlining the curriculum will give learners more time to master core concepts and develop deeper understanding. Education policy should support the adoption of contextualized learning models, the integration of numeracy within science instruction, and competency-based approaches that emphasize application, not just memorization.

For Future Researchers, further inquiry is recommended to explore other factors that may influence learners' science computational performance. These may include cognitive styles, instructional quality, learner motivation, and classroom conditions. Longitudinal studies would be beneficial in assessing how early numeracy skills impact long-term academic outcomes in science. Moreover, experimental research should be conducted to test the effectiveness of structured interventions like Project PHYSICS, which seeks to improve learners' ability to integrate mathematics into scientific reasoning.

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