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READING COMPREHENSION AS A PREDICTOR OF SYMBOLIC TRANSLATION SKILLS IN MATHEMATICS IN THE MODERN WORLD

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Abstract

This study investigated the relationship between reading comprehension and symbolic translation skills among 117 students in the BPEd and BTLEd programs. The demographic profile revealed a higher proportion of female participants (72.65%) and a nearly balanced distribution across programs. Performance outcomes indicated low proficiency in both reading comprehension (MPS = 39%) and symbolic translation skills (MPS = 40%). Analyses showed no significant differences in performance based on sex or program. Pearson correlation analysis revealed a moderate positive relationship between reading comprehension and symbolic translation skills. Furthermore, simple linear regression indicated that reading comprehension significantly predicts symbolic translation performance. These findings highlight the foundational role of reading comprehension in supporting mathematical reasoning and symbolic translation. It is recommended that targeted interventions be designed to strengthen students' reading comprehension to improve their symbolic translation skills.

INTRODUCTION

The MATATAG Curriculum was implemented by the Department of Education (DepEd) to strengthen the essential competencies of Filipino learners, with a particular focus on fostering mathematical literacy and problem-solving skills. Achieving these goals depends largely on students' mastery of foundational skills, particularly reading comprehension, which is critical for understanding and interpreting mathematical problems (Alvarado, 2023).

Reading comprehension is central to mathematics learning, as students must first decode and understand the textual information in problem statements before applying appropriate mathematical procedures. Theories of cognitive development highlight this connection: Piaget emphasized that understanding develops through active thinking (as cited in Dangao, 2025), while Vygotsky asserted that language mediates higher-order reasoning, including mathematical reasoning. These perspectives suggest that weak reading skills may hinder a student's ability to perform symbolic translation, the process of converting text-based problems into mathematical expressions. Empirical research supports this link, showing that

reading comprehension is one of the strongest predictors of mathematics performance (Akin, 2022).

Large-scale assessments reveal persistent challenges in both reading and mathematics. In the 2022 PISA, Filipino students scored 347 in reading and 355 in mathematics, both below the OECD average, with only 16% achieving the minimum proficiency level (OECD, 2023; Marcelo, 2025). Similarly, the SEA-PLM and EDCOM II (2024) reports indicate that reading comprehension deficits increase as students advance through grade levels, contributing to a widening academic gap. National surveys, such as FLEMMS (2024), show that although basic literacy among Filipinos is high (93.1%), functional literacy drops to 70.8%, leaving millions of learners ill-prepared for higher-order academic tasks (Untalan, 2025).

Reading comprehension directly influences the ability to solve word problems, which require students to analyze information, identify relationships, and translate textual data into mathematical symbols. Limited proficiency in this area can significantly affect problem-solving outcomes. Galinggan (2022) found that only 24.65% of students successfully translated textual contexts into mathematical representations, while Frutas (2019) reported a strong positive correlation between reading comprehension and problem-solving performance.

Despite extensive research at the elementary and secondary levels, the symbolic translation skills of first-year college students, particularly those enrolled in courses like Mathematics in the Modern World, remain underexplored. At this stage, students must apply reading comprehension to interpret real-world scenarios and express them mathematically. Examining the relationship between reading comprehension and symbolic translation among first-year pre-service teachers is therefore critical. Understanding this relationship can strengthen both literacy and mathematical reasoning, essential competencies for developing problem-solving proficiency and critical thinking in alignment with the goals of the MATATAG Curriculum.

METHODS

Research Design

This study employed a correlational research design to determine the relationship between the students' reading comprehension and their symbolic translation skills in mathematics. This design is appropriate for this study as it enables the researchers to measure the degree of relationship between the two variables without any form of external manipulation. In this study, reading comprehension was considered the independent variable, whereas symbolic translation skills served as the dependent variable.

Respondents and Locale of the Study

The respondents of the study were 168 first-year College of Education students at Isabela State University–Echague Campus. These students are currently enrolled in the Mathematics in the Modern World (MMW) subject during the second semester of the Academic Year 2025-2026.

Additionally, a probability sampling method was employed, specifically stratified random sampling, in selecting the respondents. The sample was classified according to sex

and programs to ensure proper representation of the different subgroups within the population.

The researchers used Cochran's Formula for Finite Population to calculate the sample size, where the confidence level is 95%, the value of z-score is 1.96, an estimated proportion of the population of 0.5, and a total population of 168 students.

$$n_0 = \frac{z^2 pq}{e^2} = \frac{(1.96^2)(0.5)(1-0.5)}{0.05^2} = 384$$

$$n = \frac{n_0}{1 + \frac{n_0 - 1}{N}} = \frac{384}{1 + \frac{384 - 1}{168}} = 117$$

The computation suggested that in the population of 168 students, a representative sample of 117 students was determined.

Research Instrument

Two standardized instruments were used in this study to measure reading comprehension and symbolic translation skills of the respondents.

Reading Comprehension

The Accuplacer reading comprehension test, adopted from the College Board, was used to assess students' reading skills. This test is part of Texas Success Initiative Assessment 2.0 (TSIA2) English Language Arts and Reading (ELAR), which promotes equal access to higher education. It is a standardized test designed for college-level students and measures their ability to understand and analyze both literary and informational texts. The test consists of 30 multiple-choice items, divided into two main categories: literary text analysis, which assesses comprehension of explicit information, author's craft, inferences, and vocabulary, and informational text analysis and synthesis, which assesses understanding of main ideas, supporting details, inferences, vocabulary, and the ability to synthesize information from paired passages. The test was administered without any modifications. Each correct answer was assigned one point, and raw scores were used in the statistical analysis.

Symbolic Translation Test

To measure symbolic translation skills, the researchers developed a 30-item proficiency test specifically for this study. The items were constructed based on the prescribed module for Mathematics in the Modern World to ensure alignment with the course learning outcomes. The test comprises five items for each of the basic arithmetic operations, such as addition, subtraction, multiplication, and division, with the remaining ten items covering mixed mathematical operations. Each correct answer was assigned one point. The instrument was content-validated by the course instructor and considered appropriate for college-level students. The raw scores were also used for statistical analysis.

Data Gathering Procedure and Analysis

The study was conducted in a classroom setting to ensure standardized testing conditions. Before administering the tests, the purpose of the study was explained to the

students, and they signed a consent form to indicate their voluntary participation. Approval from the teacher was also obtained to conduct the study during class time.

The Accuplacer reading comprehension test was administered first, allowing students one hour to complete it. This was followed by the researcher-made symbolic translation test, which had a maximum time of 30 minutes. The researcher monitored both tests to ensure academic honesty. Data collection took two days due to students' availability.

Each student's responses were scored, with one point given for each correct answer. Pearson's r correlation coefficient was used to measure the relationship between reading comprehension and symbolic translation skills. Differences based on sex and program were examined using an independent samples t-test and One-way ANOVA. Finally, simple linear regression was employed to determine if reading comprehension can statistically predict symbolic translation skills of the respondents. All statistical analyses were performed in Jamovi software.

Ethical Considerations

Ethical standards were observed throughout the conduct of this study. Before data gathering, the researchers asked permission from the instructor to administer the instruments during class hours. The respondents were informed about the purpose of the study and assured that their participation was voluntary. Only respondents who agreed and signed the consent form were part of the study. The researchers also ensured that all gathered data were kept confidential and were only used for academic purposes related to this research.

RESULTS AND DISCUSSION

Profile of the Respondents

Table 1. Frequency Count and Percentage of Respondents by Sex and Program

Profile	Frequency (n=117)	Percent (%)
Sex		
Male	32	27.35
Female	85	72.65
Program		
Bachelor of Physical Education (BPEd)	60	51.28
Bachelor of Technical and Livelihood Education (BTLEd)	57	48.72

Table 1 presents an overview of the respondents' demographic profile based on sex and program. Among the 117 participants, females accounted for the greater proportion, comprising 72.65% of the sample, while male respondents represented 27.35%.

Analysis of the data by program shows that BPEd had the highest number of participants, with a frequency of 60 (51.28%), whereas BTLEd comprised 57 participants (48.72%).

Reading Comprehension and Symbolic Translation Skills of the Respondents

Table 2. Descriptive Statistics of Reading Comprehension and Symbolic Translation Skills

Variables	N	Mean	SD	MPS	Performance Level
Reading Comprehension	117	11.7	4.24	39%	Low Proficient
Symbolic Translation	117	12.1	3.86	40%	Low Proficient

90-100: Highly Proficient; 75-89: Proficient; 50-74: Nearly Proficient; 25-49: Low Proficient; 0-24: Not Proficient

Table 2 presents the performance outcomes of students in the reading comprehension and symbolic translation skills tests. In the reading comprehension test, students obtained a mean score of 11.7 out of 30 items (SD = 4.24), with a Mean Percentage Score (MPS) of 39%. This indicates a low level of proficiency, which highlights the need to enhance students' reading comprehension skills.

For the symbolic translation test, students achieved a mean score of 12.1 out of 30 items (SD = 3.86), with an MPS of 40%, also reflecting a low level of proficiency. These results suggest that most students struggle with symbolic translation, which suggests the need to develop their competency in this area.

Differences in Reading Comprehension and Symbolic Translation Skills in Terms of Profile

Table 3. Differences in Reading Comprehension and Symbolic Translation Skills by Sex

Variables	Group Means		Mean Difference	df	t-value	p-value
	Male	Female				
Reading Comprehension	11.6	11.8	0.151	115	0.171	0.864
Symbolic Translation	12.1	12.1	-0.0232	115	-0.0288	0.977

An independent samples t-test was conducted to determine whether the performance of male and female students in reading comprehension and symbolic translation differed significantly, as shown in Table 3. For reading comprehension, female students (M = 11.8) performed slightly better than male students (M = 11.6); however, this difference was not statistically significant, $t(115) = 0.17$, $p = .86$. In symbolic translation, male and female students obtained almost identical scores (M = 12.1 for both), with a negligible mean difference of -0.02, which was also not statistically significant, $t(115) = -0.03$, $p = .98$.

These findings indicate that male and female students perform at comparable levels in both reading comprehension and symbolic translation, suggesting that interventions aimed at improving these skills should be designed to be gender-inclusive.

Table 4. Differences in Reading Comprehension and Symbolic Translation Skills by Program

Variables	Group Means		Mean Difference	df	t-value	p-value
	BPED	BTLED				
Reading Comprehension	11.8	11.6	-0.202	115	-0.256	0.798
Symbolic Translation	11.7	12.5	0.808	115	1.133	0.260

Table 4 shows the difference in the reading comprehension and symbolic translation skills of the respondents. At the 5% significance level, the results indicated that there was no significant difference found in reading comprehension, where BPEd students (M = 11.8) performed slightly better than BTLEd students (M = 11.6), t(115) = -0.26, p = 0.80. For symbolic translation, BPEd students (M = 11.7) and BTLEd students (M = 12.5) had a high mean difference of 0.81; however, this difference was not statistically significant, t(115) = 1.13, p = .26.

The findings imply that both BPEd and BTLEd students perform at comparable levels in understanding texts and translating mathematical statements into symbols, indicating that interventions can be applied to all programs.

Relationship Between Reading Comprehension and Symbolic Translation Skills

A Pearson product-moment correlation analysis was conducted to determine whether a significant relationship exists between reading comprehension and symbolic translation skills among the respondents.

Table 5. Relationship Between Reading Comprehension and Symbolic Translation Skills

Variables	r-Value	p-Value
Reading Comprehension ↔ Symbolic Translation	0.276	0.003

At the 5% level of significance, the results presented in Table 5 indicate a statistically significant, moderate positive correlation between reading comprehension and symbolic translation skills, r(115) = .276, p = .003. This finding suggests that higher levels of reading comprehension are associated with better performance in symbolic translation. In other words, as students' ability to comprehend written texts improves, their capacity to translate mathematical statements into symbolic form likewise tends to increase. This relationship underscores the essential role of language comprehension in mathematical processing and implies that interventions aimed at strengthening reading comprehension may consequently contribute to the development of students' symbolic translation skills.

Table 6. Regression Model Fit and ANOVA Results for Symbolic Translation Skills

Model	R	R^2	F	p
1	0.28	0.08	9.48	0.003

Further analysis using simple linear regression was made to determine how reading comprehension can influence symbolic translation skills in mathematics. As shown in Table 6,

the model fit statistics indicate a moderate relationship, with a correlation coefficient of R = 0.28 and an explained variance of R^2 = 0.08. These suggest that approximately 8% of the variance in symbolic translation skills can be accounted for by reading comprehension. The omnibus ANOVA test confirmed that the regression model is statistically significant, indicating that reading comprehension reliably predicts symbolic translation performance.

Table 7. Model Coefficients

Predictor	Estimate	SE	t	p	Standardized Estimate	95% CI	
						Lower	Upper
Intercept	9.13	1.02	8.98	<.001	0.28	0.10	0.45
Reading Comprehension	0.25	0.08	3.08	0.003			

Examination of the model coefficients in Table 7 further revealed that reading comprehension is a significant positive predictor of symbolic translation, β = 0.25, t = 3.08, p = .003, with a 95% confidence interval ranging from 0.10 to 0.45. The intercept was also significant (b = 9.13, p < .001), representing the expected symbolic translation score when reading comprehension is zero. This implies that a one-unit increase in reading comprehension is associated with a 0.28-unit increase in symbolic translation skills, representing a moderate effect.

These findings suggest that higher reading comprehension scores are associated with better symbolic translation performance. Although the effect size is moderate, it highlights the role of reading comprehension as a foundational skill for translating mathematical statements into symbolic form. This implies that interventions aimed at improving students' reading comprehension may have a positive impact on their ability to perform symbolic translations, reinforcing the interconnectedness of language and mathematical reasoning.

CONCLUSION AND FUTURE WORKS

Based on the results, the study reveals several key insights regarding the respondents' demographic profile, academic performance, and the relationship between reading comprehension and symbolic translation skills. The majority of participants were female and enrolled in the BPEd program, although the distribution across programs was relatively balanced. Performance outcomes in both reading comprehension (MPS = 39%) and symbolic translation (MPS = 40%) indicated low proficiency levels, highlighting the need for targeted skill enhancement. Gender- and program-based comparisons showed no statistically significant differences, suggesting that interventions should be inclusive and applicable to all students regardless of sex or program. Importantly, a moderate positive correlation between reading comprehension and symbolic translation skills was identified (r = .276, p = .003), and regression analysis confirmed that reading comprehension is a significant predictor of symbolic translation performance, explaining 8% of the variance. These findings underscore the critical role of reading comprehension as a foundation for mathematical reasoning and symbolic translation.

Future work may focus on designing and implementing targeted reading comprehension interventions to enhance students' symbolic translation abilities in mathematics.

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CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest regarding this paper.

DECLARATION OF AI USE

ChatGPT and Grammarly were used to assist the researchers in paraphrasing the selected portions of the text to improve clarity and coherence. This tool did not influence the methods, analysis, and interpretation of results. Final responsibility rests with the authors.

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