

The Relationship Between Literacy and Numeracy Skills of Prospective Primary Education Teachers

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Abstract:

Literacy and numeracy have become prerequisites for society to improve competence in social life. This research endeavor seeks to establish the correlation between the literacy components found in informational texts and literary texts and their impact on numeracy proficiency. This study involved 207 prospective primary education teachers of the Teacher Education Faculty of Tarbiyah Hamzanwadi Pancor Islamic Institute as the study population. The sampling technique used simple random sampling, so 78 prospective primary education teachers were obtained as research samples. The research findings show that there is a simultaneous relationship between literacy skills in the aspects of informational texts and literary texts with numeracy skills in prospective primary education teachers, Faculty of Tarbiyah, Hamzanwadi Islamic Institute Pancor. The contribution of literacy influence is 52% to increase numeracy ability. In addition, literacy skills in aspects of information texts and aspects of literary texts also partially affect the improvement of numeracy skills in students.

Keywords:

Aspects of Information Text; Literacy Skills; Literary Text Aspects; Numeracy Skills

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Introduction

Competencies literacy and numeracy are important in everyday life and play a key role in the development of individuals and the progress of society. Literacy skills include a person's ability to read, understand, and interpret written texts ([Statistics Canada, 2013](#)). According to the Law of the Republic of Indonesia, Number 3 of 2017, concerning the Book System, literacy is defined as the ability to critically analyze information, enabling individuals to interact with science and technology to improve their overall well-being. Literacy ability is the ability to understand, utilize, assess, and reflect on various forms of literature for problem-solving and personal growth as citizens of Indonesia and the world, intending to make a productive contribution to society ([Hidayah et al., 2021](#)).

Meanwhile, numeracy ability is the ability to understand and use numbers and mathematics in everyday situations ([Westwood, 2021b](#)). Numerical literacy includes the utilization of mathematical principles, processes, information, and tools to address everyday challenges in a variety of relevant scenarios. It can be honed through consistent learning and practice ([Sa'dijah et al., 2023](#)). Numeration is an essential skill that gives students the ability to apply numerical concepts and perform arithmetic operations in everyday life, as well as interpret quantitative data in different situations ([Westwood, 2021a](#)). According to UNESCO's approach, numeracy includes more than numeracy skills; rather, it is the use of numeracy skills in interacting with aspects of society ([Hong et al., 2020](#)).

Thus, the competencies assessed in literacy and numeracy include the ability to think logically and systematically, the capacity for logical thinking through acquired concepts and knowledge, and the proficiency in organizing and analyzing information ([Perdana, 2021](#)). Reading, writing, and visual comprehension are integral components of literacy, while numeracy involves applying number concepts and skills in everyday life, interpreting quantitative information, and solving mathematical problems ([Mentari Putri et al., 2023](#)).

Literacy and numeracy are increasingly becoming prerequisites for society to adapt and continuously improve knowledge, skills, and competencies in social life. Therefore, the development of literacy, numeracy, and other basic skills must continue in the 21st century ([Hanemann, 2015](#)). Literacy in the 21st century includes not only basic reading, writing, and numeracy skills but also knowledge and understanding of science and technology (digital literacy), finance, culture, and citizenship ([Kemendikbud, 2021](#)).

However, The Programme for the International Assessment of Adult Competencies (PIAAC) survey on adult skills has revealed that a significant number of adults in Organisation for Economic Co-operation and Development (OECD) countries have limited literacy and numeracy skills ([Windisch, 2015](#)). This limitation is because literacy is often separated in an effort to improve numeracy skills ([Howard et al., 2017](#)).

This study is based on some of the results of previous research. Some of the previous studies behind this research include the following: 1) this research is based on recommendations from research that says that research is needed related to cross-cultural literacy and numeracy learning and the relationship between cross-cultural literacy and numeracy ([Windisch, 2016](#)). 2) Research results of [Heyd-Metzuyanin \(2021\)](#) found that learners' educational achievement in mathematics shows a positive relationship with their ability in mathematical media literacy. The constraint is that learners with weak mathematical identities can significantly hinder adult engagement in understanding information. 3). The results of [Hu et al.'s \(2019\)](#) research explain that the literacy and numeracy skills of Indigenous Canadians are still low and have an impact on the labor market. 4) The results of other studies also explain that the relationship between literacy and numeracy is fully mediated by

informal numeracy skills ([Hu et al., 2019](#)). 5) Research results of [Rosyidah et al. \(2022\)](#) show that the perception of teachers in Lombok, West Nusa Tenggara, towards the implementation of literacy and numeracy learning is still in the fairly good category. This fact has an impact on the lack of optimal teacher readiness in the preparation of literacy and numeracy questions in terms of content, cognitive level, and context ([Rini et al., 2021](#)).

The lack of teacher competence certainly has an impact on the low literacy and numeracy ability of students. Therefore, schools must be able to develop teacher competence ([Sholeh, 2021](#)). Teachers need to use learning media to develop the reading literacy and numeracy of students in elementary schools ([Gunayasa et al., 2021](#); [Sholeh et al., 2021](#)). 6) The results of research by [Neumann et al. \(2013\)](#) found a relationship between literacy and numeracy in early childhood. This research has similarities and relevance to this study but different research objectives. This study refers to the importance of measuring adult literacy and numeracy as conducted by UNESCO ([Faber & Fonseca, 2014](#)).

The findings and recommendations of the above research have become the basis for conducting this research. The purpose of this study was to determine the relationship between literacy skills and numeracy skills of prospective primary education teachers in the Faculty of Tarbiyah, Hamzanwadi Islamic Institute Pancor. This research is important because the findings of previous research explain the adequacy of teachers' perceptions in literacy and numeracy learning. In addition, the relationship between literacy and numeracy can also be the basis for improving literacy and numeracy skills in the field of education.

Research Method

This research belongs to the ex post facto type of research. [McMillan & Schumacher \(2006\)](#) explain ex post facto research as research on the relationship between variables that researchers cannot control because the manifestation has occurred, and research is conducted by manipulating the dependent variable without direct manipulation of the independent variable. Researchers conclude the observed correlation between variables based on variations that occur simultaneously in independent and dependent variables without giving special treatment or manipulation to variables ([Jalota et al., 2020](#)).

A population is a collection of subjects, variables, concepts, or phenomena that have similar characteristics in terms of both location and individual characteristics ([Saifuddin, 2013](#)). The population in this study were all prospective primary education teachers, Faculty of Tarbiyah, Hamzanwadi Islamic Institute of Pancor, totaling 217 people.

The sampling technique uses simple random sampling so that each individual has the same chance to be selected as a sample ([Statistics Canada, 2021](#)). The results of simple random sampling were obtained by students in semesters I, III, and V as a research sample with a total of 78 students (11 men and 67 women). The sample of this study is large to avoid using samples with several < 30 with small categories. The use of small samples in research may be unrepresentative, untrustworthy, and inaccurate in ensuring sufficient strength to extend the findings of statistical analysis to the entire population ([Faber & Fonseca, 2014](#)).

Data collection techniques use test instruments based on literacy and numeracy indicators of the Minimum Competency Assessment developed by the National Assessment Center, especially in the content aspect. The content component of the literacy section includes two types of texts, namely information and literature. On the other hand, the content component of the numeracy section focuses on numeral, measurement and geometry skills, data handling and uncertainty, and algebra ([Faber](#)

& Fonseca, 2014). The use of this instrument is based on the feasibility of the results of internal consistency testing of grains and proving the reliability of the instrument.

The analysis begins by performing normality tests, linearity tests, multicollinearity, autocorrelation, and heteroscedasticity tests as part of the classical assumption test. Next is descriptive analysis and hypothesis testing. Testing the research hypothesis aims to see the relationship between literacy ability, including aspects of information texts (X_1) and aspects of literary texts (X_2) with numeracy ability (Y) will be analyzed using multiple linear analysis with the help of SPSS version 25 software.

Results and Discussion

The analysis begins by performing normality tests, linearity tests, multicollinearity, autocorrelation, and heteroscedasticity tests as part of the classical assumption test.

Descriptive statistical analysis is used to gain an understanding of the attributes of each variable. A summary of research data is made to illustrate the distribution of data by showing a table of results of analysis of students' literacy and numeracy abilities presented in Table 1.

Table 1. Results of Descriptive Analysis of Literacy and Numeracy Ability Data

		Informational Text	literary text	Numeracy
N	Valid	78	78	78
	Missing	0	0	0
Mean		64,74	62,56	43,83
Median		70,00	60,00	44,00
Mode		50 ^a	70	50
Std. Deviation		25,160	17,391	14,050
Variance		633,050	302,431	197,413
Range		90	80	68
Minimum		10	20	15
Maximum		100	100	83

The data score range is above 0 – 100, the ideal average is 50, and the ideal standard deviation (SDi) is 16.67, so a score classification is obtained in Table 2.

Table 2. Data Classification Literacy and Numeracy Ability

Score Range	Category	Qualification
$Mi + 1,5SDi \leq X$	A	Very High
$Mi + 0,5SDi \leq X < Mi + 1,5SDi$	B	High
$Mi - 0,5SDi \leq X < Mi + 0,5SDi$	C	Enough
$Mi - 1,5SDi \leq X < Mi - 0,5SDi$	D	Low
$X < Mi - 1,5SDi$	E	Very Low

Referring to Table 1, the average literacy ability of students from the aspect of information texts is 64.74. This value means that students' literacy skills from the aspect of information texts are in the sufficient category. The same thing is true in the literacy ability of students from the aspect of literary texts, which is in the sufficient category with a mean of 62.56. The results were different in terms of the numeracy ability of students, with a mean of 43.84. This value means that students' numeracy skills are in the low category.

Furthermore, multiple regression analysis requires several assumption tests, such as normality testing, multicollinearity, autocorrelation, and heteroskedasticity testing. The normality test conducted in this research employed the One-Sample Kolmogorov-Smirnov Test with a significance level set at 5%. The results of the data normality test can be presented in Table 3.

Table 3. Output One-Sample Kolmogorov-Smirnov Test

	Unstandardized Residual
N	78
Asymp. Sig. (2-tailed)	,200 ^{c,d}

The results of the One-Sample Kolmogorov-Smirnov Test obtained the value of Sig. Asymp. Sig. (2-tailed) 0.200, $p > \alpha:0.05$. This value means that the data on literacy and numeracy skills are normally distributed.

Next is linearity testing. The linearity test aims to find the regression line equation of the independent variable X against the bound variable Y. The following table 4 presents the results of the linearity test.

Table 5. Output Linearity Test

Regresi	N	F- <i>Linearity</i>	Sig.	Conclusion
X ₁ - Y	78	1,446	0,194	Linear
X ₂ - Y	78	1,700	0,123	Linear

Based on the table above, the significance values of F Deviation from Linearity are 1.446 and 1.700, respectively, with Sig values of more than 0.05. Sig values of more than 0.05 means that there is a linear relationship between the literacy variable and the numeracy variable.

A proficient regression model ought to exhibit no correlation with its independent variables. The investigation employed the Variance Inflation Factor (VIF) test and the Tolerance value within the regression model to ascertain the presence of multicollinearity. The results of the multicollinearity test for literacy and numeracy ability data are presented in Table 5.

Table 5. Output Coefficients^a Multicollinearity Test

Model	Collinearity Statistics	
	Tolerance	VIF
(Constant)		
Informational Text	,906	1,104
Literary Text	,906	1,104

a. Dependent Variable: Numerasi

Based on the multicollinearity test, the VIF value for the variable of information text and literary text is both 0.906, while the Tolerance value is 1.104. Because the VIF value in both variables is smaller than ten and the Tolerance value is greater than 0.10, it can be concluded that there is no symptom of multicollinearity in the regression model. In addition, Table 6 below presents the results of the autocorrelation test.

Table 6. Output Model Summary^b Autokorelasi Test

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	,719 ^a	,517	,504	9,893	2,185

a. Predictors: (Constant), informational text, literary text
 b. Dependent Variable: Numeracy

Based on Table 6, the Durbin-Watson (d_L) value is 2.185. If this figure is compared with the value of the Durbin-Watson table (d_u 2; 78) of 1.680, then d_L is greater than d_u , which means that there is no autocorrelation.

Furthermore, it is necessary to test heteroscedasticity to identify whether there is a deviation from the classical assumption that there is a similarity in variance from

residuals in the regression model for all observations. The presence of symptoms of heteroscedasticity in regression models is undesirable. The test results are presented in Table 7.

Table 7. Output Coefficients^a Heteroskedastisitas Test

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
1 (Constant)	4,748	2,837		1,673	,098
Informational text	,014	,029	,058	,479	,633
Literary text	,030	,042	,086	,713	,478

Based on Table 7, the significance value of the information text variable is 0.633, and the significance value of the literary text variable is 0.478. Hence, the significance level of the two variables above surpasses 0.05. Consequently, it can be inferred that there is an absence of heteroscedasticity indications within the regression model. In the fulfillment of the classical assumption test in this study, hypothesis testing can be carried out using multiple regression.

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This study used multiple linear regression analysis to assess the impact of informational and literary texts on numeracy ability, which is the dependent variable. The effect of independent variables is evaluated simultaneously and partially. Table 8 shows the results of IBM SPSS 25 software aid calculations.

Table 8. Multiple Regression Analysis Output

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	7860,917	2	3930,458	40,162	,000 ^b
	Residual	7339,917	75	97,866		
	Total	15200,833	77			

a. Dependent Variable: Numeracy

b. Predictors: (Constant), informational text, literary text

The table above informs that the significance value in the F test is 0.000; $P < 0.05$. The findings prove that informational texts and literary texts simultaneously contribute to the numeracy skills of prospective primary education students, Faculty of Tarbiyah, Hamzanwadi Islamic Institute Pancor.

Table 9. Value of Coefficient of Determination

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,719 ^a	,517	,504	9,893

Table 9 informs the value of the coefficient of determination of the variables of information text and literary text with a dependent variable or R Square of 0.517, which means that 52% of the variables of information text and literary text together contribute to the variable of numeracy ability. At the same time, other factors outside this study influence the rest.

Table 10. Coefficients of Regression Equation

Mode	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	5,473	4,553		1,202	,233
Informational Text	,256	,047	,458	5,431	,000
Literary Text	,349	,068	,431	5,116	,000

This table informs the equation of regression lines and whether or not there is a partial influence of informational texts and literary texts on students' numeracy abilities. The regression equation is $\hat{Y} = 5.473 + 0.256 + 0.349$.

Theoretically, the effect of literacy (informational and literary texts) on improving students' numeracy skills can be attributed to the fundamental role that early literacy and numeracy play in facilitating the acquisition and development of students' numeracy skills ([Koponen et al., 2019](#)). For students or adults, literacy skills are as important as numeracy. However, literacy and numeracy skills are not just for reading, writing, and counting but more for how to interpret them in everyday life ([Kus, 2018](#)).

Literacy skills must support the application of numeracy skills. [Howard \(2017\)](#) explained that educational institutions must be able to identify the needs of students and provide full support through directed education based on standardized assessment because that is the basic purpose of assessment in education. Therefore, the difficulties of learners must be strictly known. Specifically, he explained that a student can fail a numeracy test likely because of his lack of literacy skills rather than because of his ignorance of numeracy. This kind of difficulty will not be overcome if educators apply remedial numeracy.

In addition, numeracy skills can also improve reading and writing skills. [Neumann et al., 2013](#) explain some reasons for this are 1) numeracy ability involves logical thinking, pattern recognition, and problem-solving so that it is useful for understanding and analyzing texts, finding relationships, and expressing ideas clearly; 2) Numeracy skills can help learners interpret data, graphs, and tables often found in text. It can provide valuable information and evidence for arguments and claims. 3) Numeracy skills can help students measure their progress, and they can use numbers to track students' reading speed, comprehension, vocabulary, and writing quality.

Empirically, the results of this study are related to the research of [Neumann et al., \(2013; Zhang et al., \(2017\)](#), which said that there is a relationship between literacy ability and numeracy ability in early childhood. College students or adults with higher literacy and numeracy competencies tend to have higher levels of critical thinking skills. However, adult literacy and numeracy can be changed throughout adulthood and can change even in a period of three to six years ([Lechner et al., 2021](#)). In education, literacy holds a key position in shaping the learning experience. Therefore, the improvement of numeracy ability, mathematical skills, and other specialized areas is significantly influenced by the literacy ability of individuals ([Duncan et al., 2007](#)).

Based on theory and empirical findings, it can be concluded that literacy (informational texts and literary texts) has a simultaneous influence on the numeracy ability of prospective primary education teachers, Faculty of Tarbiyah, Hamzanwadi Pancor Islamic Institute.

The Effect of Literacy Skills in Aspects of Information Text on Numeracy Skills in Prospective Primary Education Teachers, Faculty of Tarbiyah, Hamzanwadi Islamic Institute Pancor

Based on Table 10, the significance value on the partial t-test is 0.000; $p < 0.05$, which means that literacy skills in the text aspect of information affect numeracy skills in prospective primary education teachers, Faculty of Tarbiyah, Hamzanwadi Islamic Institute Pancor.

In theory, there is an influence of literacy ability in aspects of information texts on students' numeracy ability because numeracy literacy, which includes understanding and application of numerical and mathematical concepts, is closely related to students' overall literacy proficiency, including their capacity to understand

and analyze information texts. Proficiency in numeracy literacy is essential for problem-solving and critical thinking, enabling students to work effectively with numbers and symbols, thereby improving their academic performance in mathematics and other disciplines (Nursyifa & Masyithoh, 2023). In addition, the aptitude to critically interpret and assess information, a fundamental aspect of information literacy, is essential for understanding statistical information and making data-driven decisions (Maharani & Prabawanto, 2022). In addition, the style of textbook discourse and the presentation of mathematical content can influence students' attitudes toward mathematics and their involvement in tasks related to numeracy.

Numeracy characteristics require information texts to understand numeracy, so literacy skills in aspects of information texts are needed. An informational text is a text that aims to provide facts, data, and information, especially for the development of insight and science, which, of course, is scientific. New information received by students is not only sourced from text but also obtained from educators as informers (Westwood, 2021a).

Informational texts can help students develop their numeracy skills by 1) exposing various types of data, such as graphs, tables, charts, and diagrams, and interpreting and analyzing them (Neumann et al., 2013); 2) providing opportunities to apply knowledge and explore numeracy skills into real-world situations and problems and exploring the relationship between numeracy skills and other disciplines (Gorard et al., 2018).

Sundari & Masri (2021) describes several indicators of numeracy ability in the context of information texts, including solving mathematical problems using different symbols and numbers, analyzing data displayed in tables, graphs, and diagrams, and interpreting the results of these analyses to obtain conclusions or predictions. Literacy is important in mathematics because it demands critical thinking skills and problem-solving techniques to understand informational texts, not just knowledge of formulas. Informational texts can influence numeracy attitudes and motivations by demonstrating the benefits, values, and usefulness of mathematics in various fields and situations. This is reinforced by Mata et al. (2012), who says that motivation is the main predictor of attitudes towards mathematics.

The Effect of Literacy Skills in Literary Text Aspects on Numeracy Skills in Prospective Primary Education Teachers, Faculty of Tarbiyah, Hamzanwadi Islamic Institute Pancor

Based on Table 10, the significance value on the partial t-test is 0.000; $p < 0.05$, which means that there is an effect of literacy skills in the aspect of literary texts on numeracy skills of prospective primary education teachers, Faculty of Tarbiyah, Hamzanwadi Institute of Islam Pancor.

A literary text is a text that aims to provide readers with entertainment experiences, stories, and musings. Numerical abilities are often viewed as abilities acquired from an eternal system of truths constructed by objective and rigorous methods. Literary texts are associated with individual experiences, emotions, human life, and historical-cultural contexts. However, despite these differences, literature and mathematics have characteristics that show a very close relationship between them (Engelhardt & Tubbs, 2021). For example, both literature and mathematics are concerned with patterns, structures, and relationships that involve the use of symbols to represent abstract concepts (Cohen, 2013).

Furthermore, according to an article in ourjourneywestward.com, books that introduce mathematical concepts by presenting good stories make mathematics come alive, and children feel that mathematics is not boring (Cyndi, 2023). The relationship

between the two also appears in the finding [Engelhardt & Tubbs \(2021\)](#) that the mathematical approach to literature occurs in the use of quantitative methodology in analyzing texts. Another way that can be used to teach math concepts is by helping learners understand number lines. Number lines are not just about counting but also about spatial relationships and sequences. By using stories, learners can learn to visualize number lines and understand their properties. In addition, these findings support the findings of [Priowuntato et al. \(2022\)](#) that 1) literary texts help motivate educators to learn mathematics; 2) building math lessons based on literature helps educators to make math more meaningful; 3) educators are more proactive when it comes to making mathematical connections with literature.

Empirically, research findings suggest that embedding mathematics in children's literature can improve early numeracy skills, especially for children with disabilities, by making abstract concepts more accessible and engaging through familiar contexts ([Gavin, 2022](#); [Nursyifa & Masyithoh, 2023](#)). This approach not only helps in the development of basic numeracy skills such as one-to-one correspondence and quantity comparison but also fosters a deeper understanding of mathematical concepts by placing them in relatable narratives ([Tunstall, 2016](#)). In addition, quantitative methods applied to textual data, such as the analysis of numbers in literary texts, can reveal insights into authorship and stylistic peculiarities, thereby enriching the study of literature and mathematics ([Zenkov et al., 2021](#)). Thus, the integration of literary texts into numeracy education not only improves math skills but also supports a more holistic and inclusive approach to learning, benefiting students across different age groups and educational needs.

Conclusion

Literacy and numeracy have become prerequisites for society to improve competence in social life. Therefore, improving literacy and numeracy skills is important in the 21st century. The findings of this study explain that there is a simultaneous relationship between literacy skills in the aspects of informational text and literary text with numeracy skills in prospective primary education teachers, Faculty of Tarbiyah, Hamzanwadi Islamic Institute of Pancor. The contribution of literacy influence is 52% to increase numeracy ability. In addition, literacy skills in aspects of information texts and aspects of literary texts also partially affect the improvement of numeracy skills in students.

The relationship between literacy and numeracy, both simultaneously and partially, shows that solving numeracy problems requires literacy in identifying problems, finding information (through reading graphs and patterns), and interpreting numbers to apply them in everyday life.

This study is limited to examining literacy and numeracy skills in terms of content from the Minimum Competency Assessment (MCA) component and does not examine cognitive processes and context. This study was also limited to examining the effect of literacy on improving numeracy skills. Therefore, further research is expected to examine the components of the Minimum Competency Assessment (MCA) as a whole (content, processes, context) and the influence of numeracy on improving literacy skills. This advice is very necessary because literacy and numeracy skills are important for human development in social life, especially for students.

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