Human: Journal of Community and Public Service
Published by HAQI Publishing Service
issn: (2830-0203) Vol 4 No 2 (2025)

RELATIONSHIP BETWEEN ENGLISH PROFICIENCY AND MATHEMATICAL PROBLEM-SOLVING SKILLS AMONG UNIVERSITY STUDENTS

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Abstract

English proficiency plays an important role in higher education, particularly in supporting students' comprehension of academic materials and problem-solving processes. In mathematics learning at the university level, students are required not only to perform numerical calculations but also to understand problem statements and apply appropriate reasoning strategies. This study aims to examine the relationship between English proficiency and mathematical problem-solving skills among university students. A quantitative research approach with a correlational design was employed. The participants were undergraduate students from the Industrial Engineering program at Universitas Indraprasta PGRI Jakarta, selected using a purposive sampling technique. English proficiency was measured using an English proficiency test focusing on academic reading comprehension and language understanding, while mathematical problem-solving skills were assessed through problem-solving tasks based on established mathematical frameworks. The data were analyzed using descriptive statistics and correlation analysis. The results indicate a positive and significant relationship between English proficiency and mathematical problem-solving skills. Students with higher levels of English proficiency tend to demonstrate better performance in solving mathematical problems, particularly those involving contextual and language-based descriptions. These findings suggest that English proficiency contributes to students' ability to interpret mathematical information and apply effective solution strategies. The study highlights the importance of integrating language support into mathematics instruction and encourages interdisciplinary collaboration between English and mathematics lecturers to enhance students' academic performance and problem-solving skills in higher education.
Keywords: English Proficienc, Mathematical Problem-Solving Skills, University Students, Industrial Engineering, Correlational Study

Abstrak

Kemampuan bahasa Inggris memiliki peran penting dalam pendidikan tinggi, khususnya dalam mendukung pemahaman mahasiswa terhadap materi akademik dan proses pemecahan masalah. Dalam pembelajaran matematika di tingkat perguruan tinggi, mahasiswa tidak hanya dituntut untuk melakukan perhitungan numerik, tetapi juga memahami pernyataan soal dan menerapkan strategi penalaran yang tepat. Penelitian ini bertujuan untuk mengkaji hubungan antara kemampuan bahasa Inggris dan kemampuan pemecahan masalah matematika pada mahasiswa. Penelitian ini menggunakan pendekatan kuantitatif dengan desain korelasional. Subjek penelitian adalah mahasiswa Program Studi Teknik Industri Universitas Indraprasta PGRI Jakarta yang dipilih menggunakan teknik purposive sampling. Kemampuan bahasa Inggris diukur melalui tes kemampuan bahasa Inggris yang menekankan pemahaman bacaan akademik dan pemahaman bahasa, sedangkan kemampuan pemecahan masalah matematika diukur melalui tugas pemecahan masalah berdasarkan kerangka pemecahan masalah matematika. Data dianalisis menggunakan statistik deskriptif dan analisis korelasi. Hasil penelitian menunjukkan adanya hubungan positif dan signifikan antara kemampuan bahasa Inggris dan kemampuan pemecahan masalah matematika. Mahasiswa dengan kemampuan bahasa Inggris yang lebih baik cenderung memiliki kemampuan pemecahan masalah matematika yang lebih tinggi, terutama pada soal-soal yang bersifat kontekstual dan berbasis bahasa. Temuan ini menunjukkan pentingnya integrasi dukungan bahasa dalam pembelajaran matematika serta mendorong kolaborasi antara dosen bahasa Inggris dan matematika untuk meningkatkan kinerja akademik dan kemampuan pemecahan masalah mahasiswa di perguruan tinggi.
Kata kunci: Kemampuan Bahasa Inggris, Pemecahan Masalah Matematika, Mahasiswa, Teknik Industri, Studi Korelasional

INTRODUCTION

In higher education, English proficiency has become an essential academic competence due to its function as the dominant language of scientific communication and instructional resources. University students are increasingly required to engage with textbooks, journal articles, manuals, and digital learning materials written in English. This condition is particularly relevant in science, technology, engineering, and mathematics (STEM) disciplines, where English is frequently used to present theoretical explanations, mathematical expressions, and problem-solving procedures. Consequently, students' ability to comprehend English academic texts may influence their learning effectiveness and academic performance (Crystal, 2012; Nation, 2013).

Mathematics learning at the university level emphasizes reasoning, abstraction, and structured problem solving. Mathematical problem-solving skills involve more than computational ability; they require students to understand problem statements, identify relevant information, apply appropriate strategies, and evaluate the correctness of solutions. Many mathematical problems are presented in contextual or word-problem forms, which demand adequate reading comprehension and interpretative skills (Polya, 2004; Schoenfeld, 2016). Therefore, linguistic competence plays an important role in supporting students' mathematical thinking processes.

From a cognitive perspective, language functions as a mediating tool that supports reasoning and meaning construction in learning activities. Vygotsky (1978) argues that language is closely linked to higher-order thinking and problem-solving processes. In mathematics education, language is used to interpret symbols, express logical arguments, and communicate solution strategies. Limited language proficiency may restrict students' ability to process mathematical information accurately, leading to misconceptions and ineffective problem-solving approaches (Pimm, 1987; Moschkovich, 2010).

English proficiency becomes increasingly significant when students learn mathematics in contexts where instructional materials, references, or assessment items include English terminology. Previous studies indicate that students with higher second-language proficiency tend to perform better in mathematics tasks that involve complex verbal explanations and analytical reasoning (Cummins, 2000; Abedi & Lord, 2001). This suggests that mathematical achievement may be influenced not only by numerical skills but also by students' linguistic abilities in understanding problem contexts.

In engineering education, particularly in Industrial Engineering programs, mathematical problem-solving skills are fundamental for analyzing systems, modeling processes, and making quantitative decisions. Courses such as calculus, statistics, operations research, and optimization often present problems that integrate mathematical reasoning with textual descriptions. As a result, students are required to process both numerical and linguistic information simultaneously. Inadequate English proficiency may hinder students' ability to interpret mathematical problems correctly and apply appropriate solution strategies (OECD, 2019; Prediger et al., 2016).

Although the relationship between language proficiency and mathematics learning has been widely discussed, most existing studies focus on primary or secondary education contexts. Research examining this relationship at the higher education level, particularly among engineering students in non-English-speaking countries, remains limited (Schoenfeld, 2016; Moschkovich, 2010). This indicates a research gap in understanding how English proficiency relates to mathematical problem-solving skills among university students.

In the Indonesian higher education context, English is taught as a foreign language, yet it plays a significant role in academic learning, especially through reference materials and technical terminology. At Universitas Indraprasta PGRI Jakarta, students in the Industrial Engineering program encounter mathematical content that often incorporates English-based concepts and problem

descriptions. Differences in students' English proficiency levels may result in variations in their ability to understand and solve mathematical problems effectively.

Furthermore, interdisciplinary collaboration between English and mathematics lecturers has not been widely explored as a basis for empirical research in Indonesian universities. Studies that integrate language education and mathematics education at the tertiary level are still scarce, particularly those that focus on engineering students as research participants. This condition highlights the importance of conducting research that bridges these two fields to provide a more comprehensive understanding of students' academic competencies.

Therefore, this study investigates the relationship between English proficiency and mathematical problem-solving skills among university students, specifically Industrial Engineering students at Universitas Indraprasta PGRI Jakarta. By examining this relationship, the study aims to contribute empirical evidence to interdisciplinary research in higher education and provide insights that may support instructional improvement and curriculum development.

METHODS

This study employed a quantitative research approach with a correlational design to examine the relationship between English proficiency and mathematical problem-solving skills among university students. A correlational method was considered appropriate because the study aimed to identify the degree and direction of the relationship between two variables without manipulating them. This approach allows researchers to analyze naturally occurring relationships between academic skills in educational contexts (Creswell & Creswell, 2018).

The participants of this study were undergraduate students enrolled in the Industrial Engineering program at Universitas Indraprasta PGRI Jakarta. The participants were selected using a purposive sampling technique, considering that Industrial Engineering students are required to engage intensively with mathematical problem solving as well as academic materials that incorporate English terminology. This population was chosen to ensure the relevance of both variables investigated in this study. The number of participants was determined based on accessibility and representativeness to support statistical analysis (Fraenkel et al., 2012).

English proficiency was treated as the independent variable, while mathematical problem-solving skills served as the dependent variable. English proficiency was measured using an English proficiency test that assessed students' reading comprehension, vocabulary, and basic grammatical understanding relevant to academic contexts. Mathematical problem-solving skills were measured through a set of problem-solving tasks designed to evaluate students' ability to understand problems, apply appropriate strategies, and reach correct solutions. The indicators for mathematical problem solving were adapted from established problem-solving frameworks emphasizing understanding, planning, execution, and evaluation (Polya, 2004; Schoenfeld, 2016).

Data collection was conducted during regular academic sessions with prior consent from the participants. The instruments were administered under controlled conditions to ensure consistency and reliability of the data. Before data analysis, the collected data were checked for completeness and accuracy. Descriptive statistics were used to describe students' English proficiency and mathematical problem-solving skill levels, while inferential statistics were employed to examine the relationship between the two variables.

The data were analyzed using correlation analysis to determine the strength and significance of the relationship between English proficiency and mathematical problem-solving skills. This analysis technique is commonly used in educational research to examine relationships between continuous variables (Field, 2018). The results of the analysis were interpreted to determine whether English proficiency is significantly related to students' ability to solve mathematical problems in the context of higher education.

RESULTS AND DISCUSSION

In the specific context of Industrial Engineering, this relationship is vital. The curriculum frequently utilizes international textbooks and technical manuals written in English. Our findings suggest that "linguistic barriers" may impede students' ability to apply their numerical skills to real-world engineering scenarios. Even if a student possesses strong fundamental math skills, they may fail to solve an optimization or production problem if they cannot accurately parse the technical English used to describe it.

Descriptive Analysis of Variables

The descriptive data reveals that the majority of students possess a moderate level of competence in both English and mathematical problem-solving.

Table 1. Descriptive Statistics of English Proficiency

Category	Score Range	Frequency	Percent
High	80-100	18	22.5%
Medium	60-79	42	52.5%
Low	< 60	20	25.0%
Total		80	100%

As shown in Table 1, 52.5% of students fall into the "Medium" category. This aligns with the broader context of English as a Foreign Language (EFL) in Indonesian higher education, where proficiency is often limited by a lack of immersion outside the classroom (Nation, 2013).

Table 2. Correlation Analysis Results

Category	Score Range	Frequency	Percent
High	80-100	20	25.0%
Medium	60-79	40	50.0%
Low	< 60	20	25.0%
Total		80	100%

Table 2 reflects a similar distribution, with 50% of students demonstrating moderate problem-solving skills. While students can generally navigate routine computations, the data suggests they face hurdles when encountering complex, language-intensive tasks that require higher-order interpretation.

Correlation Analysis

To determine the strength of the relationship between variables, a Pearson correlation analysis was conducted.

Tabel 3.Correlation between English Proficiency and Mathematical Problem- Solving Skills

Variables	r- Value	Sig.(p)	Interpretation
English Proficiency & Mathematical Problem- Solving Skills	0.56	0.000	Moderate Positive Correlation

The analysis yielded a correlation coefficient of $r = 0.56$ ($p < 0.05$), indicating a moderate positive relationship. This statistically significant result implies that as English proficiency increases, mathematical problem-solving performance tends to improve. This is consistent with the findings of Abedi & Lord (2001), who argued that linguistic complexity in word problems often masks a student's true mathematical ability.

Discussion of Findings

The results reinforce the theoretical perspective that language serves as a vital cognitive tool. According to Vygotsky (1978), language mediates higher-order thinking; in this study, English proficiency acts as the bridge between the problem statement and the mathematical execution.

Students with higher English scores were more adept at identifying key variables and translating textual narratives into mathematical models.

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Practical Implications

1. Interdisciplinary Curriculum: There is a clear need to integrate English for Academic Purposes (EAP) directly into the engineering syllabus rather than teaching it in isolation.
2. Pedagogical Shift: Lecturers should focus on "mathematical discourse" teaching students how to decode the specific language used in engineering problems (Moschkovich, 2010).
3. Language Support: Providing bilingual glossaries for complex technical terms could reduce the cognitive load on students, allowing them to focus on the mathematical logic of the problem.

CONCLUSION

This study confirms a significant positive relationship between English proficiency and mathematical problem-solving skills among Industrial Engineering students at Universitas Indraprasta PGRI Jakarta. The results indicate that most students possess moderate competence in both areas, suggesting that linguistic barriers often hinder their ability to process complex, context-rich mathematical tasks. Theoretically, these findings reinforce the role of language as a vital cognitive tool that facilitates higher-order thinking and the decoding of technical information. Practically, the study highlights that mathematical success in engineering is not solely dependent on numerical ability, but also on academic literacy. Consequently, there is a clear need for interdisciplinary collaboration between English and Mathematics departments to integrate language support into the engineering curriculum. Future research should expand the sample size and explore different disciplines to further validate the causal link between language proficiency and academic performance in STEM fields.

ACKNOWLEGNMENT

The authors would like to express their sincere gratitude to Universitas Indraprasta PGRI Jakarta for the academic support and facilities provided during the completion of this study. Appreciation is also extended to the Industrial Engineering program and all students who voluntarily participated in this research. The authors also thank colleagues from the English and Mathematics departments for their valuable insights and interdisciplinary collaboration. This research was supported by internal funding from Universitas Indraprasta PGRI Jakarta. The funding source had no role in the study design, data collection, data analysis, interpretation of results, or the decision to publish the findings.

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