International Journal of Social and Education (INJOSEDU) e-ISSN: 3047-6151
Vol. 2 No. 5 May 2025, hal., 1567-1580

INVESTIGATING THE RELATIONSHIP BETWEEN ENGLISH LANGUAGE PROFICIENCY AND PROGRAMMING SKILLS IN COMPUTER ENGINEERING EDUCATION

Lika Silvia Batubara
Department of Computer Engineering
Politeknik Unggulan Cipta Mandiri
lika@ucmcampus.ac.id

Abstract

This research investigates the intricate relationship between English language proficiency and programming skills within the domain of computer engineering education. In an increasingly globalized world, where English serves as a lingua franca in the field of technology, the correlation between language competence and technical aptitude becomes pivotal. This study employs a mixed-methods approach, encompassing both quantitative and qualitative analyses, to comprehensively explore this relationship. Quantitative data are collected through standardized English language proficiency tests and programming assessments, while qualitative insights are derived from interviews and surveys among computer engineering students. The findings shed light on the nuanced interplay between English language proficiency and programming skills, uncovering potential implications for curriculum design, pedagogical strategies, and student support services in computer engineering education. By elucidating the dynamics of this relationship, this research aims to inform educators, policymakers, and stakeholders in optimizing educational practices to better equip computer engineering students for success in the global technological landscape.

Keywords: *English language proficiency, Programming skills, Computer engineering education, Language competence, Curriculum design*

INTRODUCTION

In today's technologically driven world, proficiency in both English language and programming skills holds paramount importance, particularly in the realm of computer engineering education. As English continues to serve as the primary medium of communication in the globalized landscape of technology, the intersection between language proficiency and technical competence becomes increasingly significant. This study aims to delve into the intricate relationship between English language proficiency and programming skills within the context of computer engineering education. The integration of English language instruction into technical curricula has been a subject of interest and debate among educators and policymakers. While the primary focus of computer engineering programs is on developing technical expertise, the importance of effective communication skills, particularly in English, cannot be overlooked. The ability to convey complex technical

concepts, collaborate with international peers, and engage with a global audience necessitates a certain level of English language proficiency.

Despite the recognition of the importance of language skills, the specific relationship between English proficiency and programming skills remains relatively unexplored within the field of computer engineering education. This study seeks to address this gap by investigating how variations in English language proficiency may influence programming aptitude among computer engineering students. By adopting a mixed-methods approach, this research endeavours to provide a comprehensive understanding of the relationship between English language proficiency and programming skills. Quantitative analyses will involve administering standardized English language proficiency tests and programming assessments to a sample of computer engineering students. Additionally, qualitative insights will be gathered through interviews and surveys to explore students' perceptions, experiences, and challenges related to language and programming learning.

The findings of this study are expected to contribute valuable insights to both academia and practice. Understanding the nuanced interplay between language proficiency and technical skills can inform curriculum design, instructional strategies, and support services aimed at enhancing the educational experience and outcomes of computer engineering students. Furthermore, insights from this research may have implications for workforce readiness and employability in an increasingly globalized and technology-driven economy.

RESEARCH METHOD

This study adopts a mixed-methods research design to comprehensively investigate the relationship between English language proficiency and programming skills in computer engineering education. The quantitative component utilizes surveys to collect data from a sample of computer engineering students, while the qualitative component involves semi-structured interviews to gather in-depth insights.

The participants of this study will consist of undergraduate students enrolled in computer engineering programs at Politeknik Unggulan Cipta Mandiri. A purposive sampling technique will be employed to ensure diversity in English language proficiency levels and programming skill levels among the participants. Approximately 50 participants are expected to be included in the study.

The primary instrument for quantitative data collection will be a structured questionnaire developed by the researchers. The questionnaire will include validated

scales to assess English language proficiency levels, programming skills, and demographic information of the participants.

Qualitative Data Collection: Semi-structured interviews will be conducted with a subset of participants selected from the survey respondents. The interviews will explore participants' perceptions and experiences related to the relationship between English language proficiency and programming skills in more detail.

The survey questionnaire will be administered online using a secure platform, such as Google Forms or Qualtrics. Participants will be invited to complete the questionnaire voluntarily, with informed consent obtained prior to participation. The survey link will be distributed via email and social media channels, and reminders will be sent to encourage participation. Semi-structured interviews will be scheduled with selected participants who express willingness to participate in the qualitative phase of the study. The interviews will be conducted via video conferencing or in-person, depending on participants' preferences and logistical considerations. Informed consent will be obtained from all interviewees prior to the commencement of the interviews.

Descriptive statistics, such as means, standard deviations, and frequencies, will be used to summarize the quantitative data collected through the surveys. Correlation analysis, including Pearson correlation coefficients, will be conducted to examine the relationship between English language proficiency levels and programming skills. Thematic analysis will be employed to analyse the qualitative data obtained from the interviews. Transcripts of the interviews will be coded and categorized to identify recurring themes and patterns related to the research questions.

This study will adhere to ethical guidelines for research involving human participants. Informed consent will be obtained from all participants prior to data collection, and their privacy and confidentiality will be ensured throughout the research process. Participants will be informed of their right to withdraw from the study at any time without penalty.

FINDINGS AND DISCUSSION

Descriptive Statistics

Descriptive statistics were utilized to summarize the characteristics of the participants and the distribution of variables in the study. The sample consisted of 50 students enrolled in computer engineering programs at Politeknik Unggulan Cipta Mandiri. The participants' English language proficiency levels were assessed using TOEFL (Test of English as a Foreign Language), while their programming skills were measured using Codecademy. Demographic characteristics of the participants:

- Age: The participants' age ranged from 18 to 25 years old.

- Gender: The sample comprised 12 female participants and 38 male participants.
- Academic Year: The study included students enrolled in the academic years 2023 to 2024.

This demographic information provides insights into the composition of the participant sample and helps contextualize the findings within the specific demographic profile of the participants.

English Language Proficiency Levels

The analysis revealed a diverse range of English language proficiency levels among the participants. The majority of participants demonstrated proficiency in basic English language skills, with 78% achieving intermediate proficiency and 22% achieving advanced proficiency. However, a small percentage of participants exhibited limited proficiency, indicating potential challenges in comprehending English-language instructional materials in the context of computer engineering education.

Table 1. Participant Scores

PARTICIPANT	SCORES	
	English Language Proficiency	Programming Skills
No. 1	Intermediate	Basic
No. 2	Intermediate	Basic
No. 3	Intermediate	Basic
No. 4	Intermediate	Basic
No. 5	Advanced	Advanced
No. 6	Intermediate	Basic
No. 7	Intermediate	Basic
No. 8	Advanced	Advanced
No. 9	Intermediate	Basic
No. 10	Intermediate	Basic
No. 11	Advanced	Advanced
No. 12	Intermediate	Basic
No. 13	Advanced	Advanced
No. 14	Intermediate	Basic
No. 15	Intermediate	Basic
No. 16	Intermediate	Basic

No. 17	Intermediate	Basic
No. 18	Intermediate	Basic
No. 19	Intermediate	Basic
No. 20	Intermediate	Basic
No. 21	Intermediate	Basic
No. 22	Intermediate	Basic
No. 23	Intermediate	Basic
No. 24	Advanced	Advanced
No. 25	Intermediate	Basic
No. 26	Intermediate	Basic
No. 27	Intermediate	Basic
No. 28	Intermediate	Basic
No. 29	Intermediate	Basic
No. 30	Advanced	Advanced
No. 31	Intermediate	Basic
No. 32	Intermediate	Basic
No. 33	Advanced	Advanced
No. 34	Intermediate	Basic
No. 35	Intermediate	Basic
No. 36	Intermediate	Basic
No. 37	Intermediate	Basic
No. 38	Intermediate	Basic
No. 39	Advanced	Advanced
No. 40	Advanced	Advanced
No. 41	Intermediate	Basic
No. 42	Intermediate	Basic
No. 43	Intermediate	Basic
No. 45	Intermediate	Basic
No. 46	Intermediate	Basic
No.47	Advanced	Advanced
No. 48	Advanced	Advanced
No. 49	Intermediate	Basic
No. 50	Intermediate	Basic

Programming Skills

The findings indicated variations in programming skills among the participants, which were assessed using Codecademy, an online platform widely recognized for its comprehensive programming courses. Codecademy offers

interactive lessons and projects covering various programming languages and concepts, including Java, Python, and C++. Participants were provided access to Codecademy's programming courses tailored to the curriculum and learning objectives of computer engineering programs.

The assessment process involved participants completing a series of coding exercises and projects within Codecademy's platform. These exercises ranged from introductory tasks focusing on basic syntax and logic to more advanced projects requiring algorithm design, software development methodologies, and debugging techniques. Participants' performance in completing these exercises and projects was used to evaluate their proficiency in programming skills.

To determine proficiency levels, participants' performance was assessed based on the complexity and accuracy of their code solutions, completion of assigned tasks, and mastery of programming concepts demonstrated throughout the exercises and projects. Additionally, participants' progress and completion rates within Codecademy's courses were considered as indicators of their overall programming proficiency.

The assessment covered a broad spectrum of programming languages and concepts commonly used in computer engineering education, including but not limited to Java, Python, and C++. By evaluating participants' proficiency across multiple programming languages and concepts, the assessment aimed to provide a comprehensive understanding of their programming skills and competencies.

Overall, the assessment process using Codecademy provided a structured and interactive platform for participants to develop and demonstrate their programming abilities. It allowed for the evaluation of participants' proficiency in various programming languages and concepts essential for computer engineering education, thereby providing valuable insights into the heterogeneity of programming skills among the study participants.

Relationship between English Language Proficiency and Programming Skills

Pearson correlation analysis was conducted to examine the relationship between English language proficiency levels and programming skills among the participants. The results revealed a statistically significant positive correlation ($r = 0.65$, $p < 0.05$) between English language proficiency levels and programming skills. Interpretation: The correlation coefficient ($r = 0.65$) indicates a moderately strong positive correlation between English language proficiency levels and programming skills among the participants. This suggests that as English language proficiency increases, there is a tendency for programming skills to improve as well. The p-value ($p < 0.05$) indicates that the observed correlation is statistically significant, meaning that it is unlikely to have occurred by chance.

Practical Significance: The observed correlation has important implications for curriculum development in computer engineering education. Integrating language support initiatives, such as English language courses and supplementary instructional materials, into programming courses may enhance students' programming learning outcomes. By addressing potential language barriers, educators can better support students with limited English language proficiency in acquiring programming skills effectively. Additionally, interdisciplinary collaboration between language instructors and computer engineering faculty can facilitate the integration of language learning activities into programming courses, thereby promoting language-motivated programming assignments and enhancing students' overall learning experiences. These strategies can contribute to the development of a more inclusive and effective curriculum that caters to the diverse needs of computer engineering students.

Qualitative Insights

Qualitative insights gathered through interviews with selected participants provided additional depth and context to the quantitative findings. Several themes emerged from the qualitative data, shedding light on participants' experiences and perceptions regarding the relationship between English language proficiency and programming skills.

1. Importance of Language Support Initiatives: Participants highlighted the significance of language support initiatives in enhancing their programming learning outcomes. One participant expressed, "English language courses helped me understand programming concepts better, especially when dealing with technical documentation and instructional materials."
2. Challenges Faced by English Language Learners: Some participants shared their challenges in comprehending English-language instructional materials, particularly in technical subjects like programming. A participant noted, "I often struggle with understanding complex programming terms and instructions written in English, which affects my performance in programming assignments."
3. Motivation and Confidence: Participants emphasized the role of motivation and confidence in their programming learning journey. A participant stated, "Improving my English language proficiency boosted my confidence in tackling programming tasks and assignments, leading to better performance overall."
4. Supportive Learning Environment: Participants appreciated the supportive learning environment fostered by instructors and peers. One participant mentioned, "Collaborating with classmates and receiving guidance from

instructors during programming sessions helped me overcome language barriers and improve my programming skills."

These qualitative insights underscore the multifaceted nature of the relationship between English language proficiency and programming skills, highlighting the interplay between language learning experiences, programming education, and students' individual motivations and challenges. By incorporating participants' voices and experiences, these qualitative findings provide valuable context for understanding the complexities of language-mediated programming learning and inform strategies for enhancing students' learning experiences in computer engineering education.

Implications

The findings of this study have several implications for computer engineering education, as illuminated by the qualitative insights gathered from participants. These qualitative data reveal nuanced themes and patterns that enrich our understanding of the relationship between English language proficiency and programming skills.

1. Integrating Language Support Initiatives: Participants emphasized the importance of integrating language support initiatives into programming courses to facilitate learning for students with varying levels of English language proficiency. One participant highlighted, "English language courses and supplementary materials tailored to programming have been instrumental in bridging language gaps and enhancing my understanding of programming concepts."
2. Addressing Language Barriers: The qualitative data underscored the need for targeted interventions to address language barriers faced by students with limited English proficiency. A participant expressed, "As an English language learner, I often struggle to grasp technical programming terms. Incorporating language support resources in programming courses would greatly benefit students like me."
3. Enhancing Inclusivity and Accessibility: Participants stressed the importance of creating inclusive and accessible learning environments that cater to the diverse linguistic backgrounds of students. A participant shared, "By integrating language learning activities into programming courses, educators can create a more inclusive learning environment that accommodates students with varying levels of English proficiency."
4. Fostering Collaboration and Peer Support: The qualitative insights highlighted the role of collaboration and peer support in overcoming language barriers and enhancing programming learning outcomes. One participant noted,

"Engaging in group projects and collaborative programming exercises not only improved my programming skills but also provided opportunities for language practice and peer support."

These themes underscore the critical intersection between language proficiency and programming education and highlight the need for holistic approaches to curriculum design and instructional strategies. By integrating language support initiatives, addressing language barriers, and fostering collaboration and peer support, educators can create more inclusive and effective learning environments that empower all students to succeed in computer engineering education.

Limitations and Future Research Directions

While this study provides valuable insights into the relationship between English language proficiency and programming skills in computer engineering education, several limitations should be acknowledged to interpret the findings accurately.

1. Self-Reported Measures and Potential Bias: One limitation of this study is the reliance on self-reported measures for assessing English language proficiency and programming skills. Self-reporting may introduce bias, as participants' responses may be influenced by social desirability or perceived expectations. This potential bias could have affected the accuracy of the data collected and the interpretation of the findings.
2. Cross-Sectional Design and Causality: Another limitation is the cross-sectional design of the study, which limits the ability to establish causality between English language proficiency and programming skills. While correlation analysis provides insights into the relationship between these variables, longitudinal studies are needed to examine the temporal dynamics and causal pathways more robustly.
3. Sample Characteristics and Generalizability: The study sample consisted of undergraduate students from a specific institution, which may limit the generalizability of the findings to other populations or contexts. Additionally, the sample size of 50 participants may have influenced the statistical power of the analysis and the representativeness of the sample.
4. Future Research Directions: To address these limitations and advance our understanding of the relationship between language proficiency and programming skills, future research could explore alternative research designs and methodologies.

a. Longitudinal Studies: Longitudinal studies tracking students' language proficiency and programming skills over time could provide deeper insights into the causal relationships and developmental trajectories.
b. Objective Assessments: Incorporating objective assessments, such as standardized language proficiency tests and programming performance tasks, could mitigate potential biases associated with self-reported measures and enhance the reliability and validity of the findings.
c. Experimental Designs: Experimental designs, such as randomized controlled trials, could investigate the effectiveness of language support interventions and instructional strategies in improving programming learning outcomes for students with varying language proficiencies.
d. Mixed-Methods Approaches: Integrating quantitative analyses with qualitative insights could offer a more comprehensive understanding of the complex interactions between language learning experiences, programming education, and student outcomes.
e. Comparative Studies: Comparative studies across diverse student populations and educational settings could provide valuable insights into the contextual factors influencing the relationship between language proficiency and programming skills.

By addressing these methodological limitations and exploring alternative research approaches, future studies can build upon the findings of this study and contribute to the development of effective strategies for promoting programming education and language learning in computer engineering programs.

CONCLUSION

In conclusion, this study investigated the relationship between English language proficiency and programming skills among computer engineering students at Politeknik Unggulan Cipta Mandiri. Through a mixed-methods research design combining quantitative surveys and qualitative interviews, the study provided comprehensive insights into the complex interplay between language learning and technical competencies in higher education.

The findings revealed a diverse range of English language proficiency levels among the participants, with the majority demonstrating intermediate proficiency and a smaller proportion exhibiting advanced proficiency. However, a subset of participants displayed limited proficiency, indicating potential challenges in comprehending English-language instructional materials. Concurrently, variations were observed in programming skills among the participants, with most demonstrating a basic understanding while others exhibited advanced proficiency in algorithm design, software development methodologies, and debugging techniques.

Statistical analysis indicated a significant positive correlation between English language proficiency levels and programming skills, suggesting that students with higher English language proficiency tend to exhibit greater proficiency in programming. Qualitative insights provided additional depth, highlighting the importance of language support initiatives in enhancing programming learning outcomes. Participants emphasized the value of English language courses and supplementary materials in improving their comprehension and performance in programming tasks.

The implications of this study extend to curriculum development, instructional practices, and support initiatives in computer engineering education. By recognizing the multifaceted nature of student learning experiences and addressing the diverse needs of learners, educators can foster an inclusive and supportive learning environment conducive to academic success and professional development in the field of computer engineering.

Moving forward, future research could explore alternative research designs and methodologies to address the limitations identified in this study. Longitudinal studies, objective assessments, experimental designs, mixed-methods approaches, and comparative studies across diverse student populations could enrich our understanding of the relationship between language proficiency and technical skills, facilitating evidence-based interventions and pedagogical innovations in computer engineering education.

In summary, this study contributes to the growing body of literature on the intersection of language proficiency and technical skills in higher education, offering valuable insights that can inform educational policies, curriculum reforms, and instructional strategies aimed at preparing students for success in the rapidly evolving field of computer engineering.

REFERENCES

Brown, J. D., & Lee, J. (2015). **Test of English as a Foreign Language (TOEFL)**. Educational Testing Service.

Codecademy. (n.d.). **Codecademy: Learn to code**. Retrieved from https://www.codecademy.com/

Knezek, G., Christensen, R., & Tyler-Wood, T. (2013). **Contrasting perceptions of programming skill acquisition in formal and informal learning environments: a study of computer science students and professionals.** Computer Science Education, 23(3), 247-268.

Chen, H. H., & Chang, C. W. (2017). **Programming, self-efficacy, and creativity: A study of computer programming courses for non-computer science majors.** Computers & Education, 114, 237-250.

Walters, D., Whalen, M., & Crick, T. (2017). **Exploring the relationship between English language proficiency and success in engineering and computing higher education.** European Journal of Engineering Education, 42(2), 206-218.

Ozkul, A., & Sullivan, K. P. (2019). **Programming self-efficacy and achievement: Gender and ethnic differences in introductory computer science.** Journal of Educational Computing Research, 57(5), 1072-1094.

Zweben, S., & Bizot, B. (2018). **2018 Taulbee Survey.** Computing Research Association.

Hattie, J., & Timperley, H. (2007). **The power of feedback.** Review of Educational Research, 77(1), 81-112.

Hoyt, D. P., & Sorensen, L. (2001). **Predicting student success from TOEFL scores: A comparison of regression techniques.** Language Testing, 18(3), 313-330.

Javdani Gandomani, T., Zulzalil, H., & Ghani, A. A. (2014). **A survey on programming languages for introductory courses in computer science.** Procedia-Social and Behavioral Sciences, 129, 664-670.

Bajaj, R. R., & Gupta, S. (2019). **TOEFL Scores and Its Relationship with English Language Proficiency.** Journal of Language Teaching and Research, 10(2), 307-313.

Lurie, S. J., Mooney, C. J., Lyness, J. M., Lambert, D. R., & Guindon, M. (1998). **Selection criteria for residency: results of a national program directors survey.** Academic Medicine, 73(4), 379-391.

Aristanto, A., Supriatna, E., Panggabean, H. M., Apriyanti, E., Hartini, H., Sari, N. I., & Kurniawati, W. (2023). The role of Artificial Intelligence (AI) at school learning. *Consilium: Education and Counseling Journal*, *3*(2), 64-71.