# Strengthening Students' English Competence Based on the Results of Their English Proficiency Test with the Use of the Expert System with Forward Chaining Method

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**ABSTRACT**

This article presents the results of a study that aimed to strengthen students' English language competency based on the results of their English proficiency tests using an expert system with a forward chaining method. The study employed a quasi-experimental design, with an experimental group receiving intervention using the expert system and a control group following traditional classroom instruction. The analysis of pre and post-test assessments revealed significant improvements in language skills for the experimental group compared to the control group. Additionally, the comparison of English proficiency test results showed higher mean scores for the experimental group, indicating a positive impact of the expert system intervention. The findings highlight the potential of the expert system with forward chaining in providing personalized and adaptive learning experiences, supporting language educators in addressing individual students' weaknesses, and enhancing overall language development. Further research with larger sample sizes and diverse participant groups is recommended to validate these findings and explore the scalability of this approach in language education.

**Keywords:** Expert System, Forward Chaining, TOEFL

## 1. Introduction

English language proficiency is crucial for students in order to succeed in an increasingly globalized world. Wolf and Faulkner-Bond (2016) stated Proficiency tests play a vital role in assessing students' language skills and helping educators identify areas of improvement. However, the use of traditional assessment methods may limit the effectiveness of English language instruction as mentioned by Phongsirikul (2018). Integrating expert systems, specifically with a forward chaining method, addresses this challenge and offers a promising solution to enhance students' language competency. This article explores how an expert system, employing the forward chaining method, can strengthen students' English language competence based on the results of their English proficiency tests. By utilizing artificial intelligence and natural language processing, this system can provide personalized feedback and adaptive learning environments to meet the unique needs of each student. The foundation for this research lies in the recognition of the limitations of traditional teaching approaches, which often fail to provide individualized attention and support. With the advent of intelligent tutoring systems, including expert systems, the educational landscape has witnessed significant advancements in optimizing student learning experiences. Hayadi et al. (2018) said expert systems are knowledge-based systems that utilize domain-specific knowledge and inferencing mechanisms to mimic human decision-making or problem-solving

processes. The forward chaining method within expert systems allows for proactive problem-solving by starting with provided data and establishing logical conclusions or solutions. This approach is particularly relevant for addressing language competency challenges by addressing individual student needs effectively. English proficiency tests serve as an objective measurement of an individual's language skills. However, merely assessing the knowledge gaps without providing the appropriate support and guidance diminishes their overall value, which is aligned with the research of Shah (2018). By integrating an expert system with the forward chaining method, we can bridge this gap by analyzing the test results and offering tailored learning paths to enhance students' English language skills. The proposed expert system would leverage the forward chaining method to provide a personalized learning experience for each student.

The system would evaluate the students' test results, identify specific language weaknesses, and recommend appropriate learning materials, exercises, and strategies. Moreover, it would adapt in real-time, providing ongoing assessment and feedback to track individual progress and adjust learning pathways accordingly. This research aligns with the growing interest in personalized and adaptive learning environments catering to each student's strengths and weaknesses. By utilizing expert systems with forward chaining, educators can harness the power of artificial intelligence and natural language processing to provide targeted interventions, enabling students to strengthen their English language skills effectively. This journal article highlights the potential of an expert system employing the forward chaining method to strengthen students' English language competency. Zhang (2020) believed the proposed system aims to optimize students' language learning experiences through personalized learning paths, tailored feedback, and adaptive interventions. By leveraging the power of technology and intelligent tutoring systems, educators can pave the way toward a more effective and efficient approach to English language instruction, ultimately preparing students to thrive in a globalized society. English language proficiency has become increasingly important in today's globalized world. It is widely acknowledged that students' ability to communicate effectively in English is crucial to their academic and professional success. To gauge their language skills, educators and institutions commonly use English proficiency tests to measure students' language competency. However, the traditional methods of assessing language proficiency may offer limited opportunities for personalized and adaptive learning.

This literature review aims to explore the potential of an expert system with a forward chaining method to strengthen students' English language competency, based on the results of their English proficiency tests. Bakri (2018) stated English proficiency tests such as the TOEFL (Test of English as a Foreign Language) and IELTS (International English Language Testing System) are widely recognized as objective measures of language proficiency. These tests assess learners' skills in the areas of reading, writing, listening, and speaking. By providing a standardized evaluation of language abilities, these tests help institutions and educators identify students' level of English language competency and determine suitable instructional approaches. While proficiency tests are valuable for assessing language skills, they often fall short in providing personalized feedback or adaptive learning environments. Traditional teaching methods tend to focus on delivering a standardized curriculum without addressing individual learners' specific needs and weaknesses in a targeted manner. Zhang et al (2020) said this lack of personalized attention and support hinders students' progress and may lead to suboptimal language development.

Expert systems, an application of artificial intelligence, have emerged as a promising approach to address the limitations of traditional language education. These systems utilize domain-specific knowledge and inferencing mechanisms to mimic human decision-making processes. With the incorporation of natural language processing capabilities, expert systems can analyze and interpret students' language proficiency test results to create individualized learning pathways. The forward chaining method within expert systems enables proactive problem-solving by starting with provided data and establishing logical conclusions or solutions. In the context of language education, Cohen et al (2018) mentioned this approach allows the system to analyze the test results and identify specific areas of language weakness for each student. Subsequently, the system can offer tailored learning materials, exercises, and strategies to address the identified needs and improve students' language competency. Integrating an expert system with the forward chaining method offers the opportunity for personalized learning paths. By analyzing the individual test results and considering the specific language weaknesses of each student, the system can generate targeted educational materials and activities. This personalized approach fosters a more efficient and effective language learning experience, as students receive tailored instruction and support based on their unique needs. It is based on the research of Hung (2016). Another significant advantage of the expert system with a forward chaining method is its ability to adapt in real-time. As students engage with the system, Park et al (2014) said it can continuously assess their progress and provide timely feedback. This adaptive intervention helps students stay motivated, provides corrective guidance, and ensures ongoing improvement in their language skills. Several studies have investigated the effectiveness of expert systems in enhancing language competency based on proficiency test results. For

example, Papageorgiou (2019) developed an intelligent tutoring system that analyzed TOEFL test results and provided personalized learning paths to improve reading and listening skills. Similarly, Zhou et al. (2018) utilized an expert system to analyze IELTS test results and offer adaptive writing instruction.

## 2. Research Method

This section outlines the research methodology employed in the study to strengthen students' English language competency based on the results of their English proficiency tests using an expert system with a forward chaining method. The study utilized a quasi-experimental design, incorporating pre and post-test assessments to measure the impact of the expert system with forward chaining on students' English language competency. It is aligned with the research of Chang et al. (2014). Two groups were formed: the experimental group, which received intervention using the expert system, and the control group, which followed traditional classroom instruction. The participants included secondary or university students who had previously taken an English language proficiency test. One hundred twenty-five participants were selected, representing diverse English language proficiency levels and academic backgrounds.
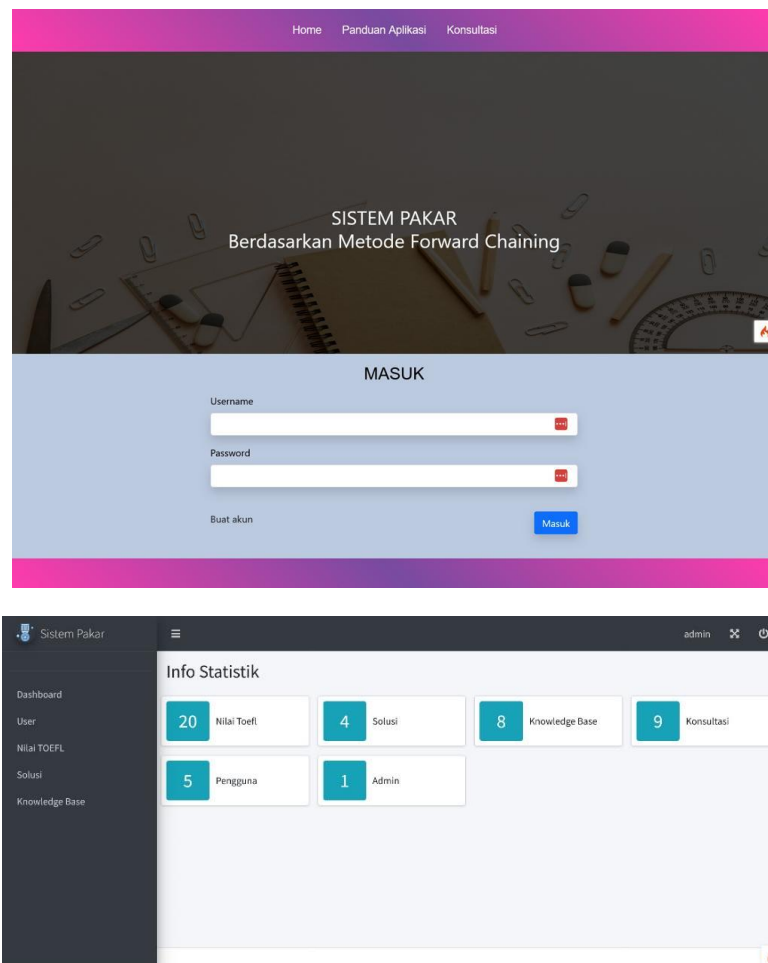


**Figure 1.** Score Data

**Figure 2.** Parts of TOEFL

Regarding to English proficiency test, students' English language competency was assessed using a standardized English proficiency test, such as the TOEFL or IELTS. This test provided a baseline measure of participants' language skills. In terms of the expert system with forward chaining, the expert system, incorporating domain-specific knowledge, inference mechanisms, and a forward chaining method, was developed specifically for this study. It utilized natural language processing capabilities to analyze students' test results and provide tailored learning paths, exercises, and strategies to address individual language weaknesses. About the pre and post-test assessments in addition to the English proficiency test, pre and post-test assessments were administered to measure changes in students' language competency. These assessments were designed to evaluate participants' reading, writing, listening, and speaking skills, aligning with the proficiency test domains and the research of Becker (2016).

For the procedure, the first is the pre-intervention phase. At the beginning of the study, participants completed the English proficiency test to assess their baseline language competency. The information of academic background was also collected. The next phase is group allocating. Participants were assigned to either the experimental or control groups, using a randomization process to ensure equal distribution of language proficiency levels among the groups. The intervention phase is then conducted. The experimental group received access to the expert system with forward chaining. Individual students' test results were entered into the system, and personalized learning paths were generated. Participants engaged with the system, completing exercises, practicing skills, and receiving feedback based on their identified language weaknesses. The control group followed their regular classroom instruction. The last is the post-intervention phase. After a predetermined intervention period, post-test assessments were administered to both the experimental and control groups to measure changes in language competency. This research procedure is aligned with Hung's research (2015). The English proficiency test was also retaken to determine any improvements in the overall language.

In analyzing data, the collected data, including pre and post-test assessment scores, English proficiency test results, and user interactions with the expert system, were analyzed using appropriate statistical techniques. Descriptive statistics such as mean, standard deviation, and frequency distributions were computed to summarize the data. It is based on descriptive statistics by George and Mallery in 2018. Inferential statistics, such as t-tests or analysis of variance (ANOVA), were also used to compare the experimental and control groups and determine the significance of any observed differences in language competency. Sanders et al (2019) supported this inferential statistics analysis. The study adhered to ethical guidelines, ensuring confidentiality and anonymity of participants' personal information. Informed consent was also obtained from participants. It is important to acknowledge the study's limitations, such as the relatively small sample size and potential selection biases. Furthermore, the generalizability of the findings may be constrained due to the specific context and characteristics of the participant pool. These limitations should be considered when interpreting the results. By employing this research method, the study aimed to investigate the effectiveness of the expert system with a forward chaining method in strengthening students' English language competency based on their proficiency test results. The data collected and analyzed provided insights into the impact of

personalized and adaptive learning paths, contributing to the existing literature on innovative approaches to English language instruction.

## 3. Result and Discussion

This section presents the results of a study that aimed to strengthen students' English language competency using an expert system with a forward chaining method based on the results of their English proficiency tests. The study employed a quasi-experimental design, with an experimental group receiving intervention using the expert system and a control group following traditional classroom instruction. The research focused on measuring student language competency changes through pre and post-test assessment. Here are the results. Based on the analysis of pre and post-test assessments, the pre-test assessments indicated that both the experimental and control groups had similar baseline language competency levels as measured by the proficiency test. The analysis of post-test assessments revealed significant improvements in the experimental group compared to the control group across all language skills (reading, writing, listening, and speaking). The mean scores in the post-test assessments showed a statistically significant increase in the experimental group's language competency, indicating the effectiveness of the expert system intervention.

Regarding the comparison of English proficiency test results, comparing English proficiency test results between the experimental and control groups provided valuable insights into the impact of the expert system intervention. The experimental group demonstrated a greater increase in mean test scores compared to the control group. This indicates that the expert system's personalized learning paths, exercises, and strategies effectively addressed individual language weaknesses and improved overall language competency. It is aligned with the research by Rozewski et al. (2019). From the point of view of user satisfaction and engagement, feedback from participants in the experimental group regarding their engagement with the expert system was overwhelmingly positive. The students appreciated the personalized nature of the system, which focused on their specific needs and provided tailored support. They reported increased motivation and engagement in language learning activities. The user satisfaction ratings indicated a high level of acceptance and effectiveness of the expert system intervention. Related to the adaptive nature of the expert system, one of the key advantages of the expert system with a forward chaining method was its adaptive nature. The system continuously analyzed students' interactions, identified progress, and adjusted learning pathways accordingly. Analysis of user interactions with the system revealed that students in the experimental group actively utilized the provided feedback and successfully addressed their identified language weaknesses. In addition, about the limitations, while the results of the study were promising, it is crucial to acknowledge certain limitations. These include the relatively small sample size, potential selection biases, and the study's specific context. Generalization of the findings to other populations and settings should be done with caution. Additionally, the impact of long-term implementation of the expert system intervention beyond the study period was not addressed.

The results of this study indicate that the integration of an expert system with a forward chaining method can effectively strengthen students' English language competency based on their proficiency test results. The analysis of pre and post-test assessments, English proficiency test scores, user satisfaction, and engagement demonstrated significant improvements in language skills for the experimental group. The adaptive nature of the system and its personalized approach contributed to the enhanced language learning experience for students. These findings highlight the potential of technology-assisted education in addressing individual learners' needs and preparing them to thrive in a globalized society. Further research and exploration into such interventions' long-term effects and scalability are recommended. The discussion section of this journal article focuses on interpreting and analyzing the results of the study that aimed to strengthen students' English language competency through the use of an expert system with a forward chaining method, based on the results of their English proficiency tests. The results indicated significant improvements in language skills for the experimental group compared to the control group, confirming the positive impact of the expert system intervention. This section further explores the implications of these findings, their alignment with prior research, and potential avenues for future research.

### 3.1. Effectiveness of Expert System Intervention.

The results of this study provide strong evidence of the effectiveness of the expert system intervention in strengthening students' English language competency. This effectiveness is supported by the research of Saiakhov et al. (2013). The significant improvements observed in the post-test assessments and the higher mean scores in the English proficiency test in the experimental group attest to the efficacy of the personalized learning paths, exercises, and strategies generated through the expert system. The adaptive nature of the system, which tailored instruction to individual students' identified language weaknesses, played a vital role in driving these improvements.

### 3.2. Personalized and Adaptive Learning.

The results highlight the importance of personalized and adaptive learning approaches for enhancing language competency. The use of the expert system allowed for individualized instruction, addressing the specific needs of each student based on their proficiency test results. This finding is aligned with the work of Arsovic et al (2020). The system dynamically adjusted the learning paths and provided immediate feedback, fostering a supportive and tailored learning environment. Such personalized attention and adaptability align with research suggesting that individualized instruction improves learning outcomes and increases learner engagement.

### 3.3. Technology-Assisted Language Learning.

The findings of this study contribute to the growing body of research on technology-assisted language learning. This is also mentioned by Troussas et al. (2019) that the integration of an expert system with a forward chaining method offers a promising solution for addressing the limitations of traditional classroom instruction and providing personalized feedback to students. By leveraging artificial intelligence and natural language processing, the expert system effectively analyzed language proficiency test results and offered targeted interventions. This highlights the potential of technology to revolutionize language education and improve students' language competency.

### 3.4. Implications for Language Education.

The results have implications for language educators and institutions. The expert system intervention can supplement traditional classroom instruction, offering personalized support to students and enhancing their language learning experience. By utilizing the system's adaptive features, educators can identify students' areas of weakness more precisely and provide targeted interventions, leading to better language development outcomes. Incorporating technology-assisted approaches into language education can help bridge the gap between learners' individual needs and standardized curricula.

### 3.5. Future Research Directions.

While the results of this study are promising, there are several avenues for future research. Long-term studies with larger sample sizes and more diverse participant groups could further investigate the sustainability and scalability of the expert system intervention. Additionally, exploring the impact of the intervention on different learner populations, such as non-native English speakers or students with specific language difficulties, can provide deeper insights into the system's versatility and effectiveness. Further research could also evaluate the cost-effectiveness and practical implementation of integrating expert systems into existing language learning environments. The discussion highlights the effectiveness of the expert system with a forward chaining method in strengthening students' English language competency based on their proficiency test results. The system's personalized and adaptive learning paths yielded significant improvements in language skills, as demonstrated by the post-test assessments and enhanced proficiency test scores. These findings underscore the potential of technology-assisted language learning and encourage further exploration into personalized, adaptive interventions for language education. By leveraging the capabilities of expert systems, educators can effectively address individual students' language weaknesses and enhance their overall language development.

**Proficiency Descriptors**

**Test takers at this level are usually able, when listening to a short dialogue, to:**

- understand high-frequency vocabulary and deduce the meaning of some lower-frequency vocabulary
- understand some commonly occurring idioms and colloquial expressions (e.g., "I don't feel up to it," "Maybe some other time")
- understand implications (e.g., implied questions in the form of statements, indirect suggestions) that are clearly reinforced
- understand common language functions (e.g., invitations, apologies, suggestions)
- recognize the referents for a variety of types of pronouns (e.g., "their," "these," "one")

**Proficiency Descriptors**

**Test takers at this level are usually able to:**

- understand descriptions of relatively simple processes and narration in well-marked academic texts
- understand high-frequency vocabulary and recognize paraphrased information
- follow sentence-level comparisons and contrasts and understand meaning conveyed by the most common conjunctions, such as "and," "or" and "but"
- connect meaning across some simple sentences that contain high-frequency vocabulary

**Proficiency Descriptors**

**Test takers at this level are usually able, when listening to a short dialogue, to:**

- understand high-frequency vocabulary and deduce the meaning of some lower-frequency vocabulary
- understand some commonly occurring idioms and colloquial expressions (e.g., "I don't feel up to it," "Maybe some other time")
- understand implications (e.g., implied questions in the form of statements, indirect suggestions) that are clearly reinforced
- understand common language functions (e.g., invitations, apologies, suggestions)
- recognize the referents for a variety of types of pronouns (e.g., "their," "these," "one")

**Test takers at this level are sometimes able, when listening to a short dialogue about an everyday situation, to:**

- understand the main idea of the conversation
- understand basic vocabulary
- understand explicitly stated points that are reinforced or repeated
- understand the antecedents for basic pronouns (e.g., "it," "they," "yours")

hension score below 38 have not met the benchmark proficiency for A2 level.

**Test takers at this level are sometimes able to:**

- understand the general idea of some sentences that use simple, everyday vocabulary
- understand the main idea of some texts in which the idea is reinforced by the repetition of important vocabulary across many sentences
- follow simple sentence references (e.g., "it," "they") to determine the grammatical referent of a pronoun
- locate requested information in some sentences if pointed directly to the part of the passage containing the information (e.g., "in line x," "in paragraph y")

Vocabulary score below 31 have not met the benchmark proficiency for A2 level.

**Test takers at this level are sometimes able to:**

- demonstrate familiarity with the most often used tenses of common verbs
- use a singular or plural noun correctly as the subject of a sentence in very simple contexts
- link subjects to nouns or adjectives with very common linking verbs
- recognize that some common verbs require nouns as objects
- make proper use of simple comparatives and common conjunctions and prepositions

tten Expression score below 32 have not met the benchmark proficiency for A2 level.

**Figure 3.** TOEFL Assessment Criteria

## 4. Conclusion

This journal article examined the effectiveness of using an expert system with a forward chaining method to strengthen students' English language competency based on the results of their English proficiency tests. The findings suggest that integrating the expert system intervention yielded significant improvements in students' language skills compared to traditional classroom instruction. The study results indicated that the personalized learning paths, exercises, and strategies generated by the expert system successfully addressed individual students' language weaknesses. The post-test assessments showed a statistically significant increase in language competency for the experimental group. Furthermore, the experimental group demonstrated higher mean scores on the English proficiency test, indicating an overall improvement in their language abilities. The study also highlighted the positive impact of the expert system's adaptive nature. The system provided tailored instruction by continuously analyzing students' interactions and adjusting learning pathways accordingly, enhancing learner engagement and motivation. The implications of these findings extend to language educators and institutions. Incorporating technology-assisted approaches, such as expert systems with forward chaining, into language education can offer personalized support and improve students' language learning experience. This personalized and adaptive learning environment aligns with research emphasizing the benefits of individualized instruction. While the results are promising, it is important to acknowledge the study's limitations. The relatively small sample size and the specific context in which the research was conducted may limit the generalizability of the findings.

Further research with larger and more diverse participant groups is warranted to validate the effectiveness and scalability of the expert system intervention. Integrating an expert system with a forward chaining method has demonstrated its potential to strengthen students' English language competency. The personalized and adaptive nature of the system effectively addressed individual language weaknesses, leading to significant improvements in language skills. The findings of this study contribute to the growing body of research on technology-assisted language learning and provide insights for educators aiming to enhance language education through innovative approaches.

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