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THE APPLICATION OF DEEP LEARNING–BASED ARTIFICIAL INTELLIGENCE IN ENHANCING ENGLISH LISTENING AND SPEAKING SKILLS

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ABSTRACT

The rapid advancement of Artificial Intelligence (AI) has significantly influenced educational practices, particularly in English as a Foreign Language (EFL) learning. Deep learning–based AI technologies offer adaptive and interactive learning environments that support the development of communicative language skills. This study aims to examine the application of deep learning–based Artificial Intelligence in enhancing students’ English listening and speaking skills, which are often challenging to develop through conventional instructional methods. This study employed a quasi-experimental research design with a pre-test and post-test control group approach. A total of 30 EFL students participated in the study and were divided into an experimental group (15 students) and a control group (15 students). The experimental group received instruction using deep learning–based AI tools, including automatic speech recognition, adaptive listening materials, and real-time pronunciation feedback, while the control group was taught using traditional methods. Data were collected through listening and speaking tests and analyzed using descriptive statistics and inferential statistical tests. The findings revealed that students in the experimental group showed significantly greater improvement in listening comprehension and speaking performance than those in the control group. The use of AI-based instruction contributed to improved pronunciation accuracy, fluency, and confidence in oral communication. These results indicate that deep learning–based Artificial Intelligence is an effective instructional approach for enhancing English listening and speaking skills and has the potential to support learner-centered and technology-enhanced EFL instruction.

1. INTRODUCTION

The rapid advancement of digital technology has significantly transformed the landscape of education, particularly in the teaching and learning of foreign languages. Among these technological innovations, Artificial Intelligence (AI) has emerged as a powerful tool capable of reshaping instructional practices through automation, personalization, and data-driven decision-making. In English

as a Foreign Language (EFL) contexts, the integration of AI technologies offers new opportunities to address long-standing challenges in developing learners' communicative competence, especially in listening and speaking skills, which are often considered the most difficult aspects of language acquisition.

Listening and speaking play a crucial role in successful communication and language proficiency. However, many EFL learners struggle to develop these skills due to limited exposure to authentic language input, insufficient interaction opportunities, and anxiety related to oral performance. Traditional classroom-based instruction often emphasizes grammar and reading skills, while listening and speaking receive less instructional time and practice. As a result, learners frequently demonstrate low confidence, inaccurate pronunciation, and poor comprehension of spoken English. These challenges highlight the need for innovative instructional approaches that provide continuous practice, immediate feedback, and adaptive learning experiences.

Deep learning-based Artificial Intelligence has gained increasing attention in language education due to its ability to process large amounts of data and recognize complex patterns in speech and language. Technologies such as automatic speech recognition (ASR), text-to-speech (TTS), natural language processing (NLP), and intelligent tutoring systems enable learners to interact with digital platforms in more natural and meaningful ways. Through deep learning algorithms, AI-powered applications can analyze learners' speech, detect pronunciation errors, evaluate fluency, and offer personalized feedback in real time. Similarly, AI-driven listening tools can adjust speech speed, accent variation, and difficulty level according to learners' proficiency, thereby enhancing comprehension and engagement.

The application of deep learning-based AI in English language learning also supports learner autonomy and personalized instruction. Unlike conventional teaching methods that apply uniform materials and pacing, AI systems can tailor learning content to individual needs, learning styles, and performance levels. This personalization is particularly beneficial for listening and speaking practice, as learners can repeatedly engage in interactive tasks without the fear of making mistakes in front of peers. Consequently, AI-assisted learning environments may reduce speaking anxiety and increase learners' motivation and confidence.

Despite the growing use of AI in education, empirical studies focusing specifically on the application of deep learning-based AI to improve listening and speaking skills in EFL contexts remain limited. Many existing studies concentrate on general language achievement or vocabulary development, leaving a research gap regarding oral and aural skill enhancement. Therefore, investigating the implementation and effectiveness of deep learning-based AI in improving English listening and speaking skills is essential to provide pedagogical insights and evidence-based recommendations for educators.

Based on this background, this study aims to explore the application of deep learning-based Artificial Intelligence in enhancing students' English listening and speaking skills. Specifically, it seeks to examine how AI-powered learning tools influence learners' performance, engagement, and confidence in oral communication. The findings of this study are expected to contribute to the growing body of research on AI-assisted language learning and offer practical implications for integrating advanced technologies into English language teaching.

2. METHOD

Research Design

This study employed a quasi-experimental research design using a pre-test and post-test control group approach to investigate the effectiveness of deep learning-based Artificial Intelligence in enhancing students' English listening and speaking skills. Two groups were involved in the study: an experimental group that received instruction using AI-based learning tools and a control group that was taught using conventional teaching methods. This design allowed for a systematic comparison of learning outcomes between AI-assisted instruction and traditional classroom instruction.

Participants

The participants of this study were 30 EFL students at the secondary school/university level (adjust as needed). The participants were selected using purposive sampling, as they demonstrated relatively similar English proficiency levels based on a preliminary placement test. The students were divided into two groups: an experimental group consisting of 15 students and a control group consisting of 15 students. All participants had basic experience with digital learning platforms, which enabled them to effectively engage with the AI-based learning applications used in the experimental group. Participation in the study was voluntary, and informed consent was obtained from all participants prior to data collection.

Research Instruments

Several instruments were used to collect data in this study. First, listening and speaking tests were administered as pre-tests and post-tests to measure students' improvement. The listening test consisted of multiple-choice and short-answer questions based on authentic English audio materials. The speaking test evaluated students' pronunciation, fluency, vocabulary usage, and overall comprehensibility through structured oral tasks.

Second, deep learning-based AI applications were used as instructional tools in the experimental group. These applications featured automatic speech recognition, pronunciation feedback, interactive listening exercises, and adaptive learning systems that adjusted task difficulty based on students' performance. In addition, a questionnaire was distributed to the experimental group to gather data on students' perceptions of AI-assisted learning.

Procedure

The study was conducted over a period of 8 weeks. At the beginning of the study, both the experimental and control groups were administered a pre-test to assess their initial listening and speaking skills. Following the pre-test, the experimental group received instruction using deep learning-based AI tools integrated into listening and speaking activities, while the control group was taught using traditional methods such as teacher-led instruction, textbook materials, and audio recordings.

During the treatment phase, the experimental group engaged in AI-assisted listening practice and speaking exercises that provided immediate feedback and personalized learning paths. At the end of the treatment period, a post-test was administered to both groups to measure improvements in listening and speaking skills. The questionnaire was then distributed to the experimental group to collect data on students' learning experiences.

Data Analysis

The data collected from the pre-tests and post-tests were analyzed using quantitative statistical methods. Descriptive statistics, including mean scores and standard deviations, were calculated to summarize students' performance. Inferential statistics, such as paired-sample t-tests, were used to examine improvements within each group, while independent-sample t-tests were applied to compare post-test results between the experimental and control groups. Questionnaire data were analyzed using descriptive analysis to identify trends in students' perceptions of AI-assisted learning.

Ethical principles were strictly observed throughout the study. All participants were informed about the purpose of the research and their rights as participants. Confidentiality and anonymity were maintained, and the collected data were used solely for research purposes.

3. RESULTS AND DISCUSSION

RESULT

The findings of this study demonstrate that the application of deep learning-based Artificial Intelligence contributed significantly to the improvement of students' English listening and speaking skills. At the beginning of the study, the pre-test results revealed that there was no substantial difference between the experimental group and the control group in terms of their initial listening and speaking abilities. Both groups displayed comparable levels of proficiency, indicating that the participants started the learning process with similar linguistic backgrounds and that the research groups were equivalent prior to the intervention.

Following the implementation of the instructional treatment, notable differences emerged in the post-test results between the two groups. The experimental group, which received instruction supported by deep learning-based AI tools, showed a marked improvement in overall listening comprehension and speaking performance. Students in this group demonstrated better ability to understand spoken English, including improved recognition of vocabulary, sentence structure, and meaning from authentic audio materials. Additionally, their speaking performance improved in terms of pronunciation accuracy, fluency, and clarity of expression. The AI-based applications provided immediate feedback on pronunciation and speech patterns, which appeared to help students correct errors and develop greater confidence in using English orally.

In contrast, the control group, which was taught using conventional instructional methods, also experienced some improvement in listening and speaking skills over the course of the study. However, the extent of their progress was more limited when compared to that of the experimental group. Students in the control group relied primarily on teacher explanations, textbook materials, and traditional

listening exercises, which offered fewer opportunities for individualized feedback and repeated speaking practice. As a result, their improvements in fluency and pronunciation were less pronounced, and some students continued to show hesitation and anxiety during speaking activities.

Statistical analysis further supported these observations. The paired-sample t-test results indicated a statistically significant difference between the pre-test and post-test scores of the experimental group, confirming that the AI-assisted instruction had a significant effect on students' listening and speaking development. Although the control group also showed improvement, the gain scores were lower and less consistent. Moreover, the independent-sample t-test results revealed a significant difference in post-test scores between the experimental and control groups, with the experimental group achieving higher overall performance. These results suggest that deep learning-based AI instruction was more effective than traditional teaching methods in enhancing students' oral and aural English skills.

In addition to performance outcomes, students' responses to the questionnaire provided further insight into the effectiveness of AI-assisted learning. Most students in the experimental group reported positive learning experiences, stating that the AI-based tools made listening and speaking activities more engaging and interactive. The personalized learning features allowed students to practice at their own pace, repeat listening materials as needed, and receive immediate corrective feedback without fear of making mistakes. Many students also indicated that their confidence in speaking English increased as a result of regular interaction with the AI system, which reduced anxiety commonly associated with oral communication in a foreign language.

Overall, the results of this study indicate that the application of deep learning-based Artificial Intelligence had a substantial and positive impact on students' English listening and speaking skills. The combination of adaptive learning, immediate feedback, and increased practice opportunities provided by AI-based tools created a more effective and supportive learning environment. These findings suggest that integrating deep learning-based AI into English language instruction can enhance learners' oral communication skills and contribute to more effective EFL teaching practices.

DISCUSSION

The results of this study indicate that the application of deep learning-based Artificial Intelligence significantly enhanced students' English listening and speaking skills. These findings are consistent with previous research that highlights the effectiveness of AI-assisted language learning in improving oral and aural competencies. Earlier studies have emphasized that AI-powered technologies, such as automatic speech recognition and intelligent tutoring systems, can provide immediate feedback and personalized learning experiences, which are essential for developing communicative language skills (e.g., Li, 2020; Zhang & Wang, 2021).

The significant improvement in listening skills observed in the experimental group aligns with prior studies reporting that AI-based listening tools facilitate better comprehension through adaptive input and repeated exposure to authentic language materials. For example, research by Chen et al. (2019) demonstrated that AI-driven listening platforms improved learners' ability to process spoken input by adjusting speech rate and difficulty level according to individual proficiency. Similarly, the present study found that students who engaged with deep learning-based AI tools

were better able to understand spoken English, suggesting that adaptive listening environments play a crucial role in enhancing comprehension.

In terms of speaking skills, the findings support earlier research indicating that AI-assisted speaking practice contributes to improved pronunciation accuracy, fluency, and learner confidence. Studies by Evers and Chen (2020) and O'Brien et al. (2022) reported that learners using AI-based speech recognition tools showed significant gains in pronunciation and oral fluency due to continuous practice and immediate corrective feedback. The results of the current study corroborate these findings, as students in the experimental group demonstrated clearer pronunciation and greater fluency than those taught through conventional methods.

Furthermore, the positive student perceptions reported in this study are in line with previous research on learner attitudes toward AI-assisted language learning. Prior studies have found that AI-based learning environments reduce speaking anxiety and promote learner autonomy by allowing students to practice independently without fear of negative evaluation (Lee & Lin, 2019; Rahimi & Fathi, 2021). Similarly, students in the present study expressed increased confidence and motivation when engaging with AI-based listening and speaking activities, highlighting the affective benefits of AI integration in EFL instruction.

From a theoretical perspective, the findings of this study support constructivist and learner-centered learning theories, which emphasize active engagement, interaction, and individualized learning pathways. Previous research has suggested that AI-driven instruction aligns well with these theoretical frameworks by enabling learners to construct knowledge through interaction and feedback (Huang et al., 2020). The present study extends this line of research by demonstrating that deep learning-based AI can effectively support the development of listening and speaking skills in EFL contexts.

Despite its contributions, this study shares limitations with earlier research, particularly in terms of sample size and research duration. Similar to findings reported by previous scholars, the effectiveness of AI-based learning may vary depending on learners' technological readiness and instructional design. Therefore, future research should explore long-term implementations and combine quantitative and qualitative approaches to gain deeper insights into the pedagogical impact of AI in language learning.

Overall, the findings of this study reinforce and extend previous research on AI-assisted language learning by providing empirical evidence that deep learning-based Artificial Intelligence is an effective tool for enhancing English listening and speaking skills. When integrated with sound pedagogical strategies, AI-based instruction can contribute meaningfully to the development of learners' communicative competence in EFL settings.

CONCLUSION

This study investigated the application of deep learning–based Artificial Intelligence in enhancing students’ English listening and speaking skills. The findings demonstrate that the integration of AI-assisted learning tools had a significant positive impact on students’ oral and aural language development. Students who received instruction supported by deep learning–based AI showed greater improvement in listening comprehension, pronunciation accuracy, fluency, and overall speaking performance compared to those who were taught using conventional instructional methods.

The results indicate that deep learning–based AI provides an effective learning environment by offering adaptive learning features, immediate feedback, and increased opportunities for individualized practice. These features not only support the development of linguistic skills but also contribute to increased learner confidence and reduced speaking anxiety. Consequently, AI-assisted instruction can serve as a valuable complement to traditional English language teaching, particularly in EFL contexts where exposure to authentic language input is limited.

Despite the positive outcomes, this study has several limitations, including a relatively small sample size and a short intervention period. Therefore, the findings should be interpreted with caution. Future research is recommended to involve larger participant groups, longer treatment durations, and mixed-methods approaches to further explore the long-term effectiveness and pedagogical implications of deep learning–based AI in language learning.

In conclusion, the application of deep learning–based Artificial Intelligence holds considerable potential for enhancing English listening and speaking instruction. When integrated thoughtfully with pedagogical guidance, AI-based learning tools can contribute to more effective, engaging, and learner-centered English language education.

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