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Exploring the Impact of Automatic Speech Recognition on Students' Speaking Skills and Perceptions

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ABSTRACT

The speaking application developed in this research by using the technology of Automatic Speech Recognition (ASR) aims to help students practice speaking autonomously in English. The main objective is to form an interactive application named LINKS, which enhances their pronunciation, fluency, and vocabulary. The design, development, and evaluation of the application were based on survey findings from 28 participants along with principles from the ADDIE model. The findings showed that 82% of the students reported improvement in their pronunciation and speaking skills, while 96% rated the user interface and feedback system positively. The participants also found that the application gave corrective feedback and helped with self-assessment, and real-time scores presented to students which enabled them to handle mistakes much better and even boosted their confidence. Furthermore, the interactive features raised learner autonomy and engagement, demonstrating that ASR-based applications can be an effective tool for enhancing independent learning. This research concludes that the application can be a useful tool to overcome students' problems in speaking as well may help the language learning process.

Keywords: Automatic speech recognition (ASR), language learning, speaking skills, speaking practice

ABSTRAK

Aplikasi berbicara menggunakan *Automatic Speech Recognition* (ASR) yang dikembangkan dalam penelitian ini bertujuan untuk membantu siswa berlatih bahasa Inggris secara mandiri. Tujuan utama dari penelitian ini adalah merancang aplikasi interaktif bernama LINKS, yang berfokus pada peningkatan pengucapan, kelancaran, dan kosakata. Penelitian ini menggunakan model ADDIE, dengan melibatkan 28 peserta, untuk merancang, mengimplementasikan, dan mengevaluasi aplikasi tersebut. Hasil penelitian menunjukkan bahwa 82% siswa mengalami peningkatan signifikan dalam kemampuan pengucapan dan keterampilan berbicara mereka, sementara 96% memberikan penilaian positif terhadap tampilan pengguna dan sistem umpan balik. Aplikasi ini menyediakan umpan balik korektif, alat penilaian mandiri, serta skor, yang membantu siswa mengatasi rasa takut membuat kesalahan dan meningkatkan rasa percaya diri. Selain itu, fitur interaktif dalam aplikasi mendorong kemandirian dan keterlibatan siswa, menunjukkan bahwa aplikasi berbasis ASR dapat menjadi alat yang efektif untuk mendukung pembelajaran mandiri. Penelitian ini menyimpulkan bahwa LINKS merupakan solusi praktis dan menarik untuk mengatasi tantangan siswa dalam keterampilan berbicara dan dapat memberikan kontribusi berarti bagi pembelajaran bahasa.

Kata kunci: Pengenalan suara otomatis (ASR), pembelajaran Bahasa, kemampuan berbicara, latihan berbicara Bahasa Inggris

I. BACKGROUND

Over the past two decades, there have been a lot of examples that technological advancements that give us more flexibility to learn and teach languages in new ways than before. Due to the emphasis on communication in the world today, foreign language acquisition is emphasized more for spoken language. The teaching of a language now mainly focuses on conversation and practical use [1]. Speaking proficiency among other things is on top of what we can achieve when it comes to language learning [2].

In the present era of globalization, speaking fluently English as a Foreign Language (EFL) is becoming crucial for exams and attending job

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interviews. Nonetheless, mastering out of the classroom and more so without native speakers is a lot of task for many students [3]. Speaking is one of the skills which many EFL learners are not comfortable with or feel scared to talk and that makes everything in learning a language so hard [4]. Many EFL learners struggle with confidence, pronunciation, and fluency when practicing English speaking, especially outside the classroom. Current ASR tools provide some support, but many learners still find it difficult to receive personalized feedback and improve fluency independently.

The answer to this is that one can use some technological help like Computer-Assisted Language Learning (CALL). The latest improvements in CALL help students to support their speaking practice in English also after school hours [5]. Among the most used tools in CALL is Automatic Speech Recognition (ASR) for providing immediate feedback on pronunciation and fluency to students [6]. This is often the use-case for ASR-based tools that are used in Computer-Assisted Pronunciation Training (CAPT) where learners can practice speaking skills with a simulated conversation.

More recently, several researchers have examined the integration of Automatic Speech Recognition (ASR) technology in English as a second language learning focusing on productive speaking and pronunciation. The use of ASR in speaking instruction has a direct impact on improving learners' pronunciation by showing that it provides accurate feedback for students to develop phonological accuracy over time [7]. This corresponds with the results of research in which ASR is claimed to take an important part because it offers the learners corrective feedback and allows them to practice pronunciation without being afraid of their wrong attempts.

Furthermore, the importance of ASR in influencing learner autonomy [8]. They found that ASR tools helped students to start individual practice, which might give them some level of ownership over their learning process by giving them the space to try speaking tasks repeatedly. This agrees with the observations from this research, where students practicing independently with an ASR-based application called LINKS, led to boosted confidence and fluency as they received instantaneous feedback.

ASR can facilitate the conduct of regular self-assessments in language learning, particularly to provide students with immediate feedback on both pronunciation and fluency [9]. This research showed that the combination of ASR helped learners to track their work and thus perform well in speaking as a whole. The current study has shown how students can use the LINKS application to self-assess their speaking in terms of fluency and pronunciation improvement.

Meanwhile, students perceived ASR for English pronunciation practice [10]. They found that students liked the instant feedback and enjoyed being able to practice independently, which echoes some of the positive results reported by users of the LINKS application. According to both studies, ASR-based tools significantly help students reduce their anxiety and improve their speaking skills.

Researchers have shown that ASR tools help in conversing skills. ASR-based programs provide opportunities for students to speak on their own and receive immediate corrective feedback enabling them to improve [11]. ASR tools can also reduce such tension as they help learners practice speaking outside of real-time conversations [12].

Advances in technology, especially Computer-Assisted Language Learning (CALL), can provide partial solutions to these circumstances. CALL technology gives students the freedom to practice on their own in interactive environments. Among the most encouraging resources is Automatic Speech Recognition (ASR) technology due to the various advantages that it provides for those learning languages. ASR gives instant pronunciation and fluency feedback that enables learners to correct themselves on the spot. It also encourages self-assessment, giving them the freedom to trace their progress in a non-stressful setting. Such tools support students in more independent practice which can reduce anxiety and enable increased personalization of learning.

While there have been studies examining the possible benefits of ASR on pronunciation and fluency, most research has focused on classroom settings or broader applications. More research is needed in this area to determine how ASR can foster learner autonomy by providing personalized feedback and real-time scoring. The aim of this study is to address that gap by developing and testing an application called LINKS, a feedback training tool targeting spoken English skills. However, the research in question investigates and explores how tools based on ASR help improve learner confidence such that he/she can speak more fluently while following pronunciation patterns contributing towards individual learning.

LINKS is one of the ASR tools or chatbots developed using artificial intelligence by Mega Voice Command Production. This allows LINKS to listen and speak, making practicing speech much easier for users. Although LINKS was not initially created for language learning, it can be tailored to the educational field. An example of these types of AI-powered ASR tools is LINKS, which previous research found was beneficial for language learners to train to speak in a more personalized and flexible manner [13].

Based on the background, the objective of this research was to develop Automatic Speech Recognition utilizing the artificial intelligence emulator LINKS for individual speaking practice among freshmen. The end product of this research was expected to serve as an innovative learning tool to boost learner speaking ability. This research also

examines EFL students' perception of the LINKS application.

II. METHOD

This study applied the ADDIE model to the design and evaluation of an AI-based tool called LINKS, which was designed to enhance the speaking proficiency of first-year English students. The ADDIE model (Analysis, Design, Development, Implementation, and Evaluation) was chosen for its systematic and iterative process which would provide a framework guiding the overall development of learning ensuring continuous feedback at every stage [14]. The proposed model is relevant to this study as it aims to get the opinions of students and experts, who were part of the validation stage activities in the developing process before a final product was developed (as shown in Fig. 1).

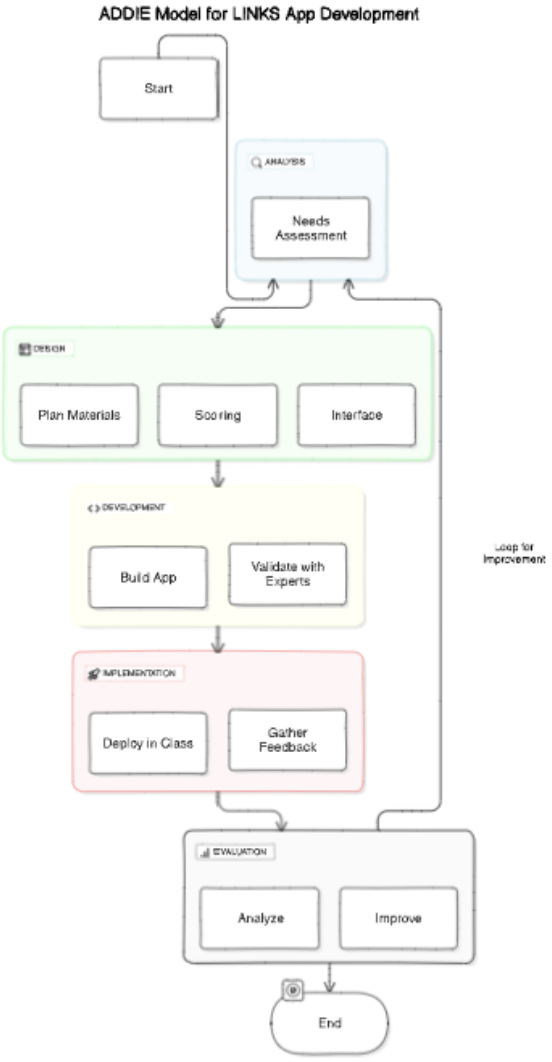

Fig 1. ADDIE Stages

A. Analysis

The initial step as part of the adapted ADDIE approach involved analysis. The analysis focused on comprehending the needs analysis in enhancing their speaking abilities. The study involved 28 students of English Education Study Program at the University of Brawijaya. We applied specific inclusion and exclusion criteria for a consistent approach to assessing the efficacy of the LINKS application. The students who participated were selected based on an initial screening test for intermediate English proficiency. Participants had to be in their first year of study as this was the most consistent level for the language learning experience. In order to determine the effect of this particular facility on their practices, the researchers did not choose respondents with high proficiency or familiarity with other ASR tools.

The participant demographics are summarized in Table 1 below, which provides an overview of the participants' age, gender, and proficiency levels.

Table 1. Participant Demographics

Participant Demographics	Count	Percentage
Total Participants	28	100%
Gender		
Male	12	42.9%
Female	16	57.1%
Age Group		
18-20 years	20	71.4%
21-23 years	8	28.6%
English Proficiency Level		
Intermediate	28	100%

B. Design

The second step was designing the product. In this stage, the researcher planned several key elements including the material, scoring system, and display interface. For the material, there were five potential topics drawn from IELTS exam preparation. The most popular topics—education, health, internet, society, and work—were incorporated into the LINKS application, allowing students to choose a topic for oral discussion, which would be recorded and evaluated. During this phase, use-case diagrams and user interface designs were also created to depict how the system would function and what users would see (as shown in Fig. 2). These diagrams were essential for visualizing the system's interactions and user experience.

To determine which topics to include, students chose their top five interests from a list of 15 options provided by the researcher. After analyzing responses to the needs assessment questionnaire, the five most popular topics were selected for inclusion in the LINKS application. These topics were education, health, internet, society, and work. Users could then freely choose one topic to discuss orally which would be recorded and scored using a speaking rubric. Finally, the score was shown to the user. There were two essential parts of the product design: use-case diagrams and user interface designs. These elements

were used to explain how the system functions and what users would see.

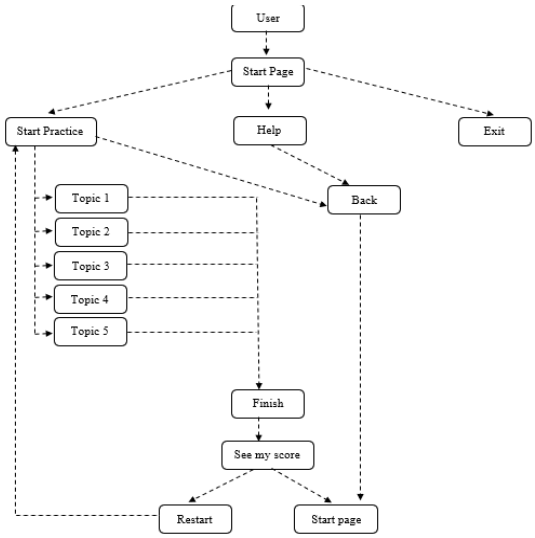

Fig 2. Use-Case Diagram

C. Development

The third step is development. In the development phase, the application LINKS was made according to that plan. This system allowed students to speak on a chosen topic and immediately receive feedback. Experts in language learning and technology were invited to validate the content and make sure the application matched the learning objectives [16]. Revisions were made according to their feedback. The Start Practice Page Design is shown in Fig. 3, illustrating how users can begin their speaking practice.

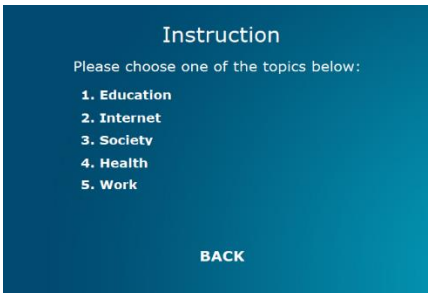

Fig 3. Start Practice Page Design

D. Implementation

The project implementation it is the fourth step by bringing the developed product to completion. The implementation occurred within the same speaking class utilized earlier in the need analysis. Results supplied insight for examining whether the final product is associated with planning and objectives. Students then received a questionnaire from the researcher to review experiences and perceptions using the program. The Practice Page Design (Fig. 4), Answer Page Design (Fig.5), and Score Page Design (Fig. 6) were referenced to help students navigate through the application and understand the scoring criteria.

E. Evaluation

The final step was evaluation. At the evaluation phase of development, data from feedback questionnaires recorded by students and experts' validation of those questions on LINKS were analyzed overall to get a picture of how effective it had been as an instructional supporting tool. The data obtained from the questionnaire were processed quantitatively to generate descriptive statistics, including frequencies and percentages. These calculations were performed using statistical software (e.g., SPSS) to ensure accuracy and reliability. Furthermore, qualitative explanations were provided for the results, giving context to the numerical findings. Based on this analysis, the application underwent revisions to address known issues. For example, modifications in the scoring system enhanced accuracy, while interface adjustments improved user-friendliness and overall usability. Based on this feedback, the application was revised to address known problems. For example, changes in the scoring system made it more accurate and some interface adjustments enhanced its user-friendliness.

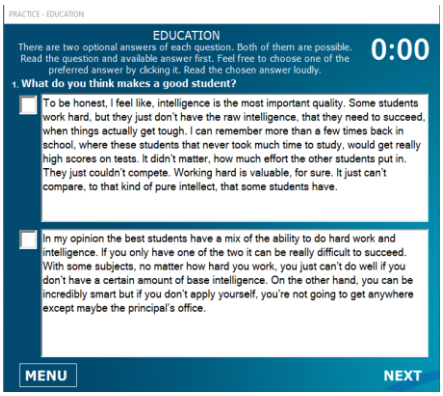

Fig 4. Practice Page Design

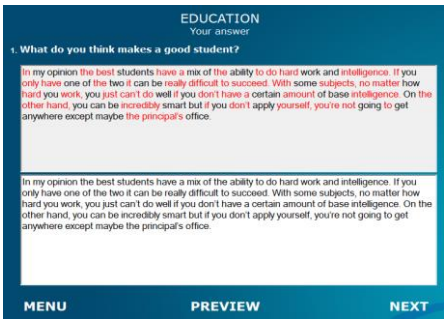

Fig 5. Answer Page Design

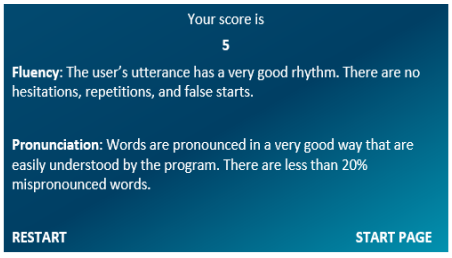

Fig 6. Score Page Design

In its final form, the LINKS application was completed and available for deployment in further educational settings. Applying the ADDIE model meant a structured approach to developing a tool that is not only practical but also quite effective at improving spoken language skills [14].

This research required gathering data that surrounds all of the information about the product. The instruments were questionnaires and documentation. The questionnaire was given to the subjects at the information collection stage, validation sheets for the stage once it had been validated by the validator, and students' questionnaire for the step of product implementation. In addition, documentation was all in the product and were just pictures of how the product operated. During the evaluation phase, data from checklist items on the validation sheets and questionnaires were analyzed quantitatively using descriptive percentage analysis. For each item, the percentage was calculated using the formula:

$$P = \frac{X}{X1} \times 100\% \quad (1)$$

where P is the result for each answer, x is the frequency score of each answer, and x1 is the maximum score. The overall percentage for the evaluation results was calculated using the formula:

$$P = \frac{\Sigma X}{\Sigma X1} \times 100\% \quad (2)$$

where ΣX represents the total score, and ΣX1 is the maximum score. Thus, the researcher could know the qualification of the product. This research adopted of validation percentage which is shown in Table 2.

Table 2. Table of Validation Percentage

Percentage	Qualification	Notes
<40%	Poor	Definitely not applicable and not suitable
40% - 55%	Fair	Not really applicable and suitable
56% - 75%	Good	Quite applicable and suitable
76% - 100%	Excellent	Very applicable and suitable

III. FINDING AND DISCUSSION

LINKS application was developed by using Visual Studio 2022 in the development phase of the product. It allows the researchers to plan and build this application with customized requirements, ensuring that it could help the students practice speaking.

After completing the initial design, the researcher required input from the content validator and media expert to ensure the validity and usefulness of the application. These professionals provided remarks on the educational materials and technical use of the program. Based on their feedback, changes were made, especially in refining the substance and optimizing the media functionality. Following revisions, the software was tested in an authentic classroom setting where students used the LINKS program, and their comments were gathered through a questionnaire.

The content validation process involved two language teaching authorities who evaluated the quality of the material within the LINKS application. The outcome of the validation showed that the substance earned a 94.3% score (see Table 3), which is considered "excellent" relating to validation standards outlined in recent educational technology criteria [16]. The experts agreed the materials effectively related to goals for learning the language, especially in assisting EFL learners' speaking abilities. In addition, the material was seen as engaging and relevant, with a focus on pronunciation, vocabulary practice, and fluency.

As one of the content validators mentioned that the platform was interactive and allowed students to practice their language production skills independently in a natural conversational setting. This feedback is in line with current research and development perspectives in the field of Computer-Assisted Language Learning (CALL), such as learner autonomy and interactive learning environments [17].

The media expert also agreed with the application on its usability and technical performance with a score of 96.8%. The media expert pointed out that the interface was easy to use, activities were varied and clear, and the navigation and instructions were also easy to understand. Therefore, audio recognition still has some things to work out as a few issues were discovered. The system had difficulty distinguishing between relevant speech input and background noise, leading to inaccuracies in the feedback provided to students (see Table 3).

Table 3. Validation Scores from Content Validators and Media Expert

Evaluator	Criteria	Score (%)	Qualification
Content Validator	Content Quality	94.3	Excellent
Media Expert	Usability & Performance	96.8	Excellent

This can be resolved by integrating a noise suppression system in the application to block background noises and enhance the speech recognition potential of the application as well. Recent investigations in educational technology development show that implementing advanced sound recognition technologies can strongly improve the effectiveness of language learning software [18].

Following the design and development of the redesigned application, a researcher collected student input through a questionnaire to determine whether students found LINKS helpful in their efforts to improve speaking. The results, not to anyone's surprise, say that 82% of students felt their pronunciation and other speaking skills have drastically improved with the help of this application. They also perceived the material as engaging and more appropriate to their proficiency levels reflecting trends found in current research that contend that customized, adaptive language-learning software can lead to greater success [19].

Furthermore, 96% of students gave the clarity of instructions and user interface design perfect scores. Simple design and work on well-organized tasks made it possible for students to concentrate on practicing their speaking instead of wrestling with the interface. Still, a few of our students did see the program crash at times. But that was more because they were working with relatively older hardware and it had problems dealing properly with the requirements of the system. However, this was resolved by implementing a Compatibility Mode execution, a well-known fix in the deployment of educational software [20]. Moreover, Figure 7 illustrates student perceptions regarding various aspects of the LINKS application.

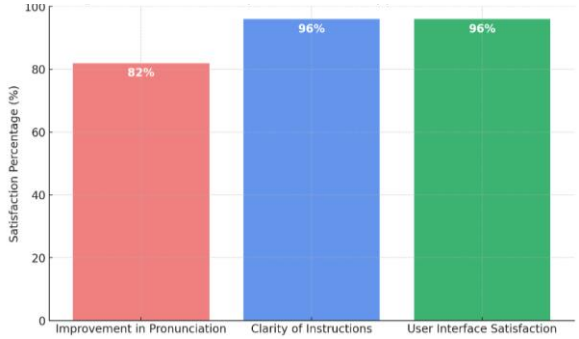

Fig 7. Student Perceptions of LINKS Application Effectiveness

The application LINKS was designed for students to have immediate feedback on pronunciation and also had activities to improve their knowledge of vocabulary. LINKS saw improved pronunciation in students. Based on the questionnaire, students said that they were able to pronounce the hard word. This was an improvement as the app included audio and pronunciation exercises. Pronunciation tasks were included in the "Start Practice" section per lesson that used a Text-to-Speech option to demonstrate to students the correct pronunciation.

Another factor that helped the students was listening practice, which involved them hearing the given text, this also supported their pronunciation. This would allow students to see and hear examples of the alphabet, so they can learn the proper pronunciation. The finding is related to the result that listening and production activities are essential to effective pronunciation practice because students need to notice what the correct use of English sounds like [21]. All sections of every lesson provided listening practice in LINKS, to help students with comprehension of spoken language. A focus on receptive skills such as listening frequently precedes increases in productive skills like speaking [22].

In the area of vocabulary, LINKS has also contributed to increasing student's vocabulary mastery through activities in which students listened to the audio texts. For example, they may choose their best topic to listen to and learn new words to be practicing finally in speaking activities. Doing this helped them learn new words and helped with their correct pronunciation as well. Vocabulary is an important element related to language fluency [23]. Through the LINKS, students were able to pick out words that would be suitable to a particular context, which in turn improved both vocabulary and language acquisition.

Along with using speaking and pronunciation skills, there were many ways in which LINKS asked students to speak the language. Some students were more confident in speaking with appropriate vocabulary and accurate pronunciation. Previous research on speech recognition applications [24], confirmed that ASR systems can improve fluency and self-consciousness in pronunciation for learners.

Based on the students' feedback, LINKS also proved to be a complementary practice tool for individual practice. Students reported that they could replay as often as needed, which allowed them to focus on improving their pronunciation and fluency over time. They liked the simplicity of the app along with interactive engagement and instant feedback which they thought motivated them to practice. Current ASR tools offer learners important feedback to improve pronunciation skills [25]. Figure 8 below illustrates the areas of improvement reported by students:

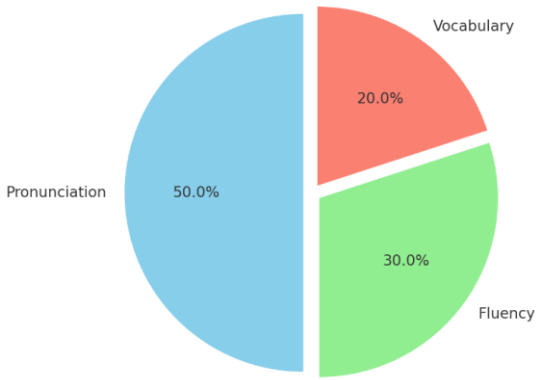

Fig 8. Learning Outcomes from Using LINKS

In terms of the pedagogy in the application, students stated that LINKS offered a chance for independent learning. CALL-based applications should provide learners with activities that promote independent learning while offering input that helps them practice effectively [26]. LINKS was a useful language learning tool because it provided content in a straightforward way and an easy-to-use platform.

Regarding the design, the students agreed that the layout is very attractive, as well as the text placement and color choices. The design characteristics made learning fun and addictive which stopped people from getting bored of using the app. The key to the success of applications for education is a simple intuitive user interface that constantly stimulates interest and learning [27].

Students also felt that the language in the application was appropriate for their level, especially

as first-year students. It was simple to understand and no significant grammatical obstacles that made learning more accessible.

IV. CONCLUSION

The LINKS application system for enhancing English proficiency was shown through expert validation to be highly effective. A content expert presented the program with a 94.3% rating while a media expert gave an even higher score of 96.8%, a strong indication that it satisfied important standards concerning materials, pedagogical approaches, usability, and design. Students found the application navigation through the individual learning instruction both comfortable and intuitive, with no meaningful issues during the application. At the same time, the tool's direct feedback helped students identify areas of their speaking that required improvement. Therefore, the innovative LINKS program functions as a helpful instrument for advancing pronunciation and fluency in English-speaking skills, especially for those studying independently.

However, some shortcomings need to be addressed. In noisy environments, the efficiency of the application is reduced as external noise interferes with the ASR system. To minimize this, the application can ideally be used in a controlled environment, such as a language laboratory, or with an addition from an external microphone for clarity of the spoken input. Failure to take such measures will affect the accuracy of such feedback and scores, as they do not reflect actual speaking abilities.

The researcher offers several suggestions for students, English teachers, and prospective researchers who are interested in exploring this field.

First, it is recommended that students use this software as an alternative technique to improve their oral skills. Although there are some minor technical issues, the program has proven to provide accurate feedback that helps students improve their speaking skills. In addition, the application allows students to practice independently, reducing the stress of speaking in front of others. The software also allows students to record themselves repeatedly and compare recordings to monitor progress over time. Longer sentences mixed with shorter ones provide variability for students to stay engaged with different content. Overall, the program shows promise as a supplemental tool for learners and teachers seeking to improve their English conversation skills.

Second, the LINKS application could be used by English teachers as a tool for speaking practice. The results of the study indicated that LINKS could be effective in engaging and motivating students to speak. LINKS is a product that can be used with any computer and microphone, making it ideal for language labs or similar educational settings.

Finally, this research also has the potential for the development of advanced Artificial Intelligence programs concerning Computer Assisted Language Learning (CALL), specifically ASR technology for practicing speaking. An external microphone is also recommended to prevent background noise problems, which may be encountered in crowded environments when using the built-in microphone. It would lead to a better learning experience in future research.

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