Effectiveness of using the Solve It application to improve English learning outcomes in high school students.

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ABSTRACT

The development of information and communication technology has encouraged the creation of innovations in all fields, including education, which is marked by the birth of the concept of electronic learning (e-learning). Most students have difficulty understanding English learning materials and have not utilized their smartphones optimally for learning. This study aims to develop an Android-based English learning application called "Solve It!" which can help students in the teaching and learning process. This study uses the Research and Development method with the Four-D (4D) development model, consisting of four stages, namely Define, Design, Develop, and Disseminate. The results of the study showed that the "Solve It!" application was successfully developed as an Android-based English learning media. Based on validation by material experts and media experts, this application received a very good feasibility score. This application can be used as an additional learning medium, besides books, that is interactive and fun.

I. INTRODUCTION

English language proficiency is very important in today's global era, especially to collaborate in the international arena and make the most of the critical period in language learning. Many students still experience difficulties in learning English due to a lack of vocabulary understanding, differences between writing and reading, and low interest in learning. (Pedagogy, 2023). The use of Android-based English learning applications is an effective solution, as evidenced by the high level of user acceptance, with a percentage reaching 98% of students. Interactive learning methods through Android applications create a more interesting learning atmosphere and help improve student understanding compared to conventional learning through textbooks.

Android apps have played a significant role in the English learning revolution over the past 5 years. The main role of Android apps as a learning medium can be seen from their effectiveness in improving students' abilities, as shown by the results of the study, where the post-test score reached 87.04 compared to the pre-test, which was only 42.65. Android-based learning apps offer a more interactive and personal learning method. As a concrete example,

apps like Duolingo have proven effective with an acceptance rate of 83% from its users due to its ability to combine gamification techniques with adaptive learning.(Putri, Hermawan., Wibawa, SC, Ruhana, A., 2021). Meanwhile, ELSA Speak, launched in 2015, has successfully reached 6.5 million users in 101 countries with AI and speech recognition technology that can detect pronunciation errors with up to 95% accuracy.

Android applications also play a role in creating a more collaborative and practical learning environment (Sarıyalçınkaya et al., 2025). Hello Talk, for example, allows users to practice directly with native speakers through a chat feature equipped with the ability to convert voice to text and automatic grammar correction. BBC Learning English provides comprehensive learning materials covering grammar, pronunciation, vocabulary, and all four language skills (listening, speaking, reading, and writing) through interesting video content. The presence of Android-based English learning applications has changed the learning paradigm from conventional methods to more dynamic and oriented to user needs (Li et al., 2025). Hello English, which has been downloaded by more than 10 million users and became the best Google application in 2016, shows how gamification can increase learning motivation through a global and local ranking system based on coins collected by users.(Thiagarajan, S., Semmel, D.S. & Semmel, 1974).

The development of information and communication technology has encouraged the creation of innovations in all fields, including the field of education, which is marked by the birth of the concept of electronic learning (e-learning).(Jalaluddin, 2010). English language proficiency is very important in today's global era, especially to collaborate in the international arena and to make optimal use of the critical period in language learning.

The reality shows that many students still have difficulty in learning English due to a lack of vocabulary understanding, differences between writing and reading, and low interest in learning (Ghavami Hosein Pour et al., 2025). Most students who have smartphones have not utilized them optimally for learning.

English language learning based on Android games that utilize smartphone media must be under the supervision and control of parents. This shows a gap between the potential of technology and its implementation in learning, where Android smartphone devices are still very rarely used for learning activities in schools. (Machin, 2013).

Information that is not yet known regarding this study is the effectiveness of using the "Solve It!" application in improving students' English language skills, as well as the long-term impact of using this application on students' learning motivation (Zarei et al., 2025). In addition, there is no concrete data on the comparison of learning outcomes between students who use this application and conventional methods.

The novelty of this research lies in the development of a learning application that integrates various aspects of English learning in one platform, not only focusing on one or two aspects of learning like existing applications. The "Solve It!" application is specifically designed for certain levels of education and can be used without an internet connection.

The research gap between this study and previous studies can be seen from Nova Suparmanto's research, which developed the "Fun Lyrics" application, which only covers the learning aspect of remembering English vocabulary through song lyrics and is intended for elementary school students. Meanwhile, the research(Farmana, Y., & Rahman, 2022)about "Development of English Language Learning Media in Early Childhood Education Based on Android Package" only focuses on learning for early childhood (Abualigah et al., 2025).

This research is the development of a comprehensive, interactive, and offline English learning application. This application is designed to help students improve their English skills through various integrated learning features. The purpose of this study is to develop an Android-based English learning application that can help students in the teaching and learning process, as well as to test the feasibility of the application as a learning medium. This application is expected to be an additional learning media besides books that are interactive and fun.

According to(Zahroh, Siti M., & Sudira, 2024), learning media is a tool that can be used as a message channel to achieve learning objectives. The need to use learning media is very important in helping students understand the information that will be given. The learning media chosen must be able to increase students' interest in learning and help them understand the learning material. The use of media in teaching has value and benefits, namely, so that teaching is more interesting to students, so that it can foster learning motivation, in addition to using teaching materials will be easier for students to understand. According to Machin, games as learning media are carried out in order to obtain or find certain understandings or concepts, and students become the main actors(Ayikpa et al., 2022).

In this case, word games or riddles can optimize vocabulary learning in students. According to the Cambridge Dictionary, a riddle is a type of question that describes something in a difficult and confusing way and has a clever or funny answer, often asked as a game. (Apriyanti, C., & Susanti, 2024). Based on this understanding, riddles can certainly entertain and motivate students in learning vocabulary (Dandash & Asadpour, 2025)(Aisyah et al., 2020).

Learning resources that are usually used by schools when teaching only rely on textbooks or other paper media. However, because technology is now advancing rapidly, digital-based learning must continue to be provided to the community so that they can adapt to technological developments.(Baldah, I.A., Mulyadi, D., & Wijayatiningsih, 2024). In addition, the use of digital learning allows students to be more enthusiastic. With this potential, it can be a big opportunity for those who create learning applications. This application can be an Android application that can be easily accessed via a smartphone. The Glide Apps website provides services to create applications according to one's creativity without the hassle of learning coding. This site only requires a Google spreadsheet as a data source(Amelia, DJ, & Ulfa, 2023).

“Solve It!” is an Android application created and can be accessed from the Glide Apps website. This application provides several interactive riddles. Based on the explanation above, there is a purpose in making this article, namely, to find out the development of learning media through Android applications. This

application is expected to help the learning process become more effective and enjoyable (Taha, 2025).

II. METHODOLOGY

This study uses the Research and Development (R&D) method that adapts Thiagarajan's Four-D (4D) development model to develop the English learning application "Solve It!". This development model was chosen because it has systematic stages and is appropriate for the development of technology-based learning media (Smith et al., 2023).

The research stages begin with defining, which includes analysis of student and teacher needs, analysis of the applicable English curriculum, and identification of user characteristics. This stage also includes the formulation of learning objectives to be achieved through the developed application. Things done in this stage are literature studies and field surveys.(Yohanis Ndapa Deda et al., 2023). Field surveys were conducted to collect information and analyze the needs of learning devices to be developed. Meanwhile, the literature study stage was conducted to obtain information about the understanding, concept, theory, or appropriate learning strategies, and to support the development of English learning devices. (Rao, 2019).

The Design stage is carried out by designing the application interface, compiling learning materials, creating flowcharts and storyboards, and determining the evaluation format to be used. This design considers aspects of ease of use and suitability to user characteristics. Development design includes selecting learning strategies and designing initial products. The creation of English learning applications is carried out through the Glide Apps website. (Moses Adeleke Adeoye et al., 2024).

At the Develop stage, the prototype of the "Solve It!" application was developed and validated by media experts and material experts. After revisions were made based on validator input, the application was tested on a limited basis to 30 students and widely to 42 students to determine its effectiveness and practicality. The preparation of learning application instruments was carried out according to the previously determined design. What needs to be done is to enter data in the form of riddles or puzzles that will be presented.

The final stage is Disseminate (Dissemination), which includes packaging the final application, registration to the Google Play Store, and socialization of application use to users. At this stage, feedback is also collected from users for further application development. At the dissemination stage, the learning application that has been created is tested directly with users. Application feasibility assessment is carried out at this stage.

The population in this study was all 11th-grade students of SMA Negeri 1 Surabaya in the 2023/2024 academic year, totaling 360 students. The research sample consisted of 72 students selected using a purposive sampling technique by considering ownership of Android smartphones and willingness to participate in the study. The research instruments used included validation sheets for media and material experts, student response questionnaires, observation sheets, and learning outcome tests in the form of pre-tests and post-tests. These instruments were used to collect data on the feasibility, practicality,

and effectiveness of the developed application. Data analysis was carried out descriptively, quantitatively, and qualitatively. The validity of the application was analyzed using a Likert scale, practicality was measured based on user responses, and effectiveness was determined through the calculation of the gain score. The reliability of the instrument was calculated using the Cronbach's Alpha formula.

The research procedure is carried out systematically from the definition stage to the dissemination stage, with each stage being interrelated and supporting the development of optimal applications. Each stage is well documented to ensure the quality of the research and facilitate the evaluation process (Chen et al., 2025).

III. RESULTS AND DISCUSSION

The results of the research on the development of the "Solve It!" application as an Android-based English learning media show several important findings that include aspects of validity, practicality, and effectiveness of the learning media (Yang et al., 2024).

Based on the assessment of two media experts and two material experts, the "Solve It!" application obtained a very good level of validity. Media experts gave an assessment with a percentage of 89% for the aspects of appearance, navigation, and ease of use of the application. Meanwhile, material experts gave an assessment with a percentage of 88.5% for the aspects of material suitability, content accuracy, and learning quality.

The practicality test was conducted through teacher and student responses to the use of the application. The results of the teacher response analysis showed a practicality level of 97%, while student responses showed a practicality level of 89.1%. Overall, the average practicality level of the application reached 93% which is included in the "Very Practical" category (Vu Thanh et al., 2025).

The effectiveness of the application was measured through the results of the pre-test and post-test on 72 students divided into two stages of testing. In a limited trial with 30 students, an average pre-test score of 53.9 and a post-test score of 84.4 were obtained. This significant increase was analyzed using a paired sample t-test with a significance value of 0.000 ($p < 0.05$), indicating that the "Solve It!" application is effective in improving student learning outcomes.

In a large trial with 42 students, a more in-depth statistical analysis was conducted: 1) The Normality Test using Kolmogorov-Smirnov showed that the data was normally distributed with a significance value of > 0.05, 2) The Homogeneity Test showed that the data variance was homogeneous with a significance value of 0.724, 3) The effect size of the application implementation was calculated using Cohen's d, producing a value of 1.82 which indicates a large effect.

Observation results show an increase in active student participation in English learning. 90% of students reported that the application helped them understand the material better. Teachers also reported time efficiency in delivering materials and ease in monitoring student progress through the tracking feature available in the application.

Based on the overall results of the study, it can be concluded that the "Solve It!" application has met the criteria of being valid, practical, and effective as an English learning medium. This application has succeeded in improving student learning outcomes and creating a more interactive and enjoyable learning experience (Luo et al., 2025).

Discussion of the results of the application development research "Solve It!" shows the success of the implementation of the Four-D model in producing effective English learning media. The validity level reaching 89% from media experts and 88.5% from material experts indicates that this application has met the eligibility standards as a learning media, both in terms of technical and learning content (Zhong et al., 2025).

The practicality aspect of the application reaching 93% shows that "Solve It!" has succeeded in meeting the needs of users in learning English. This high level of practicality is supported by positive responses from teachers (97%) and students (89.1%), which confirm that this application is easy to use and helps the learning process. This is in line with the purpose of developing the application to create practical and user-friendly learning media. A significant increase in learning outcomes can be seen from the comparison of pre-test (53.9) and post-test (84.4) scores, with a significance value of 0.000 in the t-test. The effect size of 1.82 indicates that this application has a major impact on improving students' English skills. This finding strengthens the position of "Solve It!" as an effective solution in technology-based English learning.

Qualitative observation results revealed that this application successfully increased students' learning motivation through an attractive interface and interactive features (Chandra et al., 2025). The ability to use offline is a significant added value, overcoming the internet connectivity constraints often faced in digital learning. The available tracking features make it easier for teachers to monitor student progress, creating a more structured and measurable learning system.

Further statistical analysis through the Kolmogorov-Smirnov normality test and homogeneity test validated the validity of the research results, indicating that the improvement in learning outcomes achieved was consistent and reliable. The active participation of 90% of students and positive feedback from teachers indicated that the application successfully created a more dynamic and effective learning environment.

The implementation of the Four-D model in application development has proven effective, where each stage (Define, Design, Develop, Disseminate) contributes to producing a quality final product. The Define stage successfully identifies user needs accurately, the Design stage produces an appropriate application design, the Develop stage produces a valid product through a series of tests, and the Disseminate stage ensures that the application can be easily accessed by users (Liu et al., 2025).

The success of the development of "Solve It!" is also seen from the technical aspects of the application that support independent learning. Features such as visualization of materials, direct feedback, and tracking systems allow students to learn according to their own pace and abilities (Wang et al., 2025). This reflects

the effective implementation of the principles of student-centered technology-based learning (Zhang et al., 2025).

The findings of this study confirm that the development of Android-based learning media with the Four-D model can produce valid, practical, and effective learning products. "Solve It!" not only succeeded in significantly improving student learning outcomes but also created a more engaging and meaningful learning experience in English learning (Batz et al., 2025).

The product developed is an English learning application for Android. The "Solve It!" application contains several interactive riddles that can hone the user's problem-solving skills and help increase vocabulary. The application display consists of two parts consisting of riddles and situational riddles, which contain questions or puzzles with varying levels of difficulty. Shown in Figures 1 and 2.

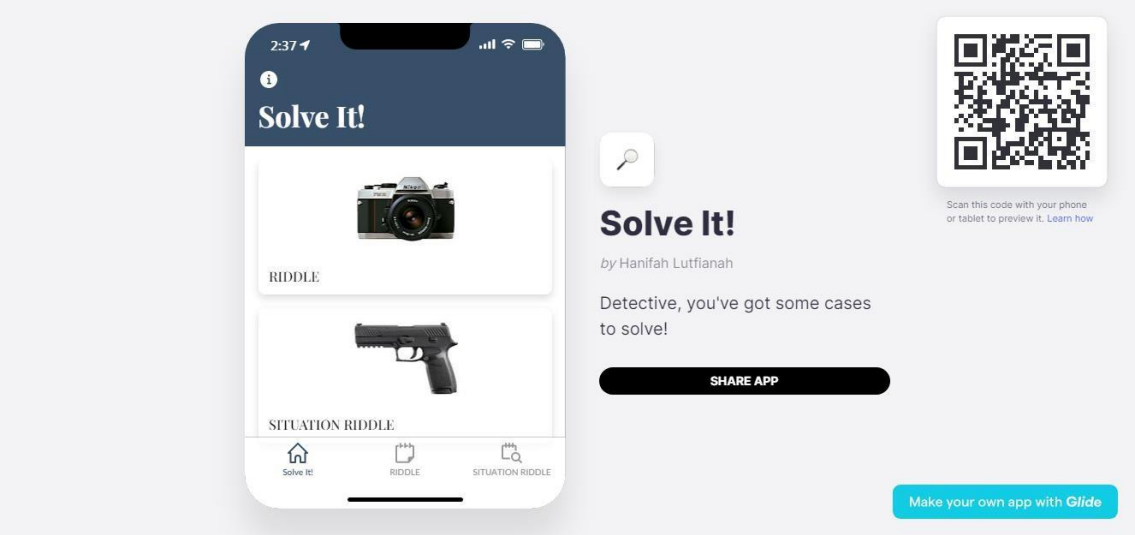

Figure 1. Learning application view

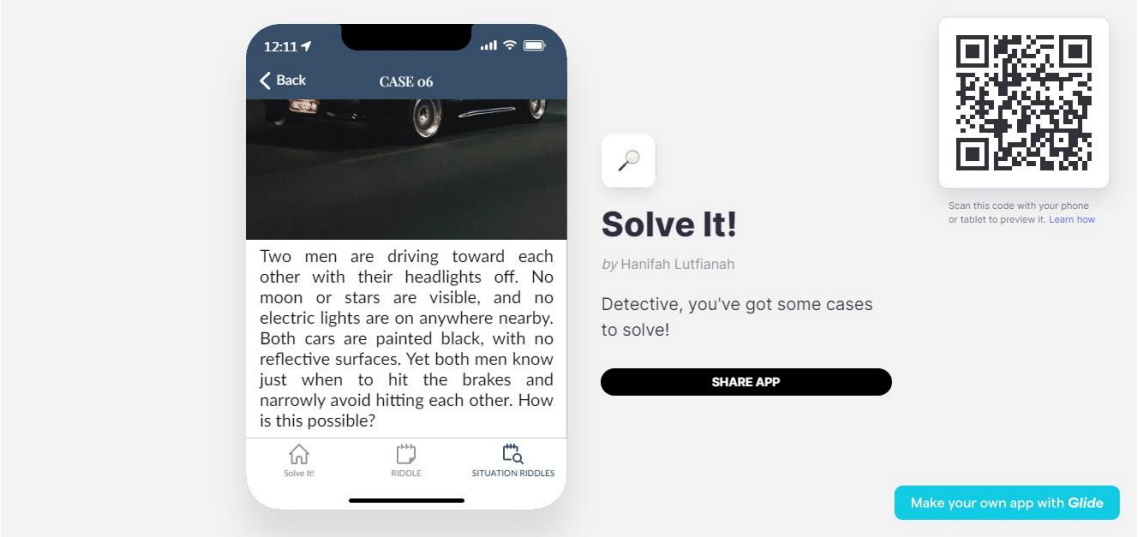

Figure 2. Contents of the learning application

This application can be accessed viahttps://cepatkantekateki.glideapp.io/)

IV. CONCLUSIONS AND RECOMMENDATIONS

Based on the results of the research and discussion that have been done, it can be concluded that the development of the "Solve It!" application as an Android-based English learning media has successfully met the eligibility criteria with a very good level of validity, as evidenced by the assessment of media experts of 89% and material experts of 88.5%. The level of practicality of the application reached 93% which shows that "Solve It!" is very practical to use in learning, supported by positive responses from teachers (97%) and students (89.1%). The effectiveness of the application is proven by the significant increase in student learning outcomes, with an average pre-test score of 53.9 increasing to 84.4 in the post-test, and reinforced by an effect size of 1.82, which shows a major impact on learning. The implementation of the Four-D development model (Define, Design, Develop, Disseminate) has proven effective in producing quality learning applications, with features that support independent learning and a tracking system that makes it easy to monitor student progress. The "Solve It!" application successfully created a more dynamic and interactive learning environment, as evidenced by the active participation of 90% of students and the ability to use offline, which overcomes internet connectivity constraints in digital learning.

Researchers realize that there are still many opportunities that can be done to improve this English learning application, so that it becomes a better and more interactive learning application (Drumond et al., 2025). In further development, researchers hope to enrich the application features, such as making the application display more attractively with animated images, adding hint features, adding variations of puzzles with more complex difficulties, and adding storyline features so that users can be introduced to new vocabulary (Luong et al., 2025).

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