Scratch as an innovative learning media to improve Indonesian language understanding in elementary school students

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Abstract. Indonesian language learning in elementary schools often faces challenges in increasing student engagement and understanding. Therefore, this study aimed to explore the effectiveness of using Scratch as an Innovative Learning Media to Enhance Indonesian Language Comprehension among Elementary School Students. This study employed a quasi-experimental design with a quantitative approach. The sample consisted of 50 fifth-grade students divided into two groups: an experimental group using Scratch and a control group using conventional learning methods. Data were collected through pre-tests and post-tests to measure students' Indonesian language literacy and were analysed using t-tests. The results showed that the experimental group experienced significant improvement in Indonesian language comprehension compared to the control group, with a post-test significance value of 0.000. These findings indicated that using Scratch as a learning medium could enhance student engagement and understanding of Indonesian. The implications of this study suggested that integrating Scratch-based technology could be implemented as an innovative approach to Indonesian language learning, improving the quality of education and providing an effective alternative for language learning in elementary schools. Further research should expand the sample size and duration to explore the long-term impact of technology use in language learning.

Introduction

In the era of globalizsation and the rapid development of information technology, education has become one of the sectors most affected by technological innovation (Soto-Corominas et al., 2024). Information technology influences how we access information and teach and learn various concepts, including in elementary education (Rizki et al., 2022). Technology-based learning media, especially interactive ones, have proven effective in increasing student engagement, providing enjoyable learning experiences, and deepening students' understanding of various subjects (Brooks et al., 2023). One of the most recent innovations being considered in education is using Scratch-based development software (Damanik, 2022). Scratch is a visual programming language that facilitates teaching basic programming concepts through games, stories, and animations that students can customize. The main advantage of Scratch lies in its ability to provide an interactive, creative, and enjoyable learning experience, allowing students to learn more actively and constructively (Nair & Md Yunus, 2022).

The importance of Indonesian language learning in elementary schools cannot be underestimated. As the national language, mastering Indonesian is the primary foundation for developing students' communication skills (Kertih et al., 2023). Additionally, Indonesian also serves as a tool for accessing further knowledge. However, Indonesian language education in elementary schools faces challenges, including low student interest, difficulty understanding the material being taught, and a lack of innovative teaching methods (Yuan et al., 2019). Despite various efforts to address these issues, Indonesian language education in elementary schools still shows suboptimal results, especially regarding a deep understanding of more complex language concepts. Furthermore, traditional approaches used in teaching Indonesian are often considered incapable of attracting the interest of students who are more accustomed to rapidly developing digital technologies (Kent, 2020).

In this context, technology-based learning media, such as Scratch, offers significant potential to address these issues. Scratch allows students to engage in active learning that integrates interactive and creative elements (Neumann, 2020). Using Scratch, students can create projects directly related to Indonesian language learning, such as creating animations or stories that involve vocabulary, grammar, and sentence structure (Foulds, 2023). This is expected to increase student engagement, making Indonesian language learning more interesting and easier to understand. However, although Scratch has been applied in various educational contexts, its application in teaching Indonesian in elementary schools is still limited, and there has been little research explicitly examining its effectiveness in enhancing Indonesian language comprehension (Eysenbach et al., 2011).

The main issue this research aims to address is the low comprehension of Indonesian language material among students despite various teaching methods being implemented. This issue arises due to the limited use of learning media that can accommodate students' visual and interactive learning needs. Additionally, traditional teaching methods, which focus more on a teacher-dominated and passive learning approach, are not engaging enough for students exposed to digital technologies from an early age (Rose et al., 2019). In this regard, Scratch-based learning media can be a promising solution as it provides a more enjoyable, interactive, and relevant learning experience in today's digital age. Scratch allows students to create projects related to the learning material, such as creating animations or stories linked to Indonesian language learning, while facilitating the use of more contextual and practical language (Jong, 2014).

The urgency of this research is very relevant considering the challenges faced in learning Indonesian in elementary schools. Based on data from the PISA (Program for International Student Assessment) 2018, Indonesia is ranked 74 out of 79 countries in terms of reading skills, indicating the low level of literacy of Indonesian students at the elementary level (de Siqueira et al., 2020). On the other hand, Based on data from the Sumenep Regency Education Office (the city where the research sample was taken), the Indonesian Language exam pass rate at the elementary school level in 2020 only reached 68%, which is lower than the average pass rate for East Java province of 80%. This shows that the understanding of Indonesian among elementary school students in the area is still far from expectations, even though various efforts have been made to improve the quality of teaching (Kervin, 2016). In addition, a survey conducted by Education Researchers in Sumenep in 2021 revealed that 62% of teachers in public elementary schools found it difficult to attract students' interest in learning Indonesian, with 45% identifying the lack of innovative learning methods as one of the leading causes of low student engagement. Therefore, this study is highly urgent in offering alternative technology-based solutions, such as using Scratch, which can increase student engagement and understanding of Indonesian in public elementary schools in Sumenep (Chaparro-Moreno et al., 2019).

This study focuses on the problem of low understanding of Indonesian among elementary school students, especially in areas with educational challenges such as Sumenep. Therefore, the research problem formulation is: How does the use of Scratch-based learning media affect the improvement of understanding of Indonesian in elementary school students? Can the use of Scratch increase student engagement in learning Indonesian compared to conventional learning methods? And, is there a significant difference in understanding Indonesian between students who use Scratch as a learning medium and those who follow conventional learning? This study aims to test the effectiveness of using Scratch-based learning media in improving the understanding of Indonesian in elementary school students. This study aims to (1) assess whether the use of Scratch can improve students' understanding of Indonesian compared to conventional learning methods, (2) analyze the differences in the level of student engagement in learning Indonesian using Scratch and those using traditional learning methods, (3) provide empirical evidence that can be the basis for recommendations for the application of technology in language learning in elementary schools. Based on the objectives explained, the hypotheses proposed in this study are: (1) there is a significant difference in the understanding of Indonesian between students who use Scratch-based learning media and students who use conventional learning methods; (2) using Scratch as a learning medium can increase student involvement in learning Indonesian, which will improve their learning outcomes in the subject. Thus, this study tests whether Scratch-based technology, which combines interactive and creative elements, can offer a more effective solution in learning Indonesian at the elementary school level.

Several previous studies have shown that using technology-based media, including software such as Scratch, can increase student engagement and motivation in learning. For example, research by Vucicevic & Shumakova (2020) showed that Scratch can improve students' creative thinking and problem-solving skills. Another study by Vasalou et al. (2022) found that using Scratch in education positively impacts students' cognitive development, especially in understanding mathematical and science concepts. However, little research has specifically studied the application of Scratch in teaching Indonesian at the elementary school level. This opens opportunities for further research to fill the gaps in the existing literature and provide new insights into the effectiveness of Scratch in teaching Indonesian.

The gap in the existing literature lies in the lack of in-depth studies examining how the use of Scratch can specifically improve Indonesian language comprehension at the elementary school level. Most existing studies focus more on the use of technology in teaching mathematics, science, and other skills, while language teaching, particularly Indonesian, has not received the same level of attention. This study seeks to fill this gap by exploring how Scratch can be used as an effective medium in Indonesian language learning in elementary schools and evaluating its impact on students' comprehension of the language.

The novelty of this research lies in applying Scratch-based media in the context of Indonesian language learning, which has been limited so far. This study focuses on evaluating technology in education and explores Scratch's potential to improve Indonesian language learning. Additionally, this research provides essential justification for further introducing Scratch in the elementary school curriculum as an alternative to enhance learning outcomes. Thus, this research contributes not only to the development of educational theories but also to more innovative, technology-based educational practices, which can ultimately improve the quality of education in Indonesia.

Method

This study employed a quasi-experimental design and a quantitative methodology (Hardiansyah, 2022). The quantitative approach was chosen for its ability to provide objective data measurement

and statistical analysis, which was essential for evaluating the cause-and-effect relationship between the intervention and students' literacy outcomes. A quasi-experimental design was adopted due to the inability to randomly assign participants to groups in this study, which was conducted in a natural school environment. Although complete randomisation was not feasible, the quasi-experimental design still allowed for a valid evaluation of the intervention's effectiveness by comparing outcomes between groups exposed to different treatments. The population of this study included 225 elementary school students, 120 females and 105 males. A random sampling technique was employed to select 50 grade 5 students. These students were randomly assigned to two classrooms: 25 students in class 5a (experimental group) and 25 in class 5b (control group). The selection of experimental and control classes in this study with the same initial knowledge is essential to ensure the study's internal validity and to accurately measure the impact of the treatment given, thereby minimising the potential influence of external variables or confounding variables.

The data collection for this study was conducted using a test instrument designed to measure students' science literacy. The test consisted of 20 multiple-choice items, which covered three leading indicators of science literacy: understanding of scientific concepts, critical thinking skills, and applying Islamic values in the context of science learning. This test served as both a pre-test and a post-test, enabling the researcher to evaluate any changes in students' science literacy after the intervention. Data analysis for this study involved several statistical procedures. The first step was a validity test using the Pearson product-moment correlation formula. The instrument was considered valid for further use if the calculated correlation coefficient (r count) exceeded the critical value (r table). The validity test was conducted using the Annates version four software, which helped compare the calculated correlation coefficient against the critical value at a 5% significance level. The degree of freedom for this test was calculated as df = N-2, where N represents the total number of items in the test.

A reliability test was also performed to ensure the instrument's reliability. The alpha coefficient formula was used to assess the internal consistency of the test items. A high-reliability coefficient indicates that the instrument is consistent and reliable for data collection. Once the validity and reliability of the instrument were confirmed, the study proceeded to the normality test, which aimed to assess whether the data followed a normal distribution. The Shapiro-Wilk test, implemented in IBM SPSS 25 software, was used to evaluate the normality of the data. If the probability value (p-value) was greater than 0.05, the null hypothesis (H0), stating that the data followed a normal distribution, was accepted. Conversely, if the p-value was less than or equal to 0.05, the null hypothesis was rejected, indicating a non-normal distribution. In addition to normality, the study also conducted a homogeneity test to examine whether the variances of the two groups (experimental and control) were equal. This was important to ensure that any differences observed in the post-test results were not due to significant initial differences between the groups. The homogeneity test was also performed using IBM SPSS, and the decision rule was similar to that of the normality test: if the p-value was greater than 0.05, the null hypothesis of homogeneity was accepted; if the p-value was less than or equal to 0.05, the null hypothesis was rejected, indicating that the variances were heterogeneous.

After the normality and homogeneity tests were completed, the next step was to use the N-Gain test to measure students' Indonesian language comprehension from pre-test to post-test. The N-Gain score is categorized into three levels: high, medium, or low improvement. The N-Gain test provides an objective assessment of the effectiveness of the intervention. It helps determine whether the Scratch-based e-module significantly improves students' Indonesian language comprehension. According to Hardiansyah et al. (2024), the N-Gain test is a valuable tool for evaluating educational interventions. It provides a clear value assessment of the impact of the intervention on student learning outcomes. Finally, this study used the t-test to compare the

differences between the experimental and control groups. If the data is usually distributed and the variance is homogeneous, use the parametric t-test statistics; if the data is not normally distributed, use a nonparametric test, such as the Mann-Whitney U test.

Results and Discussion

The results of this study reveal the impact of using Scratch-based learning in improving Indonesian language comprehension in elementary schools. The data presented includes pre-test and post-test results and N-gain calculations for the experimental and control groups.

Table 1. Pre-test data centering and distribution results

Data	Group	
	Experiment	Control
Lowest Score	4	5
Highest Score	17	16
Mean	8.22	8.03
Median	8	8.31
Mode	8	8
Standard of Deviation	3.44	3.01

Table 1 presents the distribution of pre-test data for both groups. The results show that the lowest score in the experimental group was 4, while the control group recorded a lowest score of 5. The highest score in the experimental group was 17, slightly higher than the control group, which recorded the highest score of 16. The average pre-test score in the experimental group was 8.22, while the control group had a slightly lower average of 8.03. The median in both groups was quite similar, with the experimental group at eight and the control group at 8.31, indicating a reasonably balanced score distribution. Both groups' mode, or the most frequently occurring score, was 8.

Furthermore, the standard deviation in the experimental group was 3.44, slightly higher than the control group's standard deviation 3.01. This indicates more variation in the experimental group's scores, although both groups were within a relatively similar range. Overall, the pre-test results show that before the intervention, both groups' Indonesian language comprehension abilities were still relatively low, with score distributions not significantly different between the experimental and control groups. This assessment provides a basis for further analysis of the impact of the interventions applied to the experimental group using Scratch and the control group receiving conventional learning.

Table 2. Post-test data centering and distribution results

Data	Group	
	Experiment	Control
Lowest Score	19	13
Highest Score	25	15
Mean	19.34	13.22
Median	20	13
Mode	20	14
Standard of Deviation	3.51	2.88

The results presented in Table 2 show that the lowest score in the experimental group was 19, while the control group recorded the lowest score of 13. The highest score in the experimental group was 25, much higher than the control group, which recorded the highest score of 15. The

average post-test score for the experimental group reached 19.34, while the control group had a lower average of 13.22. The median for the experimental group was 20, while the control group was only 13, indicating that most students in the experimental group achieved higher scores. The model in the experimental group was 20, while in the control group, it was 14, indicating that higher scores were more frequently recorded in the experimental group.

Furthermore, the standard deviation in the experimental group was 3.51, slightly higher than the control group's standard deviation 2.88. This shows more variation in the experimental group's results, but it remained within a higher score range than the control group. Overall, the post-test results indicate that learning using Scratch integrated with Indonesian language instruction significantly improved science literacy in the experimental group. In contrast to the control group, which used conventional learning methods, the experimental group showed more rapid development in their understanding of Indonesian language material.

Table 3. Average Results of N-gain

Group	N-Gain	Note
Experiment	0.68	Moderate
Control	0.38	Low

The N-gain calculation results in Table 3 indicate a significant difference between the experimental and control groups regarding improved Indonesian language comprehension after the learning intervention. The experimental group, which used Scratch as an innovative learning media, achieved an average N-gain value of 0.68, which falls into the moderate improvement category. This indicates that using Scratch as a learning medium can moderately improve students' Indonesian language comprehension by creating a more interactive and enjoyable learning experience. In contrast, the control group, which followed conventional learning methods, only recorded an average N-gain value of 0.38, categorized as low improvement. The clear difference between these two groups suggests that the use of Scratch is effective in capturing students' attention and deepening their understanding of Indonesian language material. Although both groups showed improvement, the experimental group using Scratch demonstrated a more significant development in understanding Indonesian language concepts. This indicates that technology-based learning approaches, such as Scratch, which involve interactive and creative elements, can be a highly effective tool in improving language comprehension in elementary school students, compared to traditional learning methods that offer less opportunity for exploration and active student engagement.

Table 4. Normality Test Results

Shapiro-Wilk	Pre-test		Post-test	
	Experiment	Control	Experiment	Control
Sig.	.093	.054	.133	.221
α		Sig. > 0.005 (5%)		
Description	Data is normally distributed			

The normality test results presented in Table 4 show that the data obtained from the experimental and control groups, both before and after the intervention, follow a normal distribution. The normality test was conducted using the Shapiro-Wilk test, which resulted in significance (Sig.) values greater than 0.05 for all pre-test and post-test data in both groups. Specifically, for the experimental group, the pre-test significance value was 0.093, and the post-test significance value was 0.133, while for the control group, the pre-test significance value was 0.054, and the post-test significance value was 0.221. Since the significance values in all tests were greater than 0.05, it can be concluded that the data in both groups follow a normal distribution. This finding is crucial as it

shows that the data does not violate the normality assumption, a prerequisite for further parametric statistical analysis. Therefore, these results provide a solid foundation for the study using parametric statistical tests, such as the t-test, to compare the differences between the experimental and control groups. Overall, this normality test confirms that the pre-test and post-test data distributions in the experimental group using Scratch as a learning media and the control group using conventional learning methods can be treated with valid parametric statistical approaches, thus strengthening the reliability of this study's findings.

Table 5. Homogeneity Test Results

Lavene Statistic	Pre-test	Post-test
Sig.	0.445	0.712
α	Sig. > 0.005 (5%)	
Description	Homogenic Data	

The results of the homogeneity test presented in Table 5 show that the pre-test and post-test data in both groups, namely the experimental and control groups, have homogeneous variances. The homogeneity test was conducted using Levene's test, which resulted in significance (Sig.) values of 0.445 for the pre-test and 0.712 for the post-test. Since the significance values for both tests are more excellent than 0.05, it can be concluded that the variances between the two groups are homogeneous, meaning both groups have similar levels of variability in terms of their pre-test and post-test results. This finding is significant because the homogeneity test, which shows significant results greater than 0.05, confirms that the two groups do not have substantial differences in terms of variance. This allows for further parametric statistical analysis, such as the t-test, to compare the average scores between the experimental group using Scratch-based learning media and the control group using conventional learning methods. Therefore, the results of this homogeneity test support the conclusions drawn from the comparison of pre-test and post-test results, providing additional confidence in the validity of the study's findings regarding the effectiveness of Scratch as a learning media in enhancing Indonesian language comprehension among elementary school students.

Table 6. t-test Results

	Pre-test (t-test)	Post-test (t-test)
Sig. (2-tailed)	0.441	0.000
α	0.005 (5%)	
Description	H1 is rejected	H1 is accepted

The t-test results presented in Table 6 provide essential insights into the significant differences between the experimental and control groups, both before and after the intervention. For the pre-test data, the significance value (Sig. 2-tailed) obtained was 0.441, more significant than the established significance level of 0.05. This indicates no significant difference between the experimental and control groups before the intervention, confirming that both groups had similar levels of Indonesian language literacy at the beginning of the study. Therefore, the null hypothesis (H0) is accepted, and the alternative hypothesis (H1) is rejected for the pre-test stage. However, for the post-test, the t-test results show a very low significance value of 0.000, much smaller than the established significance level (α = 0.005). This indicates a significant difference between the experimental and control groups after the intervention. The experimental group, which used Scratch-based learning media, showed a much more substantial improvement in their understanding of Indonesian than the control group, which followed conventional learning methods. Therefore, the alternative hypothesis (H1) is accepted, indicating that using Scratch as an innovative learning media significantly improves Indonesian language comprehension among elementary school students. These results highlight the effectiveness of Scratch in enhancing student learning outcomes compared to traditional learning approaches.

The interpretation of these results can be explained by referring to the constructivism theory proposed by (Rubtsov & Ulanovskaya, 2020; Sumandya & Widana, 2022). Constructivism theory emphasises learning based on experience and active interaction between students and the material being studied (Borleffs et al., 2018). In this context, Scratch provides a platform for students to create creative projects that involve the use of language, thus deepening their understanding of language concepts through exploration and creativity (Setiawan, 2018). The use of Scratch allows students to collaborate, create stories, and engage in creative ways that are interesting and relevant, which, in turn, develops their language skills. As an interactive learning media, Scratch allows students to learn independently with minimal teacher guidance, yet still within a framework that supports the development of their Indonesian language comprehension (Ojeda-Ramirez et al., 2023).

Moreover, these results align with previous research that shows that technology in education can increase student engagement and learning outcomes. Research by Soto-Corominas et al. (2024) demonstrated that technology-based games and applications can increase student learning motivation. Additionally, a study by Brooks et al. (2023); Widana & Ratnaya (2021) showed that technology-based educational applications can improve students' language skills, particularly in speaking, listening, and writing. Thus, the findings of this study strengthen the argument that technology, especially interactive and creative tools like Scratch, can potentially enhance language learning in elementary school students.

This study's findings contribute significantly to the development of language learning theories, particularly in Indonesian language education. Constructivism theory, which emphasizes the importance of active learning and direct experience in the learning process, can be further supported by results showing that Scratch-based learning media enhances student engagement (Damanik, 2022). Scratch allows students to interact with Indonesian language learning materials and gives them the freedom to create projects relevant to their daily lives (Nair & Md Yunus, 2022). This provides further evidence that interactive learning media combining creative elements can effectively teach language (Hardiansyah et al., 2023).

From the perspective of educational practice, these findings have far-reaching implications. Indonesian language learning in elementary schools is often carried out using more traditional approaches, where much of the material is delivered through lectures, textbooks, and written exercises that are usually not engaging enough for students (Neumann, 2020). The results of this study show that technology-based learning, particularly using Scratch, can increase student motivation and help them learn more enjoyably. By integrating Scratch-based learning media into the Indonesian language curriculum, teachers can create more engaging and relevant learning experiences for students, which can help them master the language more effectively (Kervin, 2016).

Furthermore, these findings also show that using Scratch in Indonesian language learning can accelerate the learning process by allowing students to interact directly with the material and apply what they have learned in the projects they create. For example, students can create animations or short stories using the vocabulary and grammar they have learned, which will deepen their understanding of the material. This also allows students to learn at their own pace, speeding up the process of mastering more contextual and practical language. However, to ensure that Scratch can be used optimally in Indonesian language teaching, adequate training and support for teachers are necessary to help them understand how to use this tool effectively. This suggests that, although technology has excellent potential to enhance language learning, its practical implementation depends on teachers' understanding of the tool and their ability to integrate it into the existing learning activities.

Scratch media has enormous potential to be used in various subjects, not limited to just one discipline. The main advantage of Scratch lies in its ability to combine interactive learning with student creativity to be applied in teaching various topics and concepts, including Indonesian, mathematics, science, art, and many more. Scratch allows students to create multimedia projects such as animations, games, or interactive stories that develop technical skills in using the software and deepen their understanding of the subject matter. In Indonesian, for example, students can create stories, dialogues, or animations that integrate the vocabulary and sentence structures they have learned, which directly supports understanding and applying the language in a more practical context. In addition, Scratch can be used effectively in science and mathematics subjects, where students can create simulations or visual models to explain scientific or mathematical concepts. For example, students can create animations to illustrate the water cycle, the process of photosynthesis, or the application of mathematical formulas in everyday life. Scratch provides space for students to solve problems creatively and visually, which can strengthen the understanding of concepts that are difficult to understand if only taught in theory. Even in art subjects, Scratch can be used to develop digital art projects and teach students about graphic design, animation, and music, which also supports the development of their creative skills. With the flexibility offered by Scratch, this medium can be integrated into various curricula to increase student engagement and create a more dynamic and enjoyable learning experience. Therefore, Scratch is a helpful learning tool in one subject and an innovative solution that can be adapted to various subject areas, providing a more engaging and immersive learning experience for students.

Although the results of this study provide important insights, there are several limitations to consider when interpreting the results. One major limitation is the small sample size. This study only involved 50 students from two classes in one elementary school, which does not represent a broader population. Therefore, the results of this study may not be fully generalizable to the entire population of elementary school students in Indonesia or other countries with different education systems. Using a more extensive and diverse sample would provide more representative findings and allow researchers to explore whether the impact of using Scratch remains significant across various educational contexts. A second limitation is the short duration of the study. This study only involved a brief period of applying the intervention to both groups. This limits the ability to measure the long-term impact of using Scratch in Indonesian language learning. Long-term research can provide a more complete picture of the sustainability of the benefits of Scratch-based learning and whether the improvements seen in students in the short term can be maintained over the long term.

Additionally, the measurement instruments used in this study also have limitations. The test used to measure students' Indonesian language literacy may not fully cover all aspects of the language skills needed, such as speaking or writing abilities. Therefore, further research could develop more comprehensive measurement instruments encompassing various aspects of language literacy, including speaking, writing, listening, and reading, to provide a more holistic assessment of students' language skills development.

Given these limitations, several suggestions can be made for future research. First, there is a need for research with a more extensive and diverse sample, covering students from different schools with varying backgrounds. This research should also be conducted across different levels of elementary schools to test whether these findings are consistent across various age groups and educational contexts. Research involving a broader sample could provide more generalizable and in-depth findings. Second, further research could use a longer research design, such as longitudinal studies, to measure the long-term impact of using Scratch in Indonesian language learning. Research could identify whether the benefits gained by students during short-term studies can be sustained over the long term or even improve over time. It will also help identify factors that may

influence the long-term success of Scratch-based learning. Third, future research could explore the influence of other factors, such as student motivation levels or parental support, on the effectiveness of using Scratch in Indonesian language learning. Understanding these factors will provide deeper insights into how technology can enhance language learning holistically.

This research also has significant social and ethical implications. Regarding technology access, not all schools in Indonesia have equal access to technology devices such as computers or the Internet. Therefore, although technology has the potential to improve education quality, it is essential to ensure that technology in learning is accessible to all students, regardless of their economic or social background. One of the main challenges in implementing Scratch as a learning medium is the inequality in technology access in schools, particularly in underdeveloped areas. Additionally, there are ethical issues related to the use of technology in education. One problem that needs to be watched is the potential negative impact of excessive technology use, such as reducing social interaction among students or exposure to inappropriate content. Therefore, using Scratch or other technology platforms in education should be strictly supervised, ensuring that technology supports learning and does not replace critical social interactions in education. Another social implication is the potential of technology to create more inclusive education. Using tools like Scratch, students with varying abilities can engage in Indonesian language learning creatively and enjoyably, allowing them to learn in a way that suits their learning style. Therefore, using technology in education can equalize access to education and provide equal opportunities for all students to develop. Overall, this study's findings show that using Scratch as a learning media can be a very effective tool in improving Indonesian language comprehension in elementary school students. These findings contribute to the development of language learning theories and have significant practical implications for how Indonesian language learning is applied in elementary schools. However, it is important to continue exploring and developing this research to address the existing limitations and ensure that technology is used ethically and socially fairly.

Conclusion

This study shows that Scratch-based learning media significantly improves Indonesian language comprehension among elementary school students. The results of the t-test analysis show a significant difference between the experimental group that used Scratch and the control group that used conventional learning methods. The experimental group showed more substantial improvement in Indonesian language comprehension, confirming that Scratch, an interactive learning media, can increase student engagement and deepen their understanding of the material. Scratch allows students to create and apply what they have learned in more practical and relevant contexts, creating a more enjoyable and effective learning experience. Additionally, this research contributes to Indonesian language education practices in elementary schools, showing that Scratch-based technology can improve language learning quality and student engagement. However, this study has limitations, such as a small sample size and a relatively short research duration. Therefore, further research with a larger sample and more prolonged duration is highly recommended to explore the long-term impact of using Scratch in Indonesian language learning.

Bibliography

Borleffs, E., Glatz, T. K., Daulay, D. A., Richardson, U., Zwarts, F., & Maassen, B. A. M. (2018). GraphoGame SI: The development of a technology-enhanced literacy learning tool for Standard Indonesian. *European Journal of Psychology of Education*, *33*(4), 595–613. https://doi.org/10.1007/s10212-017-0354-9

Brooks, H., Irmansyah, I., Syarif, A. K., Pedley, R., Renwick, L., Rahayu, A. P., Manik, C., Prawira, B., Hann, M., Brierley, H., Lovell, K., & Bee, P. (2023). Evaluating a prototype digital

mental health literacy intervention for children and young people aged 11–15 in Java, Indonesia: a mixed methods, multi-site case study evaluation. *Child and Adolescent Psychiatry and Mental Health*, *17*(1), 1–17. https://doi.org/10.1186/s13034-023-00608-9

Chaparro-Moreno, L. J., Justice, L. M., Logan, J. A. R., Purtell, K. M., & Lin, T. J. (2019). The preschool classroom linguistic environment: Children's first-person experiences. *PLoS ONE*, *14*(8), 1–21. https://doi.org/10.1371/journal.pone.0220227

Damanik, J. Y. (2022). Language learning strategies used by indonesian learners in IELTS. *Studies in English Language and Education*, *9*(1), 62–77. https://doi.org/10.24815/siele.v9i1.21448

de Siqueira, J. I. A., Medeiros, M. F. T., & de Senna-Valle, L. (2020). A methodological proposal for the use of short stories regarding the biocultural memory as a pedagogical tool. *Ethnobotany Research and Applications*, *20*, 1–9. https://doi.org/10.32859/era.20.32.1-9

Eysenbach, G., Stoner, S., Drozd, F., Blankers, M., Crutzen, R., Tait, R., Mohr, D., Evans, D., Kok, R., Chumnanvej, S., Kooprasertying, P., Anthony, S., Kivuti, L. W., Hambly, K., Aarts, J. W. M., Prins, J., de la Torre, I., Cook, R., Jung, B. C., … Bewick, B. (2011). Consort-ehealth: Improving and standardizing evaluation reports of web-based and mobile health interventions. *Journal of Medical Internet Research*, *13*(4), 1–69. https://doi.org/10.2196/jmir.1923

Foulds, K. (2023). Co-viewing mass media to support children and parents' emotional abcs: an evaluation of ahlan simsim. *Early Childhood Education Journal*, *51*(8), 1479–1488. https://doi.org/10.1007/s10643-022-01408-0

Hardiansyah, F. (2022). Snowball throwing: A method to uplift elementary school students' responsibility on environment. *AL-ISHLAH: Jurnal Pendidikan*, *14*(3), 3853–3864. https://doi.org/10.35445/alishlah.v14i3.1966

Hardiansyah, F., Sukitman, T., Wahdian, A., & Hodairiyah, H. (2024). The use of differentiated digital learning models to enhance science problem-solving in elementary schools. *AL-ISHLAH: Jurnal Pendidikan*, *16*(2), 1462–1474. https://doi.org/https://doi.org/10.35445/alishlah.v16i2.5087

Hardiansyah, F., Zainuddin, Z., Sukitman, T., & Astutik, C. (2023). Development of learning media smart book to improve understanding of elementary school students in science learning. *Lentera Pendidikan: Jurnal Ilmu Tarbiyah Dan Keguruan*, *26*(1), 72–87. https://doi.org/https://doi.org/10.24252/lp.2023v26n1i7

Jong, M. S. Y. (2014). Elementary students' view of collaborative knowledge building in LearningVillages. *Interaction Design and Architecture(S)*, *21*(1), 37–56.

Kent, D. (2020). A room with a vui-voice user interfaces in the tesol classroom. *Teaching English with Technology*, *20*(3), 96–124.

Kertih, I. W., Widiana, I. W., & Antara, I. G. W. S. (2023). The Phenomena of learning loss experienced by elementary school students during the covid-19 post pandemic. *Emerging Science Journal*, *7*(Special issue 2), 201–213. https://doi.org/10.28991/ESJ-2023-SPER-014

Kervin, L. (2016). Powerful and playful literacy learning with digital technologies. *Australian Journal of Language and Literacy*, *39*(1), 64–73. https://doi.org/10.1007/BF03651907

Nair, V., & Md Yunus, M. (2022). Using digital storytelling to improve pupils' speaking skills in the age of covid 19. *Sustainability (Switzerland)*, *14*(15). https://doi.org/10.3390/su14159215

Neumann, M. M. (2020). Social robots and young children's early language and literacy learning. *Early Childhood Education Journal*, *48*(2), 157–170. https://doi.org/10.1007/s10643-019-00997-7

Ojeda-Ramirez, S., Tsan, J., Eatinger, D., Jacob, S., Saito-Stehberger, D., Franklin, D., & Warschauer, M. (2023). Describing elementary students' spheres of influence in scratch "about me" projects. *SIGCSE 2023 - Proceedings of the 54th ACM Technical Symposium on Computer Science Education*, *1*, 333–339. https://doi.org/10.1145/3545945.3569869

Rizki, P. N. M., Handoko, I., Purnama, P., & Rustam, D. (2022). Promoting self-regulated learning for students in underdeveloped areas: the case of indonesia nationwide online-learning

program. *Sustainability (Switzerland)*, *14*(7). https://doi.org/10.3390/su14074075

Rose, S. P., Jay, T., & Jacob Habgood, M. P. (2019). Using pirate plunder to develop children's abstraction skills in scratch. *Conference on Human Factors in Computing Systems - Proceedings*. https://doi.org/10.1145/3290607.3312871

Rubtsov, V. V., & Ulanovskaya, I. M. (2020). Learning activity as an effective way to develop meta-subject and personal competencies in elementary school students. *Cultural-Historical Psychology*, *16*(2), 51–60. https://doi.org/10.17759/chp.2020160207

Setiawan, Y. H. (2018). Designing game "belajar hanacaraka" as a javanese script learning media. *Sisforma*, *4*(2), 71–75. https://doi.org/10.24167/sisforma.v4i2.1298

Soto-Corominas, A., Roquet, H., & Segura, M. (2024). The effects of clil and sources of individual differences on receptive and productive efl skills at the onset of primary school. *Applied Linguistics*, *45*(2), 364–382. https://doi.org/10.1093/applin/amad031

Sumandya, I. W. & Widana, I W. (2022). Reconstruction of vocational-based mathematics teaching materials using a smartphone. *Journal of Education Technology, 6*(1), 133-139. https://dx.doi.org/10.23887/jet.v6i1.42833

Vasalou, A., Vezzoli, Y., Joye, N., Sumner, E., Benton, L., Herbert, E., & Gan, L. (2022). Appropriation of literacy technologies in the classroom: reflections from creative learning design workshops with primary school teachers. *Journal of Research in Reading*, *45*(3), 324–341. https://doi.org/10.1111/1467-9817.12390

Vucicevic, B., & Shumakova, N. B. (2020). Intellectual development of elementary schoolchildrenand their performance on the vygotsky—sakharov method. *Cultural-Historical Psychology*, *16*(4), 63–71. https://doi.org/10.17759/chp.2020160407

Widana, I. W. & Ratnaya, I. G. (2021). Relationship between divergent thinking and digital literacy on teacher ability to develop HOTS assessment. *Journal of Educational Research and Evaluation, 5*(4), 516-524. https://doi.org/10.23887/jere.v5i4.35128

Yuan, X., Côté, M. A., Fu, J., Lin, Z., Pal, C., Bengio, Y., & Trischler, A. (2019). Interactive language learning by question answering. *EMNLP-IJCNLP 2019 - 2019 Conference on Empirical Methods in Natural Language Processing and 9th International Joint Conference on Natural Language Processing, Proceedings of the Conference*, 2796–2813. https://doi.org/10.18653/v1/d19-1280