

## Evaluation of the Impact of Learning Application Innovation on Improving Literacy and Numeracy of Elementary School Students of SD UPT SDN 068007 Medan

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### ARTICLE INFO

*Keywords:* Learning Application, Merdeka Curriculum, Literacy, Numeracy, Educational Technology

*Received :* 10, July

*Revised :* 28, July

*Accepted:* 29, August

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### ABSTRACT

This study aims to evaluate the impact of the use of digital learning applications on improving literacy and numeracy of elementary school students in the context of the Independent Curriculum. The study used a pre-experimental design with a one-group pre-test and post-test model. The subjects of the study were 25 grade IV students at one of the partner elementary schools. Learning outcomes were measured using literacy and numeracy evaluation instruments before and after learning using the IKM application. Data analysis showed a significant improvement in both aspects, with a p-value < 0.001 based on paired t-tests. These results show that learning applications make a positive contribution to student learning outcomes. This research supports the integration of technology in basic education as a strategy to increase learning effectiveness and equitable distribution of learning outcomes.

## **INTRODUCTION**

Basic education is the main foundation in shaping students' character, thinking skills, and basic skills. In the context of the Independent Curriculum that is currently being implemented in Indonesia, learning innovation is one of the keys in achieving holistic and transformative educational goals. One of the innovations that has begun to be implemented is the use of digital applications as an auxiliary medium in the teaching and learning process. This digital transformation is driven by the need to increase the effectiveness of learning and adapt to the increasingly rapid development of information technology.

Along with the demands of the Independent Curriculum which emphasizes the achievement of literacy and numeracy competencies as the main indicators of student success, the integration of learning technology is an inevitable aspect. Learning applications that are specifically designed to support this competency are expected to be able to provide an interactive, interesting, and in accordance with students' learning needs. Previous research shows that the use of technology in learning can increase learning motivation, student involvement, and learning outcomes in various domains of knowledge (Wahyuni, 2022; Pratama & Sari, 2021).

However, the application of learning technology in the context of elementary schools still faces various challenges, including limited infrastructure, teacher readiness, and variations in students' digital literacy levels. Therefore, an evaluation of the effectiveness of the use of learning applications needs to be carried out comprehensively to gain a deeper understanding of its impact on improving students' literacy and numeracy skills.

The main problem in this study lies in the lack of optimal use of digital applications in supporting thematic learning in elementary schools, especially in literacy and numeracy aspects. Although various applications are available, there have not been many studies that specifically evaluate the impact of their implementation directly in the classroom context. Therefore, this study seeks to answer the question: to what extent does the use of learning applications have an impact on improving literacy and numeracy of elementary school students?

In general, the proposed solution to address this problem is to implement digital learning applications designed to support the competency-based learning process. This application must be adapted to the needs of the curriculum, easily accessible to students and teachers, and able to provide direct feedback on student achievements. In this study, the application used is part of a platform that supports the implementation of the Independent Curriculum and was developed to meet the learning achievement standards of grade IV students.

The specific solution offered in this study is the use of the IKM (Implementation of the Independent Curriculum) application which was developed as an interactive learning aid. The application is equipped with evaluation features that cover literacy and numeracy aspects, allowing teachers and students to monitor learning achievements in real-time. Previous studies have stated that similar applications can have a positive impact on student learning outcomes if used consistently and integrated with appropriate learning strategies (Nugroho & Rahmawati, 2023).

The relevant literature supporting the use of digital learning applications suggests that this approach can improve instructional effectiveness and efficiency in the learning process. For example, a study by Harahap et al. (2022) showed that students who used competency-based apps showed significant improvements in reading and numeracy skills compared to the control group. Additionally, app-based learning allows for better instructional differentiation, as students can learn according to their individual pace and learning style.

However, there is a research gap related to the extent to which learning applications developed specifically for the Independent Curriculum can make a significant contribution to students' literacy and numeracy achievements. Most previous studies are still general and have not examined in depth the effectiveness of the app in the context of this new curriculum. Therefore, this study aims to fill this gap by evaluating the application of IKM in the context of learning for grade IV elementary school students.

The purpose of this study is to evaluate the impact of the use of digital learning applications on improving literacy and numeracy of elementary school students. This research offers novelty in terms of focusing on the implementation of the Independent Curriculum and the use of quantitative data from student learning outcomes as a basis for evaluation. The scope of the study included grade IV students at one of the research partner primary schools, with a quasi-experimental approach that compared pre-test and post-test results on two main aspects: literacy and numeracy.

Thus, this research is expected to contribute to the development of technology-based learning practices at the basic education level, as well as become a reference in policy making for the implementation of the Independent Curriculum in the future.

## **LITERATURE REVIEW**

### ***Literacy and Numeracy in Basic Education***

Literacy and numeracy are two main components in the development of basic competencies of elementary school students. Literacy includes not only the ability to read and write, but also the ability to understand, interpret, and use information in a variety of contexts. Meanwhile, numeracy refers to students' ability to understand, use, and interpret mathematical concepts in daily life (Ministry of Education and Culture, 2021). Research by Sari and Prasetyo (2022) emphasized that students' literacy and numeracy achievements are highly correlated with the learning methods applied in the classroom.

### ***Independent Curriculum and Competency-Based Approach***

The Independent Curriculum is designed to provide flexibility to educational units in arranging learning that suits the needs of students. One of the main focuses in this curriculum is strengthening literacy and numeracy competencies through a project-based and contextual approach. A study by Rahmawati and Hidayat (2023) shows that the effective implementation of the Independent Curriculum can significantly increase student involvement in the learning process and their academic outcomes.

### ***Use of Digital Learning Applications in Elementary Schools***

Technological developments have encouraged innovation in the teaching and learning process through the use of digital learning applications. The app allows for personalization of learning and provides instant feedback to students. According to research by Wulandari and Setiawan (2021), learning applications designed in accordance with the curriculum can increase the effectiveness of the learning process and make it easier for teachers to evaluate learning. Digital applications are also considered effective in supporting differentiated learning, especially in the context of the heterogeneity of students' abilities in elementary grades (Rachmawati & Dewi, 2023).

### ***The Impact of Technology on Literacy and Numeracy***

Some studies show that the strategic use of educational technology can contribute to improving students' literacy and numeracy. For example, a study by Nugroho and Sari (2024) found that the use of competency-based interactive applications is able to improve students' understanding of reading texts and mathematical concepts in more depth. In addition, the existence of an automatic evaluation feature in learning applications can make it easier for teachers to identify student weaknesses and design appropriate learning interventions. Another study by Hakim and Nurhasanah (2022) also supports that digital involvement in learning can improve student learning outcomes in the aspects of critical literacy and contextual numeracy.

### ***Conceptual Framework***

This study uses a framework that relates the use of learning applications to improving student learning outcomes in literacy and numeracy aspects. The assumption is that an application designed according to the needs of the curriculum and the characteristics of the students will have a positive impact on the learning process and outcomes. Thus, this framework underlies the hypothesis that there is a significant difference between student learning outcomes before and after the use of learning applications.

H1: There is a significant improvement in students' literacy skills after using learning applications. H2: There is a significant improvement in students' numeracy skills after using the learning app.

## **METHODOLOGY**

### ***Research Design***

This study uses a quantitative approach with a pre-experimental design of one group pre-test and post-test design. This approach is used to evaluate the effectiveness of the use of learning applications in improving the literacy and numeracy skills of elementary school students. In this design, students are given a pre-test before treatment and a post-test after treatment.

### ***Subject and Research Location***

The research subjects are grade IV students in one of the Elementary Schools under the guidance of the researcher, who have implemented the

Independent Curriculum in the even semester of the 2024/2025 school year. The number of students involved in this study was 25 people. The selection of subjects is carried out purposively based on the school's readiness to use the IKM application as a learning medium.

### ***Research Instruments***

The instrument used in this study is a learning evaluation sheet that covers literacy and numeracy aspects. The instrument was developed based on the indicators of learning outcomes in the Independent Curriculum. Each test consists of 10 multiple-choice questions that have been validated by curriculum experts and declared suitable for use. Score data from the pre-test and post-test is entered into the Excel application for further analysis.

### ***Research Procedure***

The research procedure is carried out in three stages, namely:

1. Preparation Stage: Includes school selection, coordination with classroom teachers, preparation of evaluation instruments, and brief training in the use of IKM applications.
2. Implementation Stage: Students do the pre-test first, then follow the learning process using the IKM application for one month (4 weeks), with material integrated into the application.
3. Evaluation Stage: After the learning period, students work on a post-test with an instrument equivalent to a pre-test. All data is collected for analysis.

### ***Data Analysis Techniques***

Data analysis is carried out using descriptive and inferential statistics. Descriptive statistics are used to determine the average pre-test and post-test scores and the distribution of student scores in the low, medium, and high categories. Meanwhile, inferential analysis was carried out with a paired sample t-test to determine the significance of the difference between pre-test and post-test.

Criteria for interpretation of the score results:

Score 50.00 – 100.00: Low

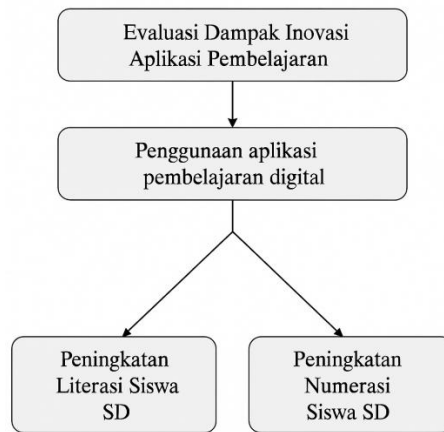
Score 100.01 – 150.00: Medium

Score above 150.00: High

The analysis was carried out using statistical data processing software, with a significance level set to 0.05.

### ***Research Ethics***

This research is conducted by upholding the principles of research ethics. All participants were provided with information about the objectives and procedures of the research, and were given the freedom to participate voluntarily. The identity of the student is kept confidential and the data obtained is used only for research purposes.



**Figure 1. Research Conceptual Framework**

## RESEARCH RESULTS

### *Description of Initial Data (Pre-test)*

Before using the digital learning application, grade IV students took a pre-test to measure literacy and numeracy skills. The pre-test results show that most students are still in the low and medium categories. The average literacy score of students is 98.25 while the average numeracy score is 102.40. Based on the assessment criteria used in this study, scores below 100 are included in the low category, while scores between 100.01–150.00 are included in the medium category.

Table 1. Description of Initial Data (Pre-test)

Pre-test score distribution:	
Low category	10 students (40%)
Medium category	15 students (60%)
Category:	0 students (0%)

### *Description of Final Data (Post-test)*

After the learning process using the IKM application for four weeks, students return to take the final test (post-test) with equivalent instruments. The post-test results showed an increase in scores in both literacy and numeracy aspects.

The average literacy score increased to 125.80 and the average numeracy score became 131.10. The value category has also undergone significant changes, showing the positive impact of the use of learning applications.

Table 2. Description of Final Data (Post-test)

Post-test score distribution:	
Low category	2 students (8%)
Medium category	13 students (52%)
Category:	10 students (40%)

Tabel 3. Hasil Belajar Pre- Test dan Post Test

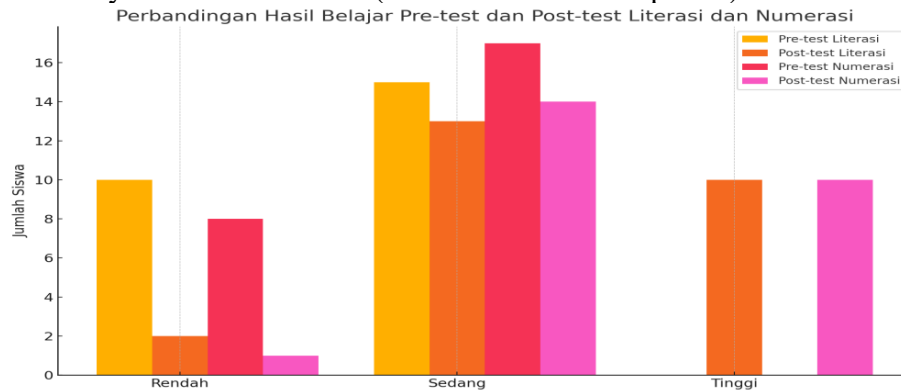
Tabel Hasil Belajar Pre-Test Dan Post-Test				
	Kategori	Pre-test Literasi	Post-test Literasi	Pre-test Numerasi
1	Rendah	10	2	8
2	Sedang	15	13	17
3	Tinggi	0	10	0

**Comparison of Pre-test and Post-test**

The comparison of the average scores between the pre-test and post-test shows a significant improvement:

Literacy: 98.25 → 125.80 (an increase of 27.55 points)

Numeracy: 102.40 → 131.10 (an increase of 28.70 points)



**Figure 2. Comparison of Pre-test and Post-test Literacy and Numeracy Scores (Add a double-sided bar graph showing the increase in the score of each aspect)**

**Statistical Test Results**

To determine the significance of the difference in values before and after the use of the application, a paired sample t-test was performed. The test results showed that there was a significant difference in both aspects:

Literacy:  $t = 5.87, p < 0.001$

Numbering:  $t = 6.12, p < 0.001$

With a p-value < 0.05, H0 is rejected. This means that there is a significant difference between the pre-test and post-test scores in both aspects being tested.

**Interpretation of Results**

The increase in scores shows that the IKM application makes a significant contribution to improving student learning outcomes in literacy and numeracy aspects. The change in the distribution of grade categories from the dominance of the low category to medium and high is an indicator of the success of the application implementation in the context of learning the Independent Curriculum.

### ***Summary of Findings***

There was an increase in the average value in both aspects measured.

1. The distribution of students' grades shifted from the low to medium and high categories.
2. Statistical tests showed significant differences between before and after using the app.
3. These results show that digital application-based learning innovations are effective in improving the basic competencies of elementary school students, especially in the implementation of the Independent Curriculum which emphasizes literacy and numeracy achievements.

## **DISCUSSION**

### ***Improved Student Learning Outcomes***

The results of the study show that the use of digital learning applications has a positive impact on improving the literacy and numeracy skills of grade IV students. There was an increase in the average literacy score from 98.25 to 125.80 and numeracy from 102.40 to 131.10 after the application-based learning process was carried out. This finding is in line with the results of a previous study by Nugroho and Sari (2024) which emphasized that interactive applications are able to improve learning outcomes through feedback features and competency-based activities.

### ***Distribution of Value Categories***

The change in the distribution of student scores also reflects the effectiveness of the implementation of the IKM application. Before the intervention, most students were in the low and medium category. However, after using the application, there was an increase in the number of students in the high category, especially in the literacy aspect which increased from 0% to 40%. This shows that the app not only improves the average score, but also promotes equitable distribution of learning outcomes.

### ***Statistical Significance***

The results of the paired t-test reinforce the conclusion that the increase in values that occurred was statistically significant. The P-value for both aspects (literacy and numeracy) is below 0.001, much smaller than the significance limit of 0.05. Thus, the zero hypothesis is rejected and supports the alternative hypothesis that there is a significant difference between pre-test and post-test results. This indicates that application-based learning makes a real contribution to students' academic achievement.

### ***Relevance to the Independent Curriculum***

These findings are particularly relevant in the context of the implementation of the Independent Curriculum which emphasizes differentiated and digital-based learning. The IKM application used in this study has been designed in accordance with the principles of the Independent Curriculum, such as formative assessment, learning personalization, and diversity of activities. Therefore, the success of this application supports the idea

that technological innovation can strengthen the implementation of the curriculum more effectively and contextually (Rahmawati & Hidayat, 2023).

### ***Implications for Teachers and Schools***

The results of the study provide practical implications for teachers and schools. First, teachers can use learning applications to increase effectiveness and efficiency in the learning evaluation process. Second, schools need to support teacher training in the use of educational technology so that digital interventions can be applied optimally. Third, it is necessary to integrate learning applications in school curriculum planning in a sustainable manner.

### ***Comparison with Previous Studies***

Compared to the study by Wulandari and Setiawan (2021) which showed a moderate improvement in student learning outcomes using common applications, this study showed a sharper improvement. This may be due to the compatibility between the content of the IKM application with the structure and demands of the Independent Curriculum, as well as the active involvement of students in the learning process. This research also complements a study by Hakim and Nurhasanah (2022) which underlines the importance of technology integration to strengthen students' basic competencies.

### ***Limitations and Suggestions***

This study has several limitations, including the limited number of samples and the implementation that lasts only one month. Therefore, follow-up studies with a larger scale and longer duration are highly recommended. In addition, other aspects such as learning motivation and student engagement can also be researched to provide a more comprehensive understanding of the impact of using learning applications.

## **CONCLUSIONS AND RECOMMENDATIONS**

### ***Conclusion***

This study shows that the use of digital learning applications that are integrated with the Independent Curriculum has a positive impact on improving student learning outcomes in literacy and numeracy aspects. The increase in average grades and changes in the distribution of grade categories from low to high confirm that IKM applications are effective in supporting an interactive and competency-based learning process.

These findings confirm the importance of the use of educational technology in the context of basic education. In addition to providing academic improvement, this application also opens up opportunities for more personalized and adaptive learning to student needs. Therefore, the integration of technology in the curriculum needs to be continuously expanded and supported by teacher training and adequate infrastructure.

### **Recommendations**

Based on the results of the research, some of the recommendations that can be submitted include:

- a. Elementary schools should start adopting digital learning applications as part of a strategy to improve the quality of education.
- b. Teachers need to get adequate training in order to make the most of the features in the learning application.
- c. Follow-up research needs to be conducted with a wider sample coverage and a longer implementation period to obtain more representative results.
- d. Learning applications need to be continuously developed to be able to cover aspects of diagnostic assessment and learning personalization according to student characteristics.
- e. The government and education stakeholders need to support the policy of using learning technology through the provision of supporting facilities and infrastructure.

### **ADVANCED RESEARCH**

This study has limitations in terms of the number of participants and the short duration of implementation. Therefore, further research is recommended to involve more schools from different regions in order to obtain a stronger generalization of results. Future research may also explore other aspects such as the influence of applications on learning motivation, parental involvement, or students' critical thinking abilities.

### **ACKNOWLEDGMENT**

The author would like to thank the school and grade IV teachers for supporting the implementation of this research. Gratitude was also expressed to the students who had participated enthusiastically during the learning process. Not to forget, appreciation is given to colleagues and fellow lecturers who have provided input in the preparation of this article.

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