

# Evaluating the Effectiveness of the iPusnas in Enhancing Elementary Students' Numeracy Skills

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## Abstract

**Background of the study:** Integrating digital resources in education is increasingly important for enhancing student learning experiences and outcomes. This study examines the impact of using iPusnas e-books on the numeracy skills of fifth-grade elementary school students.

**Purpose:** The primary aim of this study was to determine the effectiveness of iPusnas e-books in improving the numeracy skills of elementary school students compared to traditional learning methods using textbooks.

**Method:** A quasi-experimental design with a non-equivalent control group was employed. The sample consisted of two fifth-grade classes from SD Muhammadiyah 1 Wonopeti, Yogyakarta, Indonesia. One class served as the experimental group using iPusnas e-books, while the other served as the control group using traditional textbooks. Pre-tests and post-tests were administered to assess numeracy skills. Data were analyzed using T-tests and N-Gain tests.

**Findings:** The results indicated a significant improvement in the numeracy skills of students in the experimental group compared to the control group. iPusnas e-books were more effective than traditional textbooks, as evidenced by higher post-test scores and N-Gain values.

**Conclusion:** The study concludes that iPusnas e-books significantly enhance numeracy skills in fifth-grade students, highlighting the potential of digital learning resources to improve educational outcomes.

**Keywords:** E-book, numeracy skills, digital learning, elementary school

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## Introduction

Numerical literacy, which refers to the ability to use mathematical symbols to analyse, interpret findings, and solve real-life problems, is critical for students' success ([Sugianto & Utomo, 2024](#)). Numerical literacy is crucial as it equips students with the skills needed to tackle real-life issues involving mathematical concepts ([Firdaus et al., 2017](#)). Developing numerical literacy requires a strong connection to problem-solving in mathematics. Presenting and solving mathematical problems stimulates diverse thinking, explores mathematical concepts, symbols, and logical relationships, and fosters perseverance and creativity in problem-solving strategies ([Singer, 2018](#)). However, the 2018' Program for International Students Assessment (PISA) revealed that Indonesian students scored an average of 379 in math numeration, compared to the Organization for Economic Co-operation and Development (OECD) average of 487 (Ministry of Education and Culture, 2019). This significant gap highlights the urgent need to improve mathematical education in Indonesia.

The government has proposed leveraging information and communication technology (ICT) in education to address these challenges. Digital libraries, in particular, play a pivotal role in modern education by facilitating access to diverse learning materials and promoting literacy among students ([Inamdar, 2021](#)). According to the Ministry of Education and Culture (2019), key issues in Indonesia's education sector include the distribution and quality of teachers and resources. Digital libraries can mitigate some of these issues by providing equitable access to high-quality educational resources across various regions. One digital platform is iPusnas, developed by the National Library of Indonesia. These digital platforms allow users to access e-resources from anywhere and at any time, significantly enhancing the reach and efficiency of information dissemination. By offering a wealth of e-books and other digital resources, iPusnas supports enhancing student literacy.

The presence of digital libraries in the context of students can enhance their digital literacy ([Praseptiawan et al., 2019](#); [Rafi et al., 2019](#)). Additionally, digital libraries can promote reading interest due to easy access to student library collections. However, based on research findings, only a few digital libraries offer their users educational content ([Vrana, 2017](#)). The study recommends that national libraries prepare the necessary materials for teachers and students.

Moreover, research has consistently shown that digital libraries can positively impact students' academic performance and literacy skills, particularly among elementary school students. A study ([Huang et al., 2012](#)) found that mobile digital libraries enhanced elementary students' reading comprehension and motivation, providing easy access to a wide range of reading materials and interactive learning tools. Additionally, research by [Ciampa \(2014\)](#) indicated that mobile digital libraries fostered a love for reading and improved literacy skills among elementary school students through interactive and engaging content.

Wan [Ng's \(2015\)](#) research findings indicate that technology-driven cognitive learning processes and sustainable pedagogy through technology yield effective student learning outcomes. He focuses on the ways the younger generation learns with technology, particularly through digital literacy and multiliteracies. Ng asserts that the pursuit of lifelong learning involves engaging with digital technology and mobile devices on an individual level. Thus, empowering individuals with digital literacy, mobile learning literacy, and multiliteracies is essential for their personal development. The ongoing advancement of technological tools significantly impacts not only teaching and the professional growth of teachers but also how students learn mathematics ([Clark-Wilson et al., 2020](#)). Key elements for the successful integration of digital technology in mathematics education include the design of the digital tools and the tasks that leverage their pedagogical potential, the teacher's role, and the educational context ([Drijvers, 2015](#)).



Furthermore, iPusnas, Indonesia's national digital library, has proven to be an invaluable student resource, providing many educational benefits. By offering easy access to a vast collection of books, journals, and other academic resources, iPusnas supports students in their academic pursuits, fostering a culture of reading and continuous learning. The digital platform allows students from various regions, including remote areas, to access high-quality educational materials that may not be available locally, thereby bridging the educational resource gap ([Hendrayanto et al., 2022](#)). Additionally, iPusnas's interactive features ([Puspita & Irwansyah, 2018](#)), such as personalised book recommendations and user reviews, enhance the learning experience by engaging students more deeply with the content. Also, the platform's integration with mobile devices ensures that students can study on the go, making learning more flexible and adaptable to their schedules. iPusnas significantly improves students' academic performance and literacy, promoting a more inclusive and equitable educational landscape in Indonesia.

While digital libraries like iPusnas provide significant benefits, their potential in enhancing numerical literacy specifically has not been fully explored. Previous studies have focused on the general advantages of digital libraries, but there is a gap in research regarding their impact on specific educational outcomes, such as numerical literacy. This study aims to fill that gap by investigating how iPusnas e-books can enhance the numeracy skills of elementary school students.

Furthermore, implementing digital libraries in schools could address various educational challenges, including the lack of resources and the quality of educational content. By integrating digital libraries into the curriculum, schools can provide students with continuous access to updated and relevant educational materials, thereby supporting their learning process more effectively.

## Method

### *Research Type*

This quantitative study employed a quasi-experimental design with a non-equivalent control group design.

### *Population and Sample*

The population of this study consisted of fifth-grade elementary school students. The sample was determined using a simple random sampling technique involving two classes: Class V B, with 18 students as the control group, and Class V A, with 16 students as the experimental group. The simple random sampling technique was applied by randomly selecting classes from the fifth grade, ensuring each class had an equal chance of being chosen.

### *Research Location*

The research was conducted at SD Muhammadiyah 1 Wonopeti in Yogyakarta, Indonesia.

### *Data Collection*

Data collection involved administering tests to assess students' numeracy skills. The tests included multiple-choice questions, complex multiple-choice questions, and essays, totalling 15 questions related to data presentation materials. The test instrument was administered twice, as a pre-test before the intervention and as a post-test after the intervention. The tests were conducted in the classroom during regular school hours, and students were given a fixed amount of time to complete each test.



### *Intervention Details*

The control group underwent traditional learning methods utilising textbooks, while the experimental group utilised electronic library books from iPusnas. The traditional learning methods included teacher-led instruction and textbook exercises, while the iPusnas e-books provided interactive content and digital resources to enhance learning.

### *Instrument Validity*

The validity of the instrument was established through content validity. The instrument was initially assessed by an expert in mathematics, specifically a university lecturer. This assessment ensured that the test items were appropriate and comprehensively covered the relevant content areas.

### *Data Analysis*

Quantitative data represented numerically, were analysed by testing hypotheses using T-tests and the N-Gain test. Before these tests, prerequisite tests such as normality and homogeneity were conducted to ensure the data met the necessary assumptions. The N-Gain test was used to determine the increase in students' numeracy skills after the treatment using iPusnas e-books. This increase was calculated based on students' pre-test and post-test scores. The data analysis was conducted using statistical software (e.g., SPSS) to ensure accurate and reliable results.

## **Result and Discussion**

### *Pre-test results*

The pre-test was carried out before treatment. This test was to find out students' initial numeracy skills. The pre-test results can be good if the students' numeracy skills between the two groups are not significantly different. The pre-test results showed that the comprehension abilities between the control and experimental groups were relatively the same. The mean score in the pretest for the control and experimental groups can be seen below.

Table 1. Mean scores on the pre-test

Pre-test	
Control	59.2
Experimental	59.8

### *Post-test results*

The post-test aimed to evaluate the numerical abilities of the students in both groups after the treatment. The experimental group used the iPusnas e-book, while the control group used traditional textbooks. The post-test results showed a significant improvement in the experimental group compared to the control group, with mean scores of 86.3 and 71.1, respectively.

Table 2. Mean Score on the Post-test

Post-test	
Control	71.1
Experimental	86.3

### *Normality and homogeneity tests*

The normality test using the Kolmogorov-Smirnov method indicated that the pre-test and post-test data were normally distributed, with significance values of 0.889 and 0.528, respectively.



Table 3. Results of the normality test

	Pre-test	Post-test
Number	34	34
Significance	.889	.528

The homogeneity of variance test showed that the post-test data were homogeneous, with a significance value of 0.676.

Table 4. Results of the homogeneity test

Homogeneity of variance	Sig.
Post-test	0.676

### Hypothesis testing

The hypotheses tested were:

1. Null hypothesis ( $H_0$ ): There is no significant difference in the increase in numeracy skills of fifth-grade elementary school students using the iPusnas e-book.
2. Alternative hypothesis ( $H_1$ ): There is a significant difference in the increase in numeracy skills of fifth-grade elementary school students using the iPusnas e-book.

An independent t-test was conducted on the post-test data, showing a significance value of 0.000, indicating a significant difference between the two groups.

The hypothesis was tested using a t-test and N-Gain test. This test obtained information about differences in students' numeracy skills using the iPusnas e-book and conventional learning. The t-test was only carried out on the post-test data. The requirement for the t-test was normal data distribution, both homogeneous and non-homogeneous.

Based on the normality test and homogeneity test, it can be concluded that the data are typically distributed and homogeneous. Thus, the analysis used the Independent t-test, where the data were declared significantly different if the significance value was less than 0.05. The result of the t-test can be seen below:

Table 5. Results of the independent t-test

Posttest	T	df	sig
Assumed variance	11.303	32	.000
Non-assumed variance	11.486	31.322	.000

Based on Table 5, the significant value of the data is 0.000. It is less than 0.05, so the two data groups are significantly different. Therefore,  $H_0$  is rejected, and  $H_1$  is accepted.

### N-Gain test

The N-Gain test was used to measure the effectiveness of the iPusnas e-book. The experimental group had an average N-Gain score of 65.8% (quite effective), while the control group had an average N-Gain score of 28.6% (ineffective):

Table 6. Results of the n-gain test

Statistic	Experimental Group	Control Group
	N-Gain	
Max	77.50	44.64
Min	54.55	0.00
Average	65.8	28.6



The results of this study highlight the significant impact of using digital resources, such as the iPusnas e-book, on improving students' numeracy skills. The experimental group, which utilised the e-books, showed a substantial improvement in their post-test scores compared to the control group. This finding is consistent with previous research indicating that digital learning tools can enhance student engagement and learning outcomes ([Khikmawati et al., 2021](#); [Owolabi, 2016](#)).

Digital learning resources provide interactive and engaging content that can cater to different learning styles, which is often not possible with traditional textbooks. The significant improvement in the experimental group's numeracy skills suggests that e-books can offer a more personalised learning experience, allowing students to learn at their own pace and revisit challenging concepts as needed ([Tang & Barnett-Ellis, 2017](#)). Furthermore, the interactive features of e-books, such as quizzes and multimedia content, have been shown to enhance student motivation and understanding of complex subjects ([Huang et al., 2012](#); [Yorganci, 2022](#)).

Moreover, the N-Gain analysis indicates that using iPusnas e-books was quite effective, with an average N-Gain score of 65.8%. This suggests that digital resources are not just supplementary tools but can be primary resources in enhancing numeracy skills. This finding aligns with the study by [Wibowo \(2020\)](#), which demonstrated that digital library applications positively influence students' learning outcomes. Additionally, previous researches found that integrating digital educational resources significantly improves student performance and engagement ([Francescucci et al., 2020](#); [Rashid & Asghar, 2016](#)).

The use of e-books like iPusnas can revolutionise traditional teaching methods. Teachers can integrate e-books into lesson plans to provide more interactive and engaging content. E-books often come with multimedia features such as videos, animations, and interactive quizzes that can help clarify complex mathematical concepts and make learning more enjoyable for students. This aligns with previous findings that digital technology can enhance student motivation and engagement ([Fadda et al., 2022](#); [Tang et al., 2022](#)).

Moreover, the flexibility and accessibility of e-books mean that students can learn at their own pace and revisit challenging material as needed, which supports differentiated learning approaches. Teachers can also use the data from these digital tools to track student progress and tailor instruction to meet individual needs more effectively. These findings also have important implications for educational policymakers. Policies that support integrating technology in classrooms, such as providing e-books and digital devices to students, can contribute significantly to improving learning outcomes. Additionally, enhancing professional development and training for teachers in using digital technology is crucial so that they can fully leverage the potential of e-books in instruction. Government programs that ensure access to high-quality digital resources can help bridge educational gaps, particularly in under-resourced areas.

The findings also support the view that integrating Information and Communication Technology (ICT) into education is crucial for modernising teaching methods and improving learning efficiency. [Fathurrahman et al. \(2019\)](#) noted that technological advancements are essential for updating learning concepts to be more efficient, effective, and flexible. This study provides empirical evidence that digital tools can significantly enhance educational outcomes, particularly in developing critical skills such as numeracy. [Miller \(2018\)](#) found that enhancing numeracy skills and maintaining high levels of engagement in children learning mathematics are significantly impacted by the interactive use of technology. Key factors that influence this interactive use include the quality of the applications; creative and enjoyable applications, in particular, help boost children's involvement in mathematics learning.

Furthermore, the significant difference in numeracy skills improvement between the



control and experimental groups underscores the importance of adopting digital learning resources in educational settings. [Nurhayati & Zuhra \(2020\)](#) emphasise that the successful integration of technology in education relies on the effective use of digital learning resources, which this study supports. Similarly, a study by [Ross et al. \(2020\)](#) highlighted that digital resources can bridge learning gaps and provide equal learning opportunities for students from diverse backgrounds when adequately implemented.

Beyond the direct educational benefits, digital resources such as e-books can be pivotal in fostering a more inclusive and accessible learning environment. Students who struggle with traditional textbooks, whether due to physical disabilities or learning differences, can find e-books more adaptable and accommodating. This flexibility is essential in ensuring that all students have the opportunity to succeed, which aligns with the broader goals of educational equity and inclusion ([Henderson et al., 2017](#)).

Additionally, the sustainability aspect of digital resources should not be overlooked. E-books and other digital learning tools reduce the need for physical materials, which can significantly decrease the environmental footprint of educational institutions. As schools and universities strive to become more sustainable, the shift towards digital learning resources presents a viable solution that supports both educational and environmental objectives ([Henderson et al., 2017](#)).

In conclusion, using iPusnas e-books proved to be an effective tool for improving numeracy skills among fifth-grade students at SD Muhammadiyah 1 Wonopeti, Yogyakarta, Indonesia. The significant improvement in the experimental group's post-test scores and the positive results from the N-Gain analysis highlight the potential of digital learning resources to enhance educational outcomes. Future research should explore the long-term effects of digital resources on various aspects of student learning and investigate the potential benefits across different subjects and educational levels.

## Conclusion

In conclusion, the use of iPusnas e-books has been shown to enhance the numeracy skills of fifth-grade elementary school students significantly. The study demonstrated that students who used these digital resources outperformed their peers who relied on traditional textbooks. This improvement underscores the potential of technology-enhanced learning tools to provide more effective educational experiences and promote academic success. The findings are consistent with previous research highlighting the benefits of digital learning resources in boosting student engagement and achievement.

Despite the promising results, this study has several limitations. The sample size was relatively small and confined to a single school, which may limit the generalizability of the findings. Additionally, the study was conducted over a short period, which might not fully capture the long-term effects and sustainability of the improvements observed. The quasi-experimental design, while robust, cannot eliminate the influence of potential confounding factors.

Future research should include more extensive and diverse samples from multiple schools and regions to enhance the generalizability of the findings. Longitudinal studies are recommended to explore the long-term impacts of incorporating e-books into elementary school curricula on students' numeracy skills and overall academic performance. Further investigation could also focus on other factors influencing student engagement and achievement, such as the role of teacher facilitation, parental involvement, and the integration of additional digital tools. Additionally, exploring the effects of e-books on different subject areas and educational levels would provide a broader understanding of the benefits and challenges associated with digital learning resources. By addressing these areas, future research



can contribute to developing more effective and inclusive educational strategies, ultimately enhancing the learning experience for students.

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### Authors' Contributions

All authors have contributed to the final manuscript. The contribution of all authors: conceptualization, methodology, formal analysis, writing original draft preparation, writing review and editing. All authors have read and agreed to the published version of the manuscript.

### Conflict of Interest

The authors declare no potential conflict of interest regarding the publication of this work. In addition, the authors have completely witnessed ethical issues, including plagiarism, data fabrication, double publication and/or submission, and redundancy.

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