THE EFFECT OF USING E-BOOKS AS A LEARNING MEDIUM ON FOUTH-GRADE STUDENTS' CONCEPTUAL UNDERSTANDING OF THE TOPIC "CHANGES IN THE STATE OF MATTER

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Abstract
This study aims to analyze the effect of using e-books as a learning medium on fourth-grade students' conceptual understanding of the topic of changes in the state of matter. The study employed a quantitative approach using a pre-experimental design, specifically a one-group pretest–posttest design. The study was conducted at Karangpawulang Elementary School, Cimalaka Subdistrict, Sumedang Regency, West Java, with 37 students as research subjects, consisting of 20 boys and 17 girls. Data collection techniques included tests (pretest and posttest), observation, questionnaires, and documentation. The data were analyzed using descriptive statistics, the Shapiro–Wilk normality test, the Wilcoxon Signed-Rank test, N-Gain calculations, and effect size (Cohen's d). The results showed that the students' average scores increased from 74.19 on the pretest to 90.41 on the posttest. The percentage of students meeting learning standards also increased from 45.95% to 100% after instruction using e-books. The results of the normality test indicated that the pretest and posttest data were not normally distributed ($p < 0.05$); therefore, hypothesis testing was conducted using the Wilcoxon Signed-Rank test. Furthermore, an N-Gain value of 0.701 classified as high and an effect size (Cohen's d) of 1.424 classified as large were obtained, indicating that the use of e-books has a strong effect on improving students' conceptual understanding. Thus, e-books have been proven effective in enhancing students' conceptual understanding of the topic of changes in the state of matter and can serve as an alternative digital learning medium in elementary schools.

Keywords: *E-Book, Conceptual Understanding, Changes In The State Of Matter, Elementary School, Digital Learning.*

A. Introduction

Advances in information and communication technology have brought about significant changes in the world of education. The integration of digital technology into the learning process is one way to improve the quality of education while meeting the demands of 21st-century learning. Teachers are not only expected to master the subject matter but also to be able to utilize various innovative learning media to make the learning process more engaging, interactive, and learner-centered. One type of digital learning medium that is growing rapidly is the electronic book (e-book). E-books are learning tools that can combine text, images, audio, video, and animation, thereby presenting learning material in a more engaging way than printed books.

The use of e-books in learning provides students with the opportunity to learn more independently, flexibly, and interactively. Presenting material supplemented with illustrations, images, and multimedia can help students understand abstract concepts. At the elementary school level, the use of engaging learning media is essential because students are still in the concrete operational stage, so they find it easier to grasp concepts when supported by appropriate visual aids.

One science topic in fourth-grade elementary school that requires conceptual understanding is changes in the states of matter. This topic covers the concepts of melting, freezing, evaporation, condensation, sublimation, and crystallization. These concepts are often difficult to grasp if instruction relies solely on verbal explanations or textbooks. Therefore, learning media that can visualize the process of changes in the state of matter are needed so that students can connect scientific concepts to phenomena that occur in their daily lives.

Various studies show that digital learning media can improve the quality of the learning process and outcomes. Hanikah et al. (2022) state that the use of e-book-based learning media can increase students' interest in learning and their engagement in the learning process. Ginting and Simanora (2021) also report that e-books help students understand learning material more effectively because the material is presented in a more systematic, engaging, and accessible way. Furthermore, Fudin and Purwandari (2021) found that the use of 3D PageFlip Professional-based e-books can improve elementary school students' conceptual understanding of science.

Based on the results of preliminary observations at Karangpawulang Elementary School, Cimalaka Subdistrict, Sumedang Regency, West Java, instruction on the topic of changes in the physical state of matter is still dominated by the use of textbook packages and the lecture method. This situation has caused some students to struggle with understanding the abstract concepts related to changes in the physical state of matter. Pretest results showed that out of 37 fourth-grade students, only 17 students (45.95%) met the Minimum Passing Criteria (KKM) of 75, while 20 students (54.05%) had not yet achieved the required level of learning. The students' average pretest score was 74.19, indicating that their conceptual understanding still needs to be improved.

These issues highlight the need for innovation in the use of learning media that can enhance students' conceptual understanding. One alternative that can be implemented is the use of e-books as a digital learning medium. E-books allow for a more interactive presentation of material through a combination of text, images, illustrations, and visual media, which is expected to help students better understand the concept of changes in the state of matter. In addition to improving conceptual understanding, the use of e-books is also expected to increase students' motivation, engagement, and participation during the learning process.

Based on this description, this study aims to analyze the effect of using e-books as a learning medium on the conceptual understanding of fourth-grade students regarding the topic of changes in the physical state of matter at Karangpawulang Elementary School, Cimalaka Subdistrict, Sumedang Regency, West Java. The results of this study are

expected to contribute to the development of digital learning media in elementary schools and serve as a reference for teachers in implementing more innovative and effective teaching methods to improve the quality of student learning outcomes.

B. Method

This study employed a quantitative approach using a pre-experimental design, specifically a one-group pretest–posttest design. This design was used to determine the effect of using e-books as a learning medium on students' conceptual understanding of the topic of changes in the state of matter. In this design, students took a pretest before receiving the treatment—learning via e-books—and a posttest after the learning activity was completed. The difference between the pretest and posttest scores was used to determine changes in students' conceptual understanding following the use of e-books.

The study was conducted at Karangpawulang Elementary School, Cimalaka Subdistrict, Sumedang Regency, West Java, during the second semester of the 2025/2026 academic year. The study population consisted of all fourth-grade students at Karangpawulang Elementary School. The sampling technique used was total sampling, as all members of the population were included as the study sample. The study sample consisted of 37 students, comprising 20 boys and 17 girls. The independent variable in this study was the use of e-books as a learning medium, while the dependent variable was students' conceptual understanding of the topic of changes in the state of matter.

Data collection techniques included tests, observations, questionnaires, and documentation. Tests were used to measure students' conceptual understanding before and after instruction through pretests and posttests. Observations were conducted to monitor the implementation of instruction and student activities during the learning process. Questionnaires were used to determine students' responses to the use of e-books, while documentation was used to supplement the research data in the form of photographs of learning activities, student attendance lists, and other supporting documents.

The research instruments consisting of pretest and posttest questions were developed based on learning outcome indicators for the fourth-grade elementary school curriculum on changes in the physical state of matter. Before use, the instruments were validated by experts to ensure content appropriateness, linguistic clarity, and the representativeness of the indicators being measured. Additionally, learning activity observation sheets and student response questionnaires were used as supporting instruments. Data analysis was conducted using descriptive and inferential statistics. Descriptive statistics were used to describe the mean, minimum, maximum, standard deviation, and the percentage of students who met the learning mastery criteria. Learning mastery was determined based on the Minimum Mastery Criteria (KKM) of 75.

Before hypothesis testing was conducted, the pretest and posttest data were tested for normality using the Shapiro–Wilk test. The test results showed that the pretest and posttest data were not normally distributed ($p < 0.05$); therefore, hypothesis testing proceeded using the Wilcoxon Signed-Rank test. Next, improvements in learning

outcomes were analyzed using N-Gain to determine the effectiveness of using e-books, while the magnitude of the treatment effect was calculated using the effect size (Cohen's d). All analyses were conducted at a significance level of $\alpha = 0.05$.

The research procedure consisted of three stages. The first stage was preparation, which included the development of instructional materials, the design of research instruments, and the validation of those instruments. The second stage was implementation, consisting of administering the pretest, conducting instruction using e-books, and administering the posttest. The third stage was data analysis, which involved processing the pretest and posttest results, analyzing observational data and questionnaire responses, and drawing conclusions based on the statistical analyses performed.

C. Finding and Discussion

Research Results

This study aimed to determine the effect of using e-books as a learning medium on fourth-grade students' conceptual understanding of the topic of changes in the state of matter. The study was conducted with 37 fourth-grade students at Karangpawulang Elementary School, consisting of 20 boys and 17 girls.

Pretest and Posttest Results

Before instruction using e-books began, students took a pretest to assess their initial proficiency. After the instructional process was completed, students took a posttest to measure the improvement in their conceptual understanding. The results of the descriptive analysis showed an increase in students' learning outcomes following the use of e-books.

Table 1. Descriptive Statistics of Pretest and Posttest Results

Statistics	Pretest	Posttest
Number of students	37	37
Average value	74,19	90,41
Minimum value	50	75
Maximum value	95	100
Standard intersection	16,35	9,67

Table 1 shows that students' average scores increased from 74.19 on the pretest to 90.41 on the posttest. In addition, the minimum score increased from 50 to 75, while the maximum score increased from 95 to 100. The standard deviation on the posttest was smaller than that on the pretest, indicating that students' learning outcomes after using the e-book became more evenly distributed.

Learning Mastery

Learning mastery is determined based on the Minimum Mastery Criteria (KKM) of 75.

Table 2. Student Learning Achievement

Category	Pretest	Posttest
Completed	17 student (45,95%)	37 student (100%)
Not yet finished	20 student (54,05%)	0 student (0%)

The data show that before the e-book-based instruction, there were still 20 students (54.05%) who had not met the minimum passing score. After the instruction, all students (100%) had achieved the minimum passing score.

Normality Test Results

A normality test was conducted using the Shapiro–Wilk test to determine the distribution of the pretest and posttest data.

Table 3. Results of the Shapiro–Wilk Normality Test

Variable	W	Sig. (p)	Keterangan
Pretest	0,891	0,0016	Abnormal
Posttest	0,824	<0,001	Abnormal

The test results show that the significance values for both the pretest and posttest are less than 0.05, indicating that the data are not normally distributed. Therefore, the hypothesis test was conducted using the Wilcoxon Signed-Rank Test.

Hypothesis Test Results

Based on the results of the Wilcoxon Signed-Rank Test, a significance value of $p < 0.05$ was obtained; thus, H_0 is rejected and H_1 is accepted. Thus, there is a significant difference between the pretest and posttest results. These results indicate that the use of e-books as a learning medium has a significant effect on students' conceptual understanding of the topic of changes in the state of matter.

N-Gain Results

An analysis of the improvement in learning outcomes was conducted using N-Gain.

Table 4. N-Gain Calculation Results

Average N-Gain	Category
0,701	High

The average N-Gain value of 0.701 falls into the high category, indicating that the use of e-books is effective in improving students' conceptual understanding.

Effect Size Results

The magnitude of the effect of using e-books was analyzed using Cohen's d.

Table 5. Effect Size Results

Cohen's d	Category
1,424	Large

A Cohen's d value of 1.424 indicates that the use of e-books has a large effect on improving students' conceptual understanding.

Discussion

The results of the study indicate that the use of e-books as a learning medium can improve fourth-grade students' conceptual understanding of the topic of changes in the state of matter. This improvement is evident in the increase in students' average scores from 74.19 on the pretest to 90.41 on the posttest. In addition, the learning achievement rate increased from 45.95% to 100%, indicating that all students met the minimum passing score after participating in the e-book-based instruction. E-books provide a more engaging learning experience compared to conventional instruction because they present material through a combination of text, images, illustrations, and visuals that help students understand the abstract concepts of changes in the state of matter. The visual presentation of the material makes it easier for students to connect scientific concepts with phenomena they encounter in their daily lives, thereby making the learning process more meaningful.

The results of the Wilcoxon Signed-Rank test showed a significant difference between pretest and posttest scores. This indicates that the improvement in learning outcomes was not due to chance but was influenced by the use of e-books in the learning process. This finding is supported by an N-Gain value of 0.701, which falls into the high category; thus, it can be concluded that e-books are effective in enhancing students' conceptual understanding. The magnitude of the effect of e-book use is also demonstrated by the effect size (Cohen's d) of 1.424, which falls into the large category. These results indicate that the use of e-books not only yields a statistically significant improvement but also has a strong practical impact on students' learning outcomes.

The findings of this study align with the research by Hanikah et al. (2022), which states that e-book-based learning media can increase student engagement and motivation. These results also support the study by Fudin and Purwandari (2021), which reported that the use of 3D PageFlip Professional-based e-books can improve the conceptual understanding of elementary school students. Furthermore, research by Ginting and Simanora (2021) indicates that e-books provide a more flexible and interactive learning experience and help students understand the material more deeply. Thus, the use of e-books as a learning medium can serve as an effective alternative to other digital learning media for enhancing elementary school students' conceptual understanding, particularly regarding the topic of changes in the physical state of matter.

D. Conclusion

This study shows that the use of e-books as a learning medium has a positive effect on improving the conceptual understanding of fourth-grade students regarding the topic of changes in the state of matter at Karangpawulang Elementary School, Cimalaka Subdistrict, Sumedang Regency, West Java. The results of the descriptive analysis show that students' average scores increased from 74.19 on the pretest to 90.41 on the posttest. The percentage of students meeting the learning mastery criteria also increased, from 17 students (45.95%) who met the Minimum Mastery Criteria (KKM) on the pretest to 37

students (100%) on the posttest. The results of the normality test using the Shapiro–Wilk test indicated that the pretest and posttest data were not normally distributed ($p < 0.05$). Therefore, hypothesis testing was conducted using the Wilcoxon Signed-Rank Test, which revealed a significant difference between the pretest and posttest results ($p < 0.05$). These results prove that the use of e-books as a learning medium has a significant effect on improving students' conceptual understanding. The effectiveness of using e-books is further supported by an N-Gain analysis result of 0.701, which falls into the "high" category, indicating that e-books are effective in improving student learning outcomes. Furthermore, the effect size (Cohen's d) of 1.424 falls into the "large effect" category, indicating that the use of e-books not only produces a statistically significant difference but also has a strong practical impact on improving students' conceptual understanding. Thus, e-books can serve as an effective alternative digital learning medium to enhance elementary school students' conceptual understanding, particularly regarding the topic of changes in the state of matter. The results of this study are expected to serve as a reference for teachers in developing more innovative, interactive, and student-centered learning experiences in the digital age.

E. Acknowledgment

The author offers praise and thanks to God Almighty for all His grace and blessings, which enabled this research to be successfully completed. The author would like to thank the Principal of Karangpawulang Elementary School, Cimalaka Subdistrict, Sumedang Regency, for granting permission and providing support throughout the research process. Thanks are also extended to the fourth-grade teacher and all fourth-grade students at Karangpawulang Elementary School for their participation and cooperation during the data collection process. The author also thanks the academic advisor for providing guidance, direction, and constructive feedback throughout the preparation of this research. Furthermore, the author expresses appreciation to all faculty members of the Elementary School Teacher Education Program at the Indonesia University of Education for sharing their knowledge and experience during the course of study. The author would also like to thank his parents, family, and everyone who offered prayers, motivation, and support, enabling the completion of this research. It is hoped that the results of this study will contribute to the development of learning in elementary schools, particularly regarding the use of e-book-based digital learning media to enhance students' conceptual understanding.

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