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The Influence of E-Books Through a Differentiation Approach Assisted with Professional Pageflip 3-Dimensions on Student Learning Outcomes on Simple Machines Topic

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Abstract: This research aims to test the effect of e-books through a differentiated approach assisted by page flip professional 3-dimensions on student learning outcomes on simple machine topics. The research uses a pre-test and post-test control group design involving two classes as samples. Using e-books through a differentiated approach can reduce the problem of unequal distribution of printed books and make it possible to adapt them to each student's learning style because each student has their learning style. This is shown through the hypothesis criteria where the significance value of 0.030 is smaller than the significance level of 0.05, so H0 is rejected, and Ha is accepted. This is also supported by acquiring an N-gain Score value of 0.81 in the experimental class, which meets the high category, and in the control class, 0.51, which meets the medium category. For the N-gain percent interpretation category, the results obtained in the experimental class were 81 in the effective interpretation category, while for the control class, the results were 51 in the less effective interpretation category. This indicates that e-books, through a differentiated approach assisted by page flip professional 3-dimensions, can improve student learning outcomes, especially in simple machine topics. This research concludes that e-books, through a differentiated approach assisted by page flip professional 3-dimensions, can be an effective alternative for improving the quality of science learning in schools.

Keywords: E-book; Pageflip Professional; Learning Outcomes; Simple Machines.

Introduction

The development of technology and information in the 21st century has triggered the transformation of society into knowledge, with easy access to the internet enriching global knowledge [1]. According to [2], the emergence of information and communication technology with its various programs has changed millions of people worldwide. As technology and information develop, every field, including education, significantly changes. Education is a basic need for every human being that can increase human dignity. With the development of technology and information, we can develop innovation in learning, making the educational process easier.

Based on the observations made at SMP Negeri 8 Paguyaman, student learning outcomes are still relatively low. The inadequate availability of printed science books at school is a factor in the low student learning outcomes, with the one-book system for some students resulting in less focus and less active students. Then, in implementing learning methods, teachers still often use the lecture method, which makes learning in the classroom passive because the teacher is considered the only source of knowledge, which, of course, will have an impact on students who cannot express their own opinions and answers, which of course also affects students' learning outcomes. Students who are still low. Teachers are expected to be able to find solutions to this phenomenon.

Regarding the limited number of printed books in schools, it is necessary to implement e-books in learning. E-books are easy to carry in multiple files, so teachers do not run out of learning topics for students. By using e-books in learning, students can access the topic via cell phone or laptop anywhere and at any time. This aligns with the opinion [3] that e-books as a learning medium can increase learning productivity. E-books have unlimited references, so do not use one learning source. E-books are easy to carry in multiple files, so teachers do not run out of learning topics for students. By using e-books in learning, students can access the topic via cell phone or laptop anywhere and at any time. Another opinion was expressed by [4] that electronic books offer more straightforward accessibility, flexibility, and interactivity, influencing the learning process and student learning outcomes.

Not only that, student learning outcomes, which are still relatively low, are also influenced by each student having a variety of learning styles, especially in science learning. This diversity can be seen during the ongoing learning process, including the fact that there are students who focus on learning and there are also students who focus on other activities. It does not rule out the possibility that the activities carried out by these students are to be able to receive ongoing learning. Not only in the process of receiving learning, when doing assignments, it can be seen that there are students who are not distracted by friends talking next to them, but there are also students who are seen just playing with books and pencils in front of them.

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Some students do their assignments while singing despite their low voices. The diversity of student learning styles makes it difficult for teachers to adapt learning delivery so all students can understand it.

The limitations of printed books and the diversity of learning styles that students have certainly result in less than optimal classroom learning, so it is necessary to apply differentiated teaching materials that develop science and technology to overcome the limitations of printed science books and the diversity of student learning styles. According to [5], learning by implementing e-books does not require carrying lots of heavy reading books, so study time is more effective and efficient, and the multimedia function can act as a tutor, making it easier for students to learn. In line with opinion [6], electronic books (e-books) can be viewed in multimedia format, which can be made as flipbooks. This e-book contains text, images, graphics, sound, animation, and video. E-books will increase students' interest and help them concentrate when studying. Learning that can facilitate the diversity of student learning styles is known as differentiated learning. According to [7], differentiated learning creates a diverse class by providing opportunities to obtain content, process ideas, and improve each student's results so that students can learn more effectively.

Learning by applying a differentiated approach is expected to solve the diversity of student learning styles, which requires adjustments so that students can understand the learning material. The use of e-books through a differentiated approach can help overcome the limited availability of printed books in schools because e-books can be accessed via students' laptops or mobile phones, and through a differentiated approach, students are given the freedom to learn according to their interests, either through watching learning videos, listening, reading or practicing. Learning material directly according to the e-book they have. Several research results show that the use of e-books through a differentiated approach assisted by Pageflip professional 3-dimensions also has a positive impact on student learning outcomes as research showed that the learning outcomes of students who use interactive media based on 3-dimensional Pageflip in science learning are better [8]. Better than the learning outcomes of students who do not use interactive media based on 3-dimensional Pageflip. Another research shows that 3D Pageflip Professional learning media affects student learning outcomes, with the average cognitive score of students in classes that apply 3D Pageflip Professional being higher than in classes that use Powerpoint media [9].

So, from the above problems, it is necessary to apply differentiated teaching topics that develop science and technology to overcome the limitations of printed science books and the diversity of student learning styles. According to [10], differentiated teaching topics can facilitate students according to their needs because each student has different characteristics, so they cannot be given the same treatment. Using e-books through a differentiated approach assisted by page flip professional 3-dimensions can solve the limitations of printed science books, the diversity of student learning styles, and learning centered on the teacher (teacher center) [11].

The advantages of e-books are fast traceability, more frequent modifications, portability, variation, readability, value-added features, and space-saving [12]. Another opinion was expressed [13]: it is hoped that this e-book will become one of the media used for distance learning. This e-book is designed like a book and makes it easier for students to read the topics because it is laid out considering students' reading abilities, even though it is a non-print book and can be accessed by all students. With several advantages, e-books can be the right solution to overcome the limitations of printed books in schools.

Differentiated learning has advantages over other learning, including meeting students' learning needs, maximizing the quality of learning, increasing student motivation, using a student-centered approach, students become more involved and focused in class, students can connect lessons with life and their values, students can hone their self-management skills, and students can improve their achievement [14]. Another opinion expressed by [15] is that students also become more enthusiastic about learning because they learn according to their interests and readiness. So, differentiated learning makes students more active and develops according to their interests and learning styles.

The e-book, using a differentiated approach assisted by page flip professional 3-dimensions, contains learning topics in the form of readings, learning videos, and end-of-chapter evaluations which can respond to every command given by students which are expected to be able to overcome the above problems and improve student learning outcomes. Based on the results of research regarding the development of e-books based on the page flip professional 3-dimensions application, a large-scale student response test obtained a score of 86.90%, which states that the use of digital books affects increasing student learning motivation and student learning outcomes because the e-book packaging is more attractive with images, videos, hyperlinks, and sound [16]. Research also supports this [17], which reveals that implementing differentiated learning with e-books can increase students' activity and learning outcomes in class 11 Biology 4 SMA Negeri 6 Metro.

Based on problems related to the limited number of printed books available in schools and the diversity of students' learning styles, the researcher wants to know the effect of e-books through a differentiated approach assisted by page flip professional 3-dimensions on student learning outcomes in simple machines topic. This research will help improve student learning outcomes by using a differentiated approach with the help of a page flip professional 3-dimensions application that can be adapted to student's needs and abilities so that students can more easily understand simple machine topics.

Research Methods

This research uses the True Experiment Design method, and the research design is a pre-test and post-test control group design. The research flow chart in Figure 1. This research was conducted at SMP Negeri 8 Paguyaman, whose address is Bongo Tua village, Paguyaman District, Boalemo Regency, Gorontalo Province. The population in this study refers to students in class VIII (VIII 1 and VIII 2) of SMP Negeri 8 Paguyaman in the Even Semester of the 2023/2024 Academic Year. This research used a saturated

sampling technique because it used the entire student population as a sample, namely the control and experimental classes. The sample used as the object of this research was all students in class VIII of SMP Negeri 8 Paguyaman, totaling 42 students. Determination of the experimental class and control class was carried out randomly using a draw. The instrument used in the research was a test instrument in the form of 10 essay questions, given before learning (Pre-test) and after participating in learning (Post-test). The research instrument used has been validated by two validators and is classified as very valid and reliable. The data analysis technique used is the prerequisite test, namely the normality test and homogeneity test. Hypothesis testing, and n-gain test. This research was also supported by implementation, student activities, and student questionnaires, which achieved perfect criteria in the experimental class and good criteria in the control class.

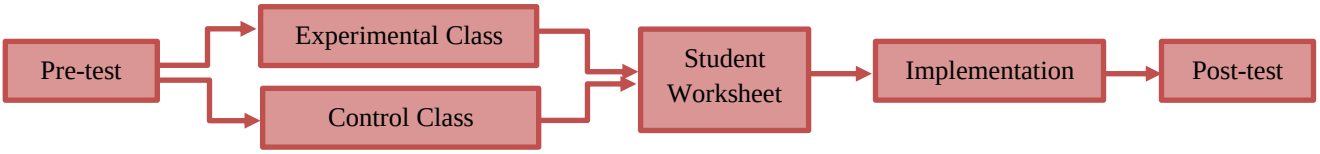

Figure 1. Research Flow Chart

Results and Discussion

This research discusses the effect of e-books through a differentiated approach assisted by page flip professional 3-dimensions on student learning outcomes in simple machine topics. The subject population in this study was the entire class VIII, which consisted of 2 study groups, namely class VIII 1 and class VIII 2. Both class populations were used as samples using a saturated sampling technique. It was found that class VIII 1 was the experimental class, and class VIII 2 was the control class using the sampling method, namely the random method. This research aims to determine the effect of e-books using a differentiated approach assisted by page flip professional 3-dimensions on student learning outcomes on simple machine topics.

Implementing e-book learning media aims to increase students' interest in reading books and solve the lack of printed books at school. This aligns with the opinion expressed by [3] that e-books as a learning medium can increase learning productivity. E-books have unlimited references, so do not use one learning source. E-books are easy to carry in multiple files, so teachers do not run out of learning topics for students.

The average pre-test score for experimental class students, namely 30.16, is higher than that for control class students, namely 27.57, with a difference of 2.59. The average post-test score for experimental class students, 86.38, is higher than the average pre-test score for control class students, 78.61, with a difference of 7.77. A comparison of the average scores for these learning outcomes can be seen in Figure 2.

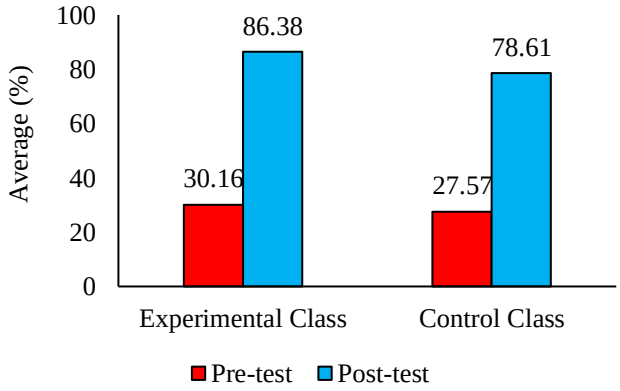

Figure 2. Average scores of pre-test and post-test results

Figure 2 shows the average pre-test and post-test scores on student learning outcomes. Student learning outcomes are the result of student abilities, which reflect the success of the learning process. Learning outcomes in the cognitive domain are student learning outcomes that focus more on intellectual aspects or intelligence in thinking. According to [18], The cognitive domain based on the revised Bloom's Taxonomy consists of 6 aspects: remember, understand, apply, analyze, evaluate, and create.

Students' cognitive learning outcomes are obtained through the results of working on questions in the form of pre-tests and post-tests, which include the ability to understand (C2), apply (C3), analyze (C4), and evaluate (C5). The results of students' cognitive skills in class VIII.1 of SMP Negeri 8 Paguyaman as an experimental class are shown in Table 1.

Table 1. Cognitive Achievements of Experimental and Control Classes

Cognitive Achievements	Experimental class (%)		Control Class (%)	
	Pre-test	Post-test	Pre-test	Post-test
C2	50	82	29	75
C3	25	90	25	86
C4	27	87	30	76
C5	30	86	30	76

Based on Table 1 regarding the percentage of cognitive achievements in the experimental class pre-test, the highest percentage was at cognitive level C2, namely 50%, and the lowest percentage was at cognitive level C3, namely 25%. In comparison, at cognitive level C4, it was 27%, and at cognitive level C5, it was 30%. This can happen because, at the C3 cognitive level, several questions are presented with answers requiring calculations so that

many respondents are fooled. At cognitive levels C4 and C5, the results show close to the cognitive level C3; this is because, at cognitive levels C4 and C5, respondents are directed to analyze and develop strategies so that understanding of the material is required. At the cognitive level, C2 got the highest pre-test results, namely 50%; the difficulty level of the questions can influence this. At the C2 cognitive level, respondents are directed to be able to differentiate, group, and describe answers, which, of course, include pictures in the questions to make them more transparent. In the post-test implementation, the highest percentage was shown at cognitive level C3, namely 89%. At cognitive level C4, it was 87%; at cognitive level C5, it was 86%; and at cognitive level C2, it was the lowest percentage of post-test scores in the experimental class, 82%.

In the control class, the cognitive achievement results of the pre-test were found to be that the highest percentage was at cognitive levels C4 and C5, with a gain of 30%. These results did not show much difference with cognitive level C2, with an increase of 29%. The lowest percentage of cognitive achievement in the pre-test was at cognitive level C3, with an achievement of 25%. This is because, in questions with cognitive level C3, questions that require calculations to complete are presented, so many respondents do not know the process of solving the questions. The percentage of students' cognitive achievements obtained in the post-test shows that C3 has a higher percentage than C2, C4, and C5. The increase was relatively high at cognitive level C3, with pre-test results increasing from 25% to 86%. At cognitive level C2, it was obtained 75%; at cognitive level C4, it was obtained 76%; and at cognitive level C5, it was obtained 76%.

The results of students' cognitive achievements are influenced by students' participation in the learning process, both in asking questions, expressing opinions, and working in groups. This aligns with the opinion [19] that students' activeness in learning is characterized by optimal student participation, intellectual, emotional, and physical. Student activities build knowledge and skills, thereby improving student learning outcomes. The level of student activity in the experimental and control classes increased with each meeting; however, in the experimental class, the level of student activity was in the high category, and the control class in the medium category.

Classroom learning implementation also influences the increase in students' cognitive percentage at each meeting. Data on the implementation of experimental and control class learning shows that the implementation of learning at each meeting is increasing and that the non-implementation of learning at each meeting is decreasing. However, the number of learning failures in the control class was more significant than in the experimental class. This also, of course, supports student activity in the learning process, which influences the cognitive achievements of students in the experimental and control classes. According to [20], students' activeness in learning activities aims to construct their knowledge and actively build a sense of everything they encounter in teaching and learning activities. This aligns with the opinion of [21] that activeness allows students to exchange opinions, collaborate, and interact with teachers, which can improve learning outcomes.

Data on learning implementation and non-implementation of learning in the experimental and control classes during four meetings are presented below, which can be observed in Figure 3.

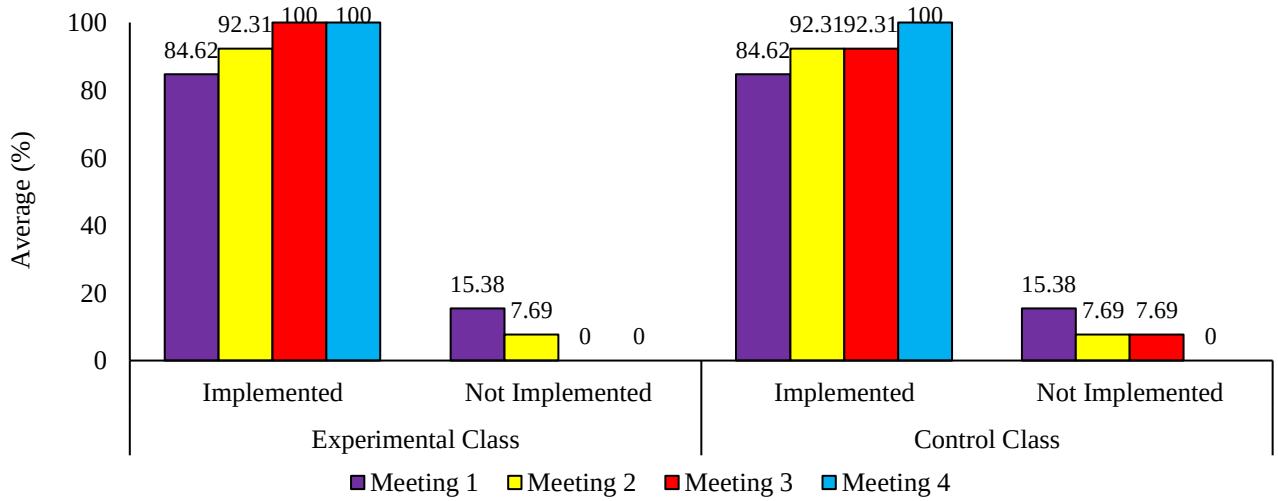

Figure 3. Analysis of Learning Implementation Data

Based on learning implementation data in Figure 3, it shows that learning implemented at each meeting is increasing, and non-implementation is decreasing. This, of course, supports student activity in the learning process, which influences student cognitive outcomes. This research also measured student questionnaires regarding student responses to learning that implemented e-books through a differentiated approach assisted by page flip professional 3-dimensions and printed books. Questionnaires are used to collect the information you want from respondents (students); with questionnaires, data can be obtained in qualitative and quantitative forms. Questionnaires support data in data collection, implementation of learning, and student activities in class. The average achievement of the indicator student questionnaire in the experimental class was in a suitable category; in the control class, the percentage range was in the sufficient category. The data obtained was then analyzed, including four tests: the normality test, homogeneity test, hypothesis test, and n-gain analysis.

Normality Test

Normality testing is a prerequisite test before hypothesis testing is carried out. According to [22], normality testing aims to determine whether the distribution of selected samples originating from a population is normal or abnormal. The Shapiro-Wilk test was used in this research because the data used was less than 100 samples in calculating the data normality test in the SPSS 27.0 program. The results of normality testing in the control and experimental classes are shown in Table 2 and Table 3.

Table 2. Normality test results of experimental pre-test and control pre-test

Normality Test	Number of Samples	Sig.	Information
Experimental pre-test	21	0.342	Normal
Control pre-test	21	0.308	Normal

Table 3. Normality test results of experimental post-test and control post-test

Normality Test	Number of Samples	Sig.	Information
Experimental post-test	21	0.092	Normal
Control post-test	21	0.174	Normal

Based on the test results in Table 2 and Table 3 in the experimental class pre-test, the significance value was > α, namely 0.342 > 0.05, so the data was normally distributed, and in the experimental class post-test, the significance value > α was obtained, namely 0.092 > 0.05, so the data was normally distributed. Testing the normality of the pre-test implementation in the control class resulted in a significance value > α, namely 0.308 > 0.05, so the data had a normal distribution, and post-test normality testing in the control class also had a normal distribution with a significance value > α, namely 0.174 > 0.05.

Homogeneity Test

The homogeneity test is a non-parametric statistical requirement used to check whether two or more sample groups have the same distribution of values [23]. It is carried out to ensure that the data group examined in the analysis process comes from a population whose diversity does not differ significantly [24]. The results of homogeneity testing in the control and experimental classes can be seen in Table 4.

Table 4. Data Homogeneity Test

Student Learning Outcome	Levene Statistics	df1	df2	Sig.
Based on Mean	1.171	1	40	0.286
Based on Median	1.091	1	40	0.303
Based on the Median and with adjusted df	1.091	1	39	0.303
Based on trimmed mean	1.092	1	40	0.302

Calculations show in Table 4 that the significance value of learning outcomes for experimental and control class students based on the mean is 0.286. The homogeneity test results show that the significance value (sig.) based on mean > 0.05, namely 0.286 > 0.05, means the data is said to be homogeneous.

Hypothesis Testing

Hypothesis testing is carried out after the prerequisite tests are met. The results of the normality test calculations and homogeneity tests that have been carried out show that the data has met the prerequisite tests. Hypothesis testing was carried out using the independent t-test at a significance level of 0.05. The results of hypothesis testing in the control and experimental classes can be seen in Table 5.

Table 5. Hypothesis Testing

Class	Average	Sig.
Experimental Post-test	86.48	0.030
Control Post-test	78.57	0.030

Based on the calculations' results in Table 5, the significance value of 0.030 is smaller than the significance level of 0.05, so H0 is rejected, and Ha is accepted. It is stated that using e-books through a differentiated approach, assisted by page flip professional 3-dimensions, influences student learning outcomes in simple machine topics.

Based on hypothesis testing, there are differences in learning outcomes between classes that apply e-books using a differentiated approach assisted by Pageflip professional 3-dimensions and classes that apply printed books. So, using E-books through a differentiated approach assisted by page flip professional 3-dimensions influences student learning outcomes in simple machine topics. The results of this research are supported by research conducted [8], which shows that the learning outcomes of students who use interactive media based on 3-dimensional page flips in science learning are better than those of students who do not use interactive media based on 3-dimensional page flips. According to [4], electronic teaching materials are used through a differentiated approach to integrate all available media to give students easy access to the learning resources they need according to their type and learning style. In line with the opinion in the educational context by [25], differentiated learning refers to understanding and recognizing the differences in students' needs, abilities, interests, and learning styles, as well as adapting instruction, materials, and learning strategies to meet the needs of each student.

E-books are an alternative to overcome the lack of sufficient teaching topics for students, especially in science learning, such as simple machine topics. This aligns with the opinion [3] that e-books as a learning medium can

increase learning productivity. E-books have unlimited references, so you do not use one learning source. E-books are easy to carry in multiple files, so teachers do not run out of learning topics for students. By using e-books in learning, students can access the topic via cell phone or laptop anywhere and at any time.

E-books also have many advantages compared to printed books, including the following: When using an e-book, the page you want to search for can be easily found, and the attraction of using a gadget is higher than a printed book. In line with research [26], most school students in Mojokerto use gadgets > 2 hours a day, with a percentage of 74.7%. Besides, e-books have more interesting features, such as learning videos, songs, educational games, and evaluation questions on websites. This opinion is in line with [27], who states that e-books and other digital books Have interesting features such as a link feature to access topics in the form of videos on YouTube, a link feature for practice questions, and barcodes.

E-book through a differentiated approach using the help of a page flip professional 3-dimensions application. According to [28], Page Flip Professional 3-dimensions is software that can be used to create PDF books in 3-dimensional form, which makes readers feel like they are reading an actual book. 3-dimensional page flip is a flash flipbook application that can transform PDF, Word, PowerPoint, and Excel files into flipbooks. Another opinion from [29] is that Page Flip Professional 3-dimensions is software that is used to create digital teaching topics that are more systematic and effective to make it easier for students to understand the lesson topic.

N-Gain Test

N-gain or normalized gain, which means normalized increase, is a method of measuring the effectiveness of learning or intervention in improving student learning outcomes [30]. The N-gain test measures the effectiveness of learning before learning (pre-test) and after learning (post-test). N-Gain testing uses SPSS 27.0 software. The N-gain test results for the experimental and control classes are in Table 6, then interpreted in Table 7 and Table 8 [31].

Table 6. N-gain Test Calculation Results

Class	Sample	N-Gain	Category
Experimental	21	0.81	High
Control	21	0.51	Medium

Table 7. Gain Value Categories

Gain Index	Criteria
g > 0.70	High
0.30 < g < 0.70	Medium
g < 0.30	Low

Table 8. Interpretation of N-Gain Effectiveness

Percentage (%)	Interpretation
< 40	Ineffective
40-55	Less effective
56-75	Enough effective
>76	Effective

Based on the N-Gain test in the experimental and control classes in Table 6, the Ngain Score value for the experimental class was 0.81, which met the high category. For the control class, it was in the medium category. The Ngain percent result obtained in the experimental class was 81 with the effectiveness interpretation category, namely Effective, while for the control class, the result was 51 with the effectiveness interpretation category, namely less effective.

Implementing e-book learning media aims to increase students' interest in reading books and solve the lack of printed books at school. This aligns with the opinion expressed by [3] that e-books as a learning medium can increase learning productivity. E-books have unlimited references, so you do not use one learning source. E-books are easy to carry in multiple files, so teachers do not run out of learning topics for students.

Using E-books through a differentiated approach assisted by page flip professional 3-dimensions as interactive multimedia for students, with varied displays, creates an enormous sense of curiosity so that students are more enthusiastic about learning, which can then influence student learning outcomes. This can be seen from the learning observations in each class, which show that in the experimental class, the score from the observation assessment of the implementation of learning was more significant than the score of the evaluation of the implementation observation in the control class. The learning implementation scores in the experimental and control classes were classified as good, namely in the 67-100% range. This data shows that there is no engineering to favor one class, and learning in the class is running as it should.

The learning model applied in research is Problem-Based Learning (PBL), an approach to learning that provides examples of authentic learning and focuses on problem-solving, aiming to develop students' independent learning skills. Learning by applying the PBL model seeks to increase student activity and independence. In learning that applies the PBL model, students can organize knowledge by building reasoning from all the knowledge they have from everything they have obtained due to interacting with others [32].

Using appropriate media and learning models will increase students' understanding of the topic and encourage active participation. Therefore, learning that combines media and effective learning models will improve student learning outcomes. In line with the opinion expressed by [33], namely that in improving learning outcomes, a learning model is needed in the teaching and learning process, one of which is utilizing learning technology in the form of learning media, which can improve student learning outcomes and can be used anytime and anywhere by students.

Using a differentiated approach assisted by pageflip professional 3-dimensions, E-books are interactive teaching topics that can solve the diversity of student learning styles. Equipped with interesting features such as audio and multimedia, students respond more actively to learning activities. In line with [34], who stated that page flip professional 3-dimensions is an application that can make the appearance of electronic modules more attractive and unique with the addition of animated images, videos, audio-visuals, sharing formats such as Exe, Zip, HTML, three dimension page flip, screen server, etc. The Pageflip

professional 3-dimensions application also provides settings for magazines, documents, and engaging multimedia content that can be integrated into e-books. Research regarding the influence of e-books using a differentiated approach assisted by page flip professional 3-dimensions is proven. Using e-books and a differentiated approach, assisted by page flip professional 3-dimensions, junior high school students learning outcomes in science subjects and straightforward machine topics have increased.

Conclusion

Based on the research results, it can be concluded that there is an influence of e-books through a differentiated approach assisted by page flip professional 3-dimensions on student learning outcomes, especially on simple machines topic at SMP Negeri 8 Paguyaman in the experimental class compared to the control class which applies conventional learning using printed books. This is shown through the hypothesis criteria where the significance value of 0.030 is smaller than the significance level of 0.05, so H0 is rejected, and Ha is accepted. This is also supported by acquiring an N-gain Score value of 0.81 in the experimental class, which meets the high category, and in the control class, 0.51, which meets the medium category. For the N-gain percent interpretation category, the results obtained in the experimental class were 81 in the effective interpretation category, while for the control class, the results were 51 in the less effective interpretation category. This shows that e-books, through a differentiated approach assisted by page flip professional 3-dimensions, influence student learning outcomes in simple machine topics at SMP Negeri 8 Paguyaman.

Author's Contributions

Asih Nurbaiti Gimnastiar: Conceptualization, writing-original draft preparation, methodology; Tirtawaty Abdjul: Methodology; Nurhayati: Curation, writing-original draft preparation; Abdul Haris Odja: Writing-review and editing; Muhammad Yusuf: Formal analysis, methodology; Citron S. Payu: Validation.

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