



# The Use of Interactive Digital Books to Improve Cognitive Learning Outcomes Class X Students on Energy Flow and Biogeochemical Cycle in MAN 1 Garut

Demmy Dharma Bhakti<sup>1\*</sup>, Elsa Safitriyani<sup>2</sup>, Hudiana Hernawan<sup>3</sup>, De Budi Irwan Taofik<sup>4</sup>, Aceng Ahmad Rodian S<sup>5</sup> Irdam Denni<sup>6</sup>, Iman Nasrulloh<sup>7</sup>

<sup>1234567</sup> Institut Pendidikan Indonesia Garut, Indonesia

\*demmy@institutpendidikan.ac.id

**Abstract.** The aim of this research is to determine the effect of using interactive digital books on students' cognitive learning outcomes in the sub-material of energy flow and biogeochemical cycles. The research method used is an experimental research method with a quantitative approach. The form of the method uses Quasi Experimental Design with the design used is Non Equivalent Control Group design. This research was carried out at MAN 1 Garut, with the samples selected in this research being class X MIPA 3 MAN 1 Garut as the experimental class and class X MIPA 1 MAN 1 Garut as the control class. The sample population is 71 students. The results of this research are: 1) Students' cognitive learning outcomes increase in learning that uses interactive digital books on the sub-materials of energy flow and biogeochemical cycles; 2) Students' cognitive learning outcomes increase in learning that does not use interactive digital books on the sub-materials of energy flow and biogeochemical cycles; 3) There is a difference in the increase in students' cognitive learning outcomes in learning that uses interactive digital books compared to students' cognitive learning outcomes in learning that does not use interactive digital books in the sub-materials of energy flow and biogeochemical cycles; 4) Student responses agree with learning using interactive digital books on the sub-material of energy flow and biogeochemical cycles.

**Keywords:** Interactive Digital Books, Cognitive Learning Outcome, Energy flow and biogeochemical cycles.

## 1 Introduction

Education is an effort to improve human quality as a whole, including aspects of skills, knowledge, values, and attitudes. The development of this aspect is carried out to improve and develop life skills through a series of competencies so that students can survive, adapt and succeed in their lives in the future (Zaini, Darmawan & Hernawan, 2019: 815).

Learning consists of objectives, materials, methods and evaluation that teachers must pay attention in determining media, methods, strategies and approaches to be used in

learning activities (Rusman, 2018, p. 95). Learning is an inseparable part of human life. Susanto (in Tiara, 2021, p. 146) stated that the abilities that students have after carrying out learning activities which are said to be learning outcomes.

## 1.1 Research Background

Based on the results of observations made when running PLP program at MAN 1 Garut, data from the results of daily class X tests shows that there are still many students whose biology subject scores do not reach the KKM score at MAN 1 Garut. After conducting interviews with teachers and students, it was discovered that educators used the lecture method and Power Point (PPT) learning media which contained descriptions of material, pictures along with picture captions, the picture question exercises could not be explained in detail so that students still did not understand the material being taught, especially with limited time in classroom learning activities. In biology material there is abstract material, the stages cannot be directly understood by students. Factors that influence learning outcomes According to Slameto (in Raresik, K. A., 2016) suggests that there are two influencing factors, namely factors from the individual himself such as body condition, interests, talents and readiness while external factors are school factors such as curriculum, media, teaching methods, condition of buildings and libraries. Referring to the background above, it is necessary to conduct research to find out how much influence the use of learning media can have in improving student learning outcomes, especially in learning biology material.

Rudi (2017) said that learning media can be interpreted as tools and materials used to make each learning process effective so that it can achieve learning goals. Then learning media has a role and function as an intermediary for information and delivery of the message itself, namely the teacher to students as recipients. Even though the learning method is the same, the learning outcomes obtained by students are definitely different. Because learning will influence many aspects that can generate new interest in learning (Hardiaman & Wahidi, 2022, pp. 29-30). According to Firdaus & Ismayati (2020), the teacher's function as an agent delivering educational messages seems to need to be assisted by educational media, this is because, among other things, the learning material that will be delivered is increasingly diverse.

Interactive digital books can be used as the media in the learning process (Zaini & Dermawan, 2019, p. 818). According to Morgan (in Zaini & Dermawan, 2019, p. 818) states that "Digital books are a combination of hardware or software specifically designed for reading and can be viewed on a computer". The advantages of using digital books according to Aji (in Febrianti, 2021: 106). Flip book media can be flipped back and forth like a real book, animations and videos can be inserted inside to support the learning material. According to Bagas (in Aftiani, Khairinal, 2021, p. 460) It is stated that professional PDF flip software is an application to convert PDF file to digital flipping pages which allows us to create interactive learning content with several supporting features.

This is a strong reason for researchers to choose professional digital book media with the help of flip PDF because this media can be used as a source of independent learning.

This electronic book contains writing, images and videos that can be read via a computer or other electronic devices. And it is hoped that this media can improve cognitive learning outcomes.

## 1.2 Research purposes

The purpose of this research is to determine the increase in the use of interactive digital books to improve students cognitive learning outcomes on energy flow and biogeochemistry material at Man 1 Garut.

## 2 Research Methods

This study uses a quantitative approach. The method used in this research is an experimental method, namely a quasi-experimental method (quasi-experiment) with the form of research design that will be used, namely Non equivalent control group design.

The sample used in this research is class X MIPA 3 with 36 students as an experimental class who will be treated using interactive digital book media, while class sampling was taken using purposive sampling technique.

Data collection regarding learning outcomes is in the form of a multiple choice objective text with 30 questions. The learning outcomes are measured by scores through tests, namely: Initial Test (Pretest) and Final Test (Post test). The data obtained was then analyzed to include validity, reliability, distinguishing power, level of difficulty. This trial was carried out to determine the feasibility of the instrument to be used in the research.

The power gain that will be analyzed is test score data which is the result of student learning in energy flow and biogeochemistry material which is carried out sequentially as follows.

1. Give scores on the pretest and post test.
2. Analysis Requirements Testing

### 2.1 Assessment of Learning Outcomes

To investigate whether the data collected follows the expected normal distribution or not, this test was carried out using the Shapiro-Wilk test with the help of the IBM SPSS Statistics 22 application. The criteria for rejecting  $H_0$  is based on the sig value. SPSS is as follows.

- (1) If  $\alpha > \text{Sig value}$ , then  $H_0$  is rejected.
- (2) If  $\alpha \leq \text{Sig value}$ , then  $H_0$  cannot be rejected.

The hypothesis for the Mann-Whitney test is as follows:

- (1)  $H_0: \eta_1 = \eta_2$ , assuming that the learning outcomes of control class and experimental class students are not different.
- (2)  $H_1: \eta_1 \neq \eta_2$ , assuming that the learning outcomes of control class and experimental class students are different.

The criteria for rejecting  $H_0$  is based on the Sig value. SPSS is as follows:

- (1) If  $\alpha > \text{Sig value}$ , then  $H_0$  is rejected.
- (2) If  $\alpha \leq \text{Sig value}$ , then  $H_0$  cannot be rejected.

If there is no difference in initial ability between the experimental class and the control class, then proceed with post test data analysis to test the research hypothesis using the same steps as when analyzing pretest data. If there are differences in students' initial abilities (seen from the post test), then this is done by calculating the difference in the average post test scores in the experimental class to determine the magnitude of the increase in student learning outcomes.

## 2.2 Calculating Gain Score

To see the increase in student learning outcomes in biology learning after receiving treatment, the gain score was calculated.

$$\text{sample } g = \frac{\text{post test score} - \text{pre test score}}{\text{ideal score} - \text{pre test score}}$$

Data Normalized gain scores can be grouped into three categories, namely as follows:

- a)  $g < 0.3$ : low
- b)  $0.3 \leq g < 0.7$ : moderate
- c)  $g \geq 0.7$ : high

## 3 Results and Discussion

This research was carried out at MAN 1 Garut in the even semester of the 2021-2022 academic year. This research aims to determine whether the use of interactive digital book media can improve the cognitive learning outcomes of class X students in the sub-materials of flow and biogeochemistry at MAN 1 GARUT.

In accordance with the problems that the author discusses in this research, the data needed in data processing is learning results.

### 3.1 Student cognitive learning outcomes in learning using interactive digital books.

**Table 1.** Data on experimental class pretest results

Experimental Class Pre test		
N	Valid	32
	Missing	0
Mean		52.81
Std. Deviation		16.701
Variance		278.931
Minimum		20
Maximum		80
Sum		1690

**Table 2.** Data on experimental class post test results

<b>Experimental Class Post test</b>		
<b>N</b>	<b>Valid</b>	32
	<b>Missing</b>	0
<b>Mean</b>		78.91
<b>Std. Deviation</b>		8.204
<b>Variance</b>		67.314
<b>Minimum</b>		65
<b>Maximum</b>		95
<b>Sum</b>		2525

Based on the research results, it can be seen that the average pretest for the experimental class was 52.81. Furthermore, after being given a pre-test, learning was carried out using an interactive digital book and after the learning was carried out, a post-test was given. The post-test data showed that the average/mean post-test for the experimental class was 78.91. From the results of the gain or increase calculation, an average increase of 0.53 was obtained. If you refer to the gain interpretation table, this value is included in the "Medium" category. The conclusion that can be drawn is that the use of interactive digital books can improve student learning outcomes in energy flow and biogeochemical cycles.

Looking at the conditions above, it appears that student learning outcomes after using interactive digital books have increased. In other words, the increase in student learning outcomes cannot be separated from the role of the interactive digital books used. Researchers stated that students who used interactive digital books found more stimulants in their learning so that the learning outcomes of students who studied using interactive digital books were better. This stimulant arises because of the use of technology in learning. This is in accordance with the opinion of Sulaeman (in Warsita, 2010, p. 67) who says that to achieve the final target, technologies in the learning sector need to be developed as learning resources to meet needs in accordance with its characteristics.

**3.2 Learning outcomes that do not use interactive digital books.**

**Table 3.** Control Class Pretest Result Data

<b>Statistics</b>		
<b>Control Class Pre test</b>		
<b>N</b>	<b>Valid</b>	32
	<b>Missing</b>	0
<b>Mean</b>		52.97
<b>Std. Deviation</b>		12.818
<b>Variance</b>		164.289
<b>Minimum</b>		30
<b>Maximum</b>		75
<b>Sum</b>		1695

**Table 4.** Control Class Post Test Result Data

<b>Statistics</b>		
<b>Control Class Post Test</b>		
<b>N</b>	<b>Valid</b>	32
	<b>Miss- ing</b>	0
<b>Mean</b>		61.88
<b>Std. Deviation</b>		8.590
<b>Variance</b>		73.790
<b>Minimum</b>		45
<b>Maximum</b>		80
<b>Sum</b>		1980

After conducting research, it can be seen from the pretest result data in the control class that the control class pretest average is 52.97. Furthermore, after being given a pretest, learning was carried out by applying learning media in the form of PowerPoint and after the learning was carried out and then given a post test, it can be seen that the average/mean post test for the control class was 61.88. There was an increase of 0.14, if you refer to the table interpretation of gain then this value is included in the "Low" category. The conclusion that can be drawn is that the use of PPT media in control classes can improve student learning outcomes on energy flow and biogeochemical cycles.

Highlighting the research results presented above, it appears that the role of teaching materials is able to improve class student learning outcomes on energy flow and biogeochemical cycles. This is due to the fact that educational materials may be defined as content or materials that are thoroughly and methodically developed in accordance with the learning principles that both teachers and students employ during the learning process. Differences in students cognitive learning outcomes in learning that uses interactive digital books and students cognitive learning outcomes in learning that does not use interactive digital books.

#### **a. Initial Ability Differences**

Furthermore, before testing the differences, a prerequisite test is first carried out, namely the data normality distribution test. Considering that the amount of data obtained for each was 32, the data distribution test or normality test of experimental class data with control class data was carried out using the Shapiro-Wilk test (Sundayana, 2016, p. 88).

The results of the normality testing of the two researchers' data are presented in table 5.

**Table 5.** Tests of Normality

Tests of Normality			
	Shapiro-Wilk		
	Statistic	Df	Sig.
Experiment	.920	32	.021
Control	.948	32	.123

The  $\alpha$  value used is 0.05; so that the Sig value of the experimental class pretest is less than  $\alpha$ , meaning the data is not normally distributed and the control class pretest is greater than  $\alpha$  (0.05) or normally distributed. It is known that one of the two sets of data above is not regularly distributed based on the findings of the normality test. so to test the hypothesis of the difference between two means, a non-parametric statistical test is used, in this case using the Mann-Whitney test.

**Table 6.** Mann-Whitney Pre Test

	Data Pretest
<b>Mann-Whitney U</b>	495.000
<b>Wilcoxon W</b>	1023.000
<b>Z</b>	-.230
<b>Asymp. Sig. (2-tailed)</b>	.818

Because Asymp. Sig. (2 tailed) is greater than the  $\alpha$  value (0.05), it can be concluded that accept  $H_0$  and reject  $H_a$ , which means that: The starting skill levels of the pupils in the experimental class and the control class are the same. Given that the experimental class's starting talents were the same as those of the control class, statistical data processing continued to the next stage, namely finding out the differences in final abilities.

**b. Final Ability Differences**

**Table 7.** Test of Normality

Tests of Normality			
	Shapiro-Wilk		
	Statistic	Df	Sig.
Experiment Class	.929	32	.037
Control Class	.951	32	.157

Based on the table 7, the sig value is known. The experimental class post test was  $0.037 < \alpha$  (0.05), meaning the data was not normally distributed and the sig. The control class post test was  $0.157 > \alpha$  (0.05), meaning the data was normally distributed.

Based on the results of the normality test of the two data above, it is known that one of the data is not normally distributed, so to test the hypothesis of the difference between two means, a non-parametric statistical test is used, in this case using the Mann-Whitney test.

**Table 8.** Mann-Whitney Post Test

<b>Mann-Whitney Post Test</b>	
	Data Post test
Mann-Whitney U	73.500
Wilcoxon W	601.500
Z	-5.939
Asymp. Sig. (2-tailed)	.000

To show whether there is a difference between the two learning outcomes, it is explained in the test results which obtained an Asymp. Sig. (2 tailed) of 0.000 which is smaller than the  $\alpha$  value of 0.05. Because Asymp. Sig. (2 tailed) is smaller than the  $\alpha$  value (0.05), it can be concluded that  $H_a$  is accepted and  $H_o$  is rejected, which means that: There is a difference in students' final abilities between the experimental class and the control class.

Because the results of testing the working hypothesis show that there are differences, which means that the research hypothesis in the previous chapter is accepted, so that "Using the Interactive Digital Book can improve the cognitive learning outcomes of class X MIPA students in the sub-material of energy flow and biogeochemical cycles at MAN 1 Garut".

### c. Improvement Differences

**Table 9.** Improved Normality Test

	Shapiro-Wilk		
	Statistic	Df	Sig.
Control Class	.859	32	.001
Experiment Class	.970	32	.489

Based on the results of the normality test for the two data above, it is known that one of the data is not normally distributed, so to test the hypothesis of the difference between two means, a non-parametric statistical test is used, in this case using the Mann-Whitney test. Based on the test results, Asymp. Sig. (2 tailed) of 0.000 which is smaller than the  $\alpha$  value of 0.05. Because Asymp. Sig. (2 tailed) is smaller than the value of  $\alpha$  (0.05), it can be concluded that accept  $H_a$  and reject  $H_o$ , which means that: **There is a difference in the increase in student learning outcomes between the experimental class and the control class.**

## 4 Conclusion

1. Students cognitive learning outcomes increase in learning that uses interactive digital books.
2. Student cognitive learning outcomes increase in learning that does not use interactive digital books.



3. There is a difference in the increase in students cognitive learning outcomes in learning that uses interactive digital books compared to students cognitive learning outcomes in learning that does not use interactive digital books in the sub-materials of energy flow and biogeochemical cycles.
4. Student responses agree with learning using interactive digital books on the sub-material of energy flow and biogeochemical cycles.

## 5 Authors Contributions

Demmy Dharma Bhakti as researcher, Elsa Safitriyani as researcher, Hudiana Hernawan as researcher, De Budi Irwan Taofik as researcher, Aceng Ahmad Rodian as data collector, Irdam Denni as translator, Iman Nasrulloh as editor.

## Acknowledgments

The researchers would like to extend gratitude to Dr. Nizar Alam Hamdani M.M., M.T., M.Si., M.Kom. as The Rector of Indonesia Institute of Education for all the support and motivation given to the researchers.

## References

1. Aftiani, R. Y., Khairinal, K., & Suratno, S. (2021). Pengembangan Media Pembelajaran E-Book Berbasis Flip Pdf Professional Untuk Meningkatkan Kemandirian Belajar Dan Minat Belajar Siswa Pada Mata Pelajaran Ekonomi Siswa Kelas X Iis 1 Sma Negeri 2 Kota Sungai Penuh. *Jurnal Manajemen Pendidikan Dan Ilmu Sosial*, 2(1), 458-470.
2. Febrianti, F. A. (2021). Pengembangan Digital Book Berbasis Flip PDF Professional untuk Meningkatkan Kemampuan Literasi Sains Siswa. *Caruban: Jurnal Ilmiah Ilmu Pendidikan Dasar*, 4(2), 102-115.
3. Hardiman, Wahidi. (2022). *Media Pembelajaran*. CV Jejak (Jejak Publisher), 29-30.
4. Raresik, K. A., Dibia, I. K., & Widian, I. W. (2016). Analisis faktor-faktor yang mempengaruhi hasil belajar bahasa indonesia pada siswa kelas V SD gugus VI. *Mimbar PGSD Undiksha*, 4(1).
5. Rusman. (2018). *Belajar Dan Pembelajaran Berbasis Komputer*. Bandung: Alfabeta.
6. Sugiyono. (2017). *Metode Penelitian Kuantitatif*. Bandung: Alfabeta.
7. Sundayana, R. (2016). *Statistika Penelitian Pendidikan*. Bandung: Alfabeta.
8. Tiara, T., Diarta, F., & Kantun, S. (2021). Penggunaan Buku Digital untuk Meningkatkan Motivasi dan Hasil Belajar Siswa Kelas Xii Ips 3 Sman Pakusari Jember (Studi Kasus pada Mata Pelajaran Ekonomi Materi Jurnal Penyesuaian pada Perusahaan Dagang Semester Genap Tahun Ajaran 2019/2020). *Jurnal Pendidikan Ekonomi: Jurnal Ilmiah Ilmu Pendidikan, Ilmu Ekonomi dan Ilmu Sosial*, 15(1), 173-179.
9. Zaini, H., Darmawan, D., & Hernawan, H. (2019). Penggunaan Bahan Ajar Berbasis Digital Book untuk Meningkatkan Hasil Belajar Siswa dalam Mata Pelajaran Matematika pada Materi Logika Matematika. *Teknologi Pembelajaran*, 4(2)

**Open Access** This chapter is licensed under the terms of the Creative Commons Attribution-NonCommercial 4.0 International License (<http://creativecommons.org/licenses/by-nc/4.0/>), which permits any noncommercial use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license and indicate if changes were made.

The images or other third party material in this chapter are included in the chapter's Creative Commons license, unless indicated otherwise in a credit line to the material. If material is not included in the chapter's Creative Commons license and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder.

