

THE EFFECTIVENESS OF COORDINATION SYSTEM E-BOOKLET ON STUDENT LEARNING OUTCOMES IN PHASE F AT SMAN 13 PADANG

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ABSTRACT

The development of learning tools is an integral part of innovation in education. Learning tools are designed to enhance the learning experience, facilitate understanding of complex concepts, and encourage active engagement in various learning processes. The development of learning tools still exists today, one of the learning tools that is often developed is learning resources. E-booklets are a learning resource that is quite promising considering the complexity of the material that must be delivered and the need to keep up with very important technological developments. Even so, research regarding the effectiveness of using e-booklet coordination systems on student learning outcomes is still limited. Facing these dynamics, strong empirical evidence is needed regarding the effectiveness of using e-booklets in improving student learning outcomes. This research aims to fill the knowledge gap by evaluating in detail the extent of the effectiveness of using the e-booklet coordination system on student learning outcomes. This type of research is quasi-experimental with a Posttest-only control group design using purposive sampling techniques. The learning outcomes of the group that received treatment using the e-booklet coordination system in learning activities were higher than the group without treatment using the e-booklet coordination system. Based on field facts and various existing considerations, it can be said that learning using e-booklets has more effective learning outcomes when compared to without using e-booklets. It can be concluded that the difference in treatment between the experimental class and the control class had a very significant influence.

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Introduction

The development of technology has changed the way humans communicate and manage information. Technology has enabled a person to communicate instantly and without barriers. A person can easily find and access various information, ranging from news, academic knowledge, to various guides and tutorials (Umar, 2022). The use of physical documents from conventional has gradually shifted to the use of digital platforms. This change has affected various things up to

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the realm of Education, a significant impact on the realm of education has brought about a transformation in the way of learning and teaching (Pratama & Rahman, 2023). One of the impacts is enabling the development of learning tools such as learning resources, learning media, and learning platforms.

The development of learning tools is an integral part of educational innovation. Learning tools are designed to enhance the learning experience, facilitate understanding of concepts, and encourage active involvement of students in the learning process (Fakhri, 2023). Innovation in learning tools continues along with the times. The development of learning tools is based on the needs and benefits generated for students in order to achieve learning goals. The use of learning tools is important to improve the quality and accessibility of education for everyone.

The development of learning tools has been widely carried out, including in the scope of the Department of Biology, FMIPA UNP. The Biology Department of FMIPA UNP has carried out various developments in learning tools, starting from the development of learning platforms, learning resources, multimedia-based teaching modules, the development of student worksheets and many others. The development of learning tools still exists today. One of the learning tools that is often developed is learning resources. Learning resources are divided into 2 types, namely online learning resources and offline learning resources (Khan, 2005). Online and offline learning resources are learning resources that are commonly used by students. Each learning resource has advantages and disadvantages, however, the increasingly rapid development of technology makes online learning resources suitable for use in supporting learning activities.

Based on a literature study on the development of learning tools, a study was found on the development of an e-booklet for a coordination system entitled "Development of an E-Booklet on Coordination System Material for Grade XI High School Students" with the researcher "Zakia Aulia". E-booklets are one of the online learning resources that are designed and presented in electronic format such as in the form of PDF files or e-book format (Sarip et al., 2022). Based on the literature study, it was found that the e-booklet that was developed would go through a development stage using the 4D model (Aulia, 2022). The 4D development model consists of the define, design, develop, and disseminate stages (Thiagarajan, 1974).

The research of 'Zakia Aulia' has reached the develop stage and has not passed the disseminate stage. The first flow that has been carried out using the 4D model is the define stage, at this stage front-end analysis, student analysis, task analysis, concept analysis, and learning objective analysis are carried out. The second flow using the 4D model is the design stage, at this stage media selection, format selection, and initial design have been carried out. The third flow using the 4D model is the develop stage, at this stage validity and practicality tests are carried out. Based on the stages of development research using the 4D model, it can be seen that the research conducted by "Zakia Aulia" has not been completed. This is because of the appropriateness and agreement of the Biology Education Bachelor's study program, development research is allowed up to the develop stage for each student, however, further research needs to be done so that all steps in the 4D model are implemented.

The disseminate stage consists of validation testing, packaging, diffusion and adoption. Further research is limited to the validation testing stage for effectiveness testing. Further research is carried out by evaluating in more depth the effectiveness of the coordination system e-booklet, especially in seeing how effectively the coordination system e-booklet improves students' cognitive learning outcomes. Further research is important for the perfection of this research. The effectiveness of the coordination system e-booklet is assessed from various perspectives, including in terms of material understanding, student involvement, flexibility of access, and efficiency in its use. E-booklets can be said to be effective if they are able to facilitate the learning process and contribute to the achievement of expected learning outcomes.

The e-booklet whose effectiveness was tested was the coordination system e-booklet that received approval for use from its owner. The coordination system material is one of the scopes of the Biology material in Phase F which discusses the organ systems included in the coordination system. Based on the results of observations with the Biology teacher of Phase F SMAN 13 Padang, the teacher revealed that the coordination system material was quite difficult to understand and had a fairly broad scope of discussion, causing students to pay less attention and often feel bored in learning activities. The coordination system material includes the structure and function of nerve cells, nerve impulse mechanisms, conscious movement, reflex movement, the central nervous system and peripheral nerves, the structure of the tissue that makes up the human sense organs, hormones produced by the endocrine glands, and disorders that occur in the coordination system.

The coordination system e-booklet is an effective solution in dealing with these problems. The e-booklet is designed with various interactive features such as images, videos, audio, and links that enrich the learning experience (Erawati, 2021). In addition, the e-booklet can also be adjusted to the individual's learning style to ensure a better understanding of independent learning (Amalia et al., 2020). E-booklets can be accessed through various digital devices such as computers, tablets, or mobile phones with or without an internet connection (Prananta & Safitri, 2023). Compared to printed books, e-booklets can be easily updated to reflect the latest developments in the field of Education (Wahyuni, 2023). E-booklets contain more detailed information so that they give the impression of increasing interest in reading (Sari & Werdiharini, 2020). Research on the effectiveness of the coordination system e-booklet on student learning outcomes is still limited. Strong empirical evidence is needed on how effective the coordination system e-booklet is in improving students' cognitive learning outcomes. Quasi-experimental research was conducted to provide more concrete evidence on this problem. The purpose of this study was to determine the effectiveness of the coordination system e-booklet on the cognitive learning outcomes of Phase F students at SMAN 13 Padang.

Based on data from previous development research, and the need for further research on the effectiveness of the coordination system e-booklet on learning outcomes, the researcher is interested in conducting research entitled "The Effectiveness of the Coordination System E-Booklet on Learning Outcomes of Phase F Students at SMAN 13 Padang".

Method

The type of research used in this study is a quasi experiment, a quasi experiment involves the context of placing the smallest experimental unit into an experimental and control group (Hastjarjo, 2019). This type of research is used to see the influence or impact of certain treatments given in a study.

The research design used in this research is Posttest Only Control Group Design. The experimental group and control group were selected using a purposive sampling technique. This technique is also known as selective or subjective sampling (Firmansyah & Dede, 2022). The sample class groups were selected based on the smallest difference in the 1st semester Biology UAS scores from each class. The two classes obtained were then randomized to choose which was the experimental or control class. The experimental group's learning process used the coordination system's e-booklet learning resources and the control group's learning process did not use the coordination system's e-booklet learning resources.

The sample in this study consisted of two classes, one used as the experimental class and the other used as the control class. The sampling technique used in this study was purposive sampling. In this study, the researcher took class F4 as the experimental class and class F1 as the control class. The selection of the group was based on the consideration of the difference in

values from each class with an average Biology learning outcome that was not much different, the two classes obtained were then randomized to choose which class was the experiment or control.

The data used in this study is primary data, primary data is research data obtained directly (Quraisy, 2022). The data obtained is collected directly and has never been processed or used before by other parties. The primary data collection process involves direct research by researchers, through observation, interviews, experiments, and tests.

The hypothesis in this study is that the e-booklet coordination system is effective in improving the cognitive learning outcomes of Phase F students at SMAN 13 Padang. Interpretation of data in the independent sample test table in the t-test column for equality of means with a real level of $\alpha = 0.05$. The criteria in this test are as follows: " H_0 is accepted, if Sig / (p-value) > 0.05 then H_1 is rejected" or " H_0 is rejected, if Sig / (p-value) < 0.05 then H_1 is accepted". H_0 is that there is no increase in the cognitive learning outcomes of Phase F students at SMAN 13 Padang, while H_1 is that there is an increase in the cognitive learning outcomes of Phase F students at SMAN 13 Padang.

Results

This research was conducted from April 29 to May 31 in Phase F of SMAN 13 Padang in the even semester of the 2023/2024 academic year. The number of students was 72 people, consisting of 36 students in the experimental class and 36 students in the control class.

1) Data description

a) Pre-Research Interview.

The interview was conducted at SMAN 13 Padang with the Biology teacher, Mrs. Nova Irianti S.Pd as the biology subject teacher for classes Phase E and Phase F. The results of the interview showed that quasi-experimental research could be conducted to see the effectiveness of the coordination system e-booklet on the learning outcomes of Phase F students at SMAN 13 Padang.

b) Research Instrument

The test instrument used was a multiple-choice test with 25 questions. Each question will be given 4 points if correct and 0 if wrong, with a maximum total score of 100. Before using the test questions, the questions will be tested and selected first, as many as 35 questions are made according to the Learning Objectives (TP) and Learning Objective Achievement Criteria (KKTP) in the coordination system material. The test questions are tested outside the experimental and control classes, each test question instrument is kept so that it does not leak or spread to the experimental and control classes. The tests used are test validity, test reliability (Arikunto, 2008), test difficulty index and discriminatory power (Arikunto, 2009). A total of 35 questions are tested, 25 questions will be used as posttest questions for students according to the test requirement criteria. The following is a grid of the test instrument before testing

No	Learning objectives	Cognitive Aspect of Questions						Amount
		C1	C2	C3	C4	C5	C6	
1.	Analyze the organ system that is included in the coordination system.				1, 2			2
2.	Analyze the components of the human nervous system.			3, 4, 5				3

No	Learning objectives	Cognitive Aspect of Questions						Amount
		C1	C2	C3	C4	C5	C6	
3.	Analyze the structure and function of nerve cells	7, 8,	9		6			4
4.	Analyze the mechanism of impulse transmission in the nervous tissue.		10, 11					2
5.	Analyze the differences in conscious movement mechanisms and reflex movements.	13					12	2
6.	Analyze the types of the nervous system.		15	14				2
7.	Analyze the organs and types of hormone systems in humans.	18, 19	17		16			4
8.	Analyze the differences in the working mechanisms of the nervous and endocrine systems.				20			1
9.	Analyze the structure and working mechanisms of the sensory system.	23, 25	21, 22	28, 29, 30	24, 26, 27	31		11
10.	Analyze abnormalities and technology in the coordination system.			35	32, 33, 34			4
	Persentase	20%	20%	22,85%	31,42%	2,85%	2,85%	100%

After conducting the test instrument testing, 25 questions were selected that met the test requirements for each Learning Objective (TP). From the results of the analysis, there were 28 very significant questions, 2 significant questions, and 5 insignificant questions with the XY correlation showing a figure of 0.89 and the test reliability showing a figure of 0.94. Several questions must be removed and revised, so that all questions are covered in the existing learning objectives. The following is a recap of the item analysis of each question:

REKAP ANALISIS BUTIR
 =====

Rata2= 18.19
 Simpang Baku= 8.65
 KorelasiXY= 0.89
 Reliabilitas Tes= 0.94
 Butir Soal= 35
 Jumlah Subyek= 26
 Nama berkas: C:\USERS\ADMINISTRATOR\DOCUMENTS\TES SOAL 35.ANA

Btr Baru	Btr Asli	D.Pembeda(%)	T. Kesukaran	Korelasi	Sign. Korelasi
1. 1		71.43	Sedang	0.605	Sangat Signifikan
2. 2		85.71	Sedang	0.703	Sangat Signifikan
3. 3		14.29	Sangat Mudah	0.289	-
4. 4		57.14	Sedang	0.605	Sangat Signifikan
5. 5		57.14	Sedang	0.434	Sangat Signifikan
6. 6		71.43	Sedang	0.569	Sangat Signifikan
7. 7		57.14	Sedang	0.526	Sangat Signifikan
8. 8		0.00	Sedang	0.150	-
9. 9		57.14	Sangat Mudah	0.437	Sangat Signifikan
10. 10		85.71	Sedang	0.588	Sangat Signifikan
11. 11		28.57	Sukar	0.403	Sangat Signifikan
12. 12		71.43	Sedang	0.684	Sangat Signifikan
13. 13		100.00	Sedang	0.770	Sangat Signifikan
14. 14		28.57	Sedang	0.302	-
15. 15		-14.29	Sedang	-0.059	-
16. 16		57.14	Sukar	0.569	Sangat Signifikan
17. 17		57.14	Sedang	0.467	Sangat Signifikan
18. 18		42.86	Sedang	0.364	Signifikan
19. 19		57.14	Sedang	0.458	Sangat Signifikan
20. 20		85.71	Sedang	0.652	Sangat Signifikan
21. 21		28.57	Mudah	0.269	-
22. 22		85.71	Sedang	0.708	Sangat Signifikan
23. 23		71.43	Sedang	0.697	Sangat Signifikan
24. 24		57.14	Mudah	0.413	Sangat Signifikan
25. 25		71.43	Mudah	0.598	Sangat Signifikan
26. 26		57.14	Sedang	0.517	Sangat Signifikan
27. 27		57.14	Sedang	0.525	Sangat Signifikan
28. 28		57.14	Sedang	0.531	Sangat Signifikan
29. 29		71.43	Sedang	0.665	Sangat Signifikan
30. 30		85.71	Sedang	0.625	Sangat Signifikan
31. 31		85.71	Sedang	0.698	Sangat Signifikan
32. 32		100.00	Mudah	0.729	Sangat Signifikan
33. 33		85.71	Mudah	0.648	Sangat Signifikan
34. 34		71.43	Sedang	0.470	Sangat Signifikan
35. 35		57.14	Sedang	0.339	Signifikan

Figure 1. Recap of Tested Question Item Analysis

The analysis data above is used as a benchmark in selecting questions to be used as a posttest. The following is the instrument grid after the questions have been revised and are suitable for use as a posttest:

No	Learning objectives	Cognitive Aspect of Questions						Amount
		C1	C2	C3	C4	C5	C6	
1.	Analyze the organ system that is included in the coordination system.				1			1
2.	Analyze the			2, 3				2

No	Learning objectives	Cognitive Aspect of Questions						Amount
		C1	C2	C3	C4	C5	C6	
	components of the human nervous system.							
3.	Analyze the structure and function of nerve cells		5		4			2
4.	Analyze the mechanism of impulse transmission in the nervous tissue.		6, 7					2
5.	Analyze the differences in conscious movement mechanisms and reflex movements.	9					8	2
6.	Analyze the types of the nervous system.	10						1
7.	Analyze the organs and types of hormone systems in humans.	13	12		11			3
8.	Analyze the differences in the working mechanisms of the nervous and endocrine systems.				14			1
9.	Analyze the structure and working mechanisms of the sensory system.	16, 18	15	20, 21, 22	17, 19	23		9
10.	Analyze abnormalities and technology in the coordination system.				24, 25			2
	Persentase	20%	20%	20%	32%	4%	4%	100%

c) Posttest results of experimental and control classes

Posttests were given to students after the learning activities were completed. The following is a summary of the posttest data of students in the experimental and control classes.

Class	Average	Variances	Scor max	Scor min
Experimental Class	68,67	274,743	100	40
Control Class	60,22	342,806	100	24

Based on the data of the two class samples, the average value in the experimental class was 68.67 with the highest value of 100 and the lowest value of 40, while the average value of the control class was 60.22 with the highest value of 100 and the lowest value of 24. The average value shows that the experimental class value is higher than the control class value. The following are the posttest results of each class:

No	Score	Amount	
		Experimen	Control
1	100	2	2
2	96	1	1
3	88	4	1
4	84	3	-
5	80	3	4
6	68	4	2
7	64	4	3
8	60	8	6
9	56	-	3
10	52	1	2
11	48	4	6
12	44	-	2
13	40	2	2
14	24	-	2
Amount		36	36

2) Data analysis

a) Normality Test

The data normality test is conducted to determine whether the learning competency result data is normally distributed or not. This study uses the Shapiro-Wilk test, because each sample of the experimental and control classes is no more than 50. The following are the results of the calculation of the normality test of the experimental and control classes:

Tests of Normality							
	class	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
		Statistic	20df	Sig.	Statistic	df	Sig.
student grades	experimental class	0,155	36	0,029	0,947	36	0,082
	control class	0,144	36	0,058	0,950	36	0,102

a. Lilliefors Significance Correction

Based on the rules in the normality test, the decision making value is normally distributed, if the significance is > 0.05 , if the opposite occurs then the data is not normally distributed. Based on the data analysis, it can be concluded that the experimental and control class data are normally distributed. The following is a summary of the normality test data above:

Statistical Data	Posttest	
	Experimen	Control
Sig/(p-value)	0,082	0,102
Information	0,082 $>$ 0,05	0,102 $>$ 0,05
Conclusion	Normal	Normal

b) Homogeneity Test

The next prerequisite test is the homogeneity test, after obtaining normally distributed data, then its homogeneity is tested using the Levene statistical test. The homogeneity test is used to determine whether several population variants are the same or not. The following are the results of the calculation of the homogeneity test of the experimental class and the control class:

Test of Homogeneity of Variances			
student grades			
Levene Statistic	df1	df2	Sig.
0,002	1	70	0,969

Based on the rules in the homogeneity test, the basis for decision making If the sig. value > 0.05 then the data is declared homogeneous and if the opposite occurs the data is declared not homogeneous. Based on the data analysis, it can be concluded that the experimental and control class data have the same variance or are homogeneous. The following is a summary of the data from the homogeneity test above:

Statistical Data	Sig
Sig/(p-value)	0,969
Information	0,969 $>$ 0,05
Conclusion	Homogen

c) Hypothesis test

Based on the normality test and homogeneity test on the sample class, the data is normally distributed and has homogeneous variance. Based on the rules in hypothesis testing, if the data is normally distributed and homogeneous, the test used in this study is the independent sample t-test. The following are the results of the calculation of the experimental and control class hypothesis tests:

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
student grades	Equal variances assumed	0,002	0,969	2,039	70	0,045	8,444	4,142	0,184	16,705
	Equal variances not assumed			2,039	69,160	0,045	8,444	4,142	0,182	16,707

From the calculation results in the table above, H_0 is rejected because $\text{Sig.}(2\text{-tailed}) < 0.05$, namely each shows a figure of 0.045. then H_1 is accepted with the conclusion that there is a significant difference between student learning outcomes before and after using e-booklets. The following is a summary of the data from the hypothesis test above:

Statistical Data	Sig
Sig.(2-tailed)	0,045
Information	0,045<0,05
Conclusion	H ₁ is accepted and H ₀ is rejected

Discussion

During the learning on the coordination system material, the time allocation was 8 lesson hours x 45 minutes. The research was conducted for 3 meetings with a posttest as the final treatment. The research was conducted by comparing learning between using the coordination system e-booklet and without using the coordination system e-booklet. The data compared were the posttest data in each treatment group. The comparison was made to see how effective the coordination system e-booklet was on cognitive learning outcomes.

Learning activities using the coordination system e-booklet took place for the experimental class and without using the coordination system e-booklet for the control class. The results showed that learning using the coordination system e-booklet was better than learning without using the coordination system e-booklet. The t-test analysis obtained Sig. (2-tailed) 0.045 (smaller than 0.05) with normally distributed and homogeneous data. The data obtained showed that H₁ was accepted and H₀ was rejected, with the conclusion that there was an increase in the cognitive domain learning outcomes of Phase F students at SMAN 13 Padang. The significant difference in learning outcomes between the use of the coordination system e-booklet and without the use of the coordination system e-booklet indicates that the hypothesis put forward has been proven. The average posttest result of students in the experimental class was 68.67, while the average posttest result of students in the control class was 60.22. These data show that the group that received the treatment of using the coordination system e-booklet in learning activities obtained higher cognitive learning outcomes than the group with treatment without the coordination system e-booklet.

The high cognitive learning outcomes in the experimental class were caused by the coordination system e-booklet which could support the learning process. The use of e-booklets aims to make it easier to understand the material presented by the teacher (Erawati, 2021). Teaching using the coordination system e-booklet makes it easier for students to understand the material when compared to learning without using the coordination system e-booklet. The coordination system e-booklet is equipped with multimedia such as video, audio, and animation which can help explain complex concepts more clearly (Rosa et al., 2022). E-booklets are effective to use because they are equipped with concise and systematic explanations, as well as images as illustrations, making it easier for students in the learning process (Wulandari, 2023). Content presented with multimedia (video, audio, animation) can help deeper understanding and visualization of complex concepts (Erawati, 2021).

The coordination system e-booklet provides access to learning materials that can be studied independently, according to the user's schedule (Amalia et al., 2020). Users can mark, take notes, and repeat difficult sections, thereby increasing independence in learning. E-booklets can be used as independent learning materials (Try Dayanti et al., 2022). The coordination system e-booklet makes students more responsible and independent in completing the tasks given. Students can learn independently anywhere and anytime using e-booklet learning (Erawati, 2021). In using the coordination system e-booklet, feedback occurs between students and teachers. Teachers using the coordination system e-booklet can make it easier to deliver and provide materials, while for students the coordination system e-booklet can be used as a source for independent learning.

The completeness of the material in the coordination system e-booklet, and supported by multimedia such as video, audio, and appropriate animation, makes the coordination system e-booklet an effective learning resource in learning activities (Astuti et al., 2024). The significant difference in cognitive learning outcomes of learning using the coordination system e-booklet with learning without using the coordination system e-booklet is quite far. The average difference in cognitive learning outcomes of 8.45 indicates that the coordination system e-booklet has a very effective effect on learning activities.

Experimental class students were much more enthusiastic during the learning process compared to the control class. Students are very enthusiastic about something new they see and read (Prananda et al., 2022). The use of the coordination system e-booklet shows a positive effect that students' interest in learning increases. E-booklets make students happy and enthusiastic in carrying out learning (Fauzizah et al., 2023). When viewed from the condition of students in the control class, the teaching and learning process is still in the usual condition and there has been no improvement in learning outcomes. The factors that influence this are caused by several factors, namely the selection of learning resources, misconceptions, non-contextual learning, low reading ability, ineffective learning environment and climate (Utomo & Oktarisa, 2022).

Considering this, it can be concluded that the difference in treatment between the experimental class and the control class has a very significant effect. Field facts show that learning using the coordination system e-booklet is more effective in improving cognitive learning outcomes when compared to learning without the use of the coordination system e-booklet. In addition to the advantages of learning using the coordination system e-booklet, there are also obstacles experienced during the research. The obstacle experienced is that the e-booklet presented in APK format has a fairly large file size. Students who have devices with low storage have difficulty installing the e-booklet file, around 80% of students can install it and only a few students have difficulty installing the file.

From the description above, it can be seen that the presence of the coordination system e-booklet can increase the enthusiasm and cognitive learning outcomes of students. Researchers strongly recommend the use of this coordination system e-booklet in learning activities, but from the existing limitations, researchers suggest that teachers can consider the situation or conditions of the school and students in using the e-booklet (Nurhasanah & Sobandi, 2016).

Conclusion

Based on the results and discussions in this study, it can be concluded that the use of the e-booklet coordination system is effective in improving the learning outcomes of the cognitive domain of Phase F students at SMAN 13 Padang.

With various considerations, and from the obstacles faced by researchers during the study, researchers suggest that developers who want to develop e-booklets are expected to be able to adjust to the conditions of the students. In the study, it was found that students had difficulty installing and using e-booklets on the devices they had, due to the large file size.

For teachers who want to use e-booklets, they can consider the situation and conditions of the students' schools, if the school is adequate with complete facilities, e-booklets are highly recommended for use.

For other researchers, because the research at the disseminate stage is still at the validation testing stage and has not completed the other two main stages, it is recommended to continue this research to the packaging, diffusion and adaptation stages.

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