Project Based Learning Interactive E-Book: A Solution to Self Regulated Learning and Student Learning Outcomes

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ABSTRACT
The era of digitalisation helps the education sector in developing digital teaching materials, one of which is through the application of a learning project-based learning model. This study aimed to produce an interactive e-booke with a project-based learning approach with the Genially application, which has been validated by e-booke material experts and experts and tested on small groups, as well as knowing the differences in self regulated learning and student learning outcomes. This kind of RnD research uses the 4D model. The test subjects consisted of e-book experts, material experts, and class XI MP SMK Negeri 1 Malang students divided into small and large groups. The resulting research data is in the form of quantitative data and qualitative data. The analysis technique uses the normality test and the independent sample t-test. The results of this research and development are interactive e-books with a project-based learning approach with the Genially application, which have been declared very valid and feasible by material experts, e-book experts, and small group trials to be used in supporting the learning and learning process and being able to increase independence. Learning and student learning outcomes in office management subjects, of material archive management.

Keywords : *Genially; interactive e-book; project based learning; self-regulated learning; learning outcomes.*

1. INTRODUCTION

The development of technology and information helps the role of educators in realising digitally simulated learning. Digital teaching materials that are innovated with learning models can support the self-learning process and improve student learning outcomes. [24], [26], [41]. The success of learning outcomes depends on the teacher in developing media and learning models that are oriented towards increasing intensity, able to increase student involvement effectively. [17] The effectiveness of active students in academic learning encourages students to learn independently in developing skills so as to maximise learning outcomes. [15], [26], [46]. Learning outcomes are competencies achieved by students during the learning process [18]. An effective learning process requires the involvement of technology and information development [6], [43].

Learning that is integrated with technology and information is *electronic based e-learning,* one of which is an interactive e-book. [17], [39] (The advantages of interactive e-books are easy navigation in displaying images, text, and videos equipped with assessments and can provide feedback between teachers and students, making it easier for teachers and students in the learning process. [44], [33] The *project-based learning* model is student-centred to integrate new knowledge with activities in the form of practical activities. [12], [21]. *Project-based* learning in research (E. T. Pratiwi & Setyaningtyas, 2020) outlines 6 stages, namely creating essential questions, designing project plans, developing schedules, and facilitating and monitoring student work, assessing student results, and evaluating experiences. Research [11], [38], and [2] have proven that developing interactive e-books with a *project-based learning* approach can increase student self regulated learning and learning outcomes and facilitate the learning process. Based on the research that has been mentioned, it can be concluded that the solution to solving the problem of self regulated learning and student learning outcomes can be done by developing interactive e-book teaching materials that can optimise the learning process.

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The results of observations that have been made through interviews with Office Management subject teachers at SMK Negeri 1 Malang state that the majority of students get an average score of 80. Student learning outcomes are not optimal because the implementation of the independent curriculum causes limited teaching materials that are used as guidelines for the learning process . Meanwhile, individual student self regulated learning is less than optimal because of frequent group assignments. Another condition is that the teacher only uses *Microsoft Word* for making e-books . These problems encourage researchers to develop innovative digital-based teaching materials with a *project-based learning* approach g.

The developed interactive e-book utilises the Genially platform because it can be accessed online using *mobile phones* and laptops, by presenting interesting menus such as materials, learning videos, and assessments. In addition, in the development of interactive e-books, researchers also developed a digital archive system that is very relevant to be applied to practical archive management activities combined with *project-based* learning models. The existence of interactive e-books developed by researchers can help schools to have a variety of innovative technology-based teaching materials and be able to support digital practical activities in office management subjects on archive management material.

This research is important to do considering that the research that has been done by [11], [22] show that the use of e-books is feasible in learning and there is an increase in self regulated learning and student learning outcomes. showed that the use of e-books is feasible to use in learning and there is an increase in self regulated learning and student learning outcomes. The development of teaching materials with the Genially application has been done before but only focuses on gamification learning media [8], [38]. While the e-book developed by researchers in this research and development is an interactive e-book with a *project-based learning* approach that is equipped with practicum activities through a digital archive system that suits archival management material. The purpose of research and development is to produce an interactive e-book with a *project-based learning* approach with the Genially application that has been validated by e-book experts, material experts, and has been tested in small groups, and to determine differences in self regulated learning and learning outcomes of grade XI students.

2. METHODS

This research is a *Research* and *Development* (RND) applying the 4D development model with 4 stages of development:

Figure 1. Stages of Research and Development Source: Thiagarajan (1974) processed by Researcher (2023)

At the define stage, researchers analysed the needs and collected information from the research location, namely SMK Negeri 1 Malang regarding student learning resources, student self regulated learning during learning, student learning outcomes and learning outcomes and objectives. At the design stage, researchers made a product design, namely an interactive e-book that was prepared with a *project-based learning* model on archiving management material for class XI Office Management. The develop stage, at this stage researchers produce products then researchers validate the feasibility of the product on module experts, material experts, and small group trials totalling 6 students. Comments and suggestions from the feasibility test results will be used as an evaluation to complete the shortcomings in the e-book. At the disseminate stage, researchers distributed to a large group, namely class XI MP 3 to find out the increase in self regulated learning and student learning outcomes in the use of interactive e-books developed by researchers.

The test subjects were e-book experts, material experts, small groups, and large groups consisting of class XI MP. The data generated is quantitative data in the form of questionnaire scores that have been filled in by validators and small groups, self regulated learning in the form of questionnaires that have been filled in by students, and student psychomotor learning outcomes. Then, qualitative data is obtained from criticism and suggestions from validators and small group students. Data from validation results and small group trials were then analysed using descriptive percentage method to measure the feasibility level of the e-book developed, data on self regulated learning using descriptive percentage analysis with standard criteria and aspects of self regulated learning including aspects of metacognition, motivational aspects, and behavioural aspects [46], [9]. Meanwhile, psychomotor learning outcomes were analysed using normality tests and *Independent Sample t-Test* tests. Indicators in

psychomotor assessment include preparation, process, work results, and work attitude. Psychomotor learning outcomes were taken during the digital archive management practice process.

3. RESULT

This research and development produces an interactive e-book product interactive e-book *project-based learning* approach with Genially application office management subject matter archival management. Interactive e-books can be accessed online via *mobile phones* and laptops that present interesting menus and are easily understood by users. The interactive e-book menus are shown in Figure 2 as follows:

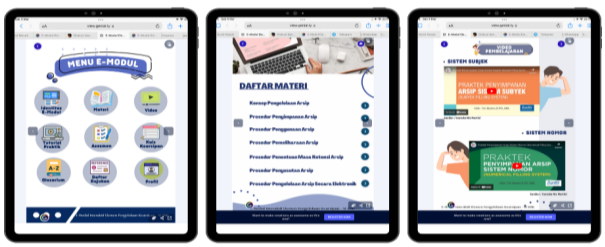

Figure 2. Interactive E-book Main Menu, Material Menu, and Learning Videos

The display of interactive e-books with the Genially application is visually designed and attractive and can connect interactions between teachers and students. In the material menu presents 7 learning outcomes while on the video menu researchers connect YouTube videos into interactive e-books. Teaching materials with the implementation of the *project-based learning* model in interactive e-book products are structured based on PjBL syntax, namely making essential questions can be seen in the material menu, while designing project plans, developing schedules, and facilitating and monitoring student work, assessing student results, and evaluating experiences can be seen through the evaluation menu. The practice of digital archive management can be seen on the website display of the incoming mail and outgoing mail system (SIAMAR). Figure 2 has presented an example of an interactive e-book display with the Genially application:

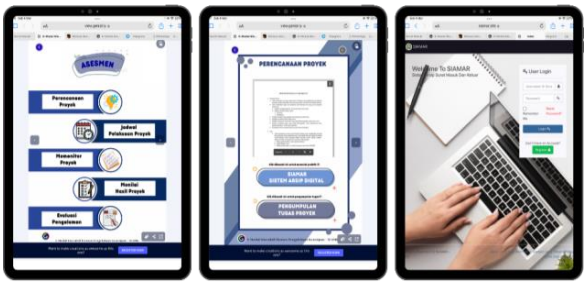

Figure 3. Menu View of Assessment, Project Planning, and SIAMAR Website

The project-based learning interactive e-book product with the Genially application can be seen at the following link: https://bit.ly/emodulinteraktifpjblpengelolaankearsipanSMK

The results of the validation of e-book experts and material experts who have been analysed using the descriptive percentage method are presented in table 1 as follows:

Table 1. Product Validation Results

No.	Validator		Aspects	Indicators	Percentage	Criteria
1	E-book Expert	1.	Ease	a. Ease of link/barcode access b. Ease of access to the e-book menu c. Ease of access to learning videos d. Easy access to online practice questions e. Ease of opening the material in the e-book	100 %	Very Valid
		2.	Presentation	a. Colour suitability of the e-book b. Appropriateness of e-book cover c. Completeness of e-book menu d. Appropriateness of the e-book with the *Project Based Learning* approach e. Accuracy of e-book theme selection f. Accuracy in selecting menu icons in the e-book g. Clarity of usage flow	96%	Very Valid
Average					98%	Very Valid
2	Material Expert	1.	Completeness	a. Suitability of material content with the flow of learning objectives b. Content suitability with learning outcomes c. Appropriateness of evaluation to the flow of learning objectives d. Presenting the benefits and importance of mastering competencies for students' lives e. Packaging material in accordance with the *Project Based Learning* approach	88 %	Very Valid
		2.	Relevance	a. The material is relevant to the learning objectives that must be mastered b. The project given is relevant to the learning objectives to be mastered c. Practice questions are relevant to the learning objectives that must be mastered d. The learning video is relevant to the learning objectives	100%	Very Valid
		3.	Accuracy	a. The material presented is in accordance with scientific truth b. The material presented is in line with the latest developments. c. Packaging material in accordance with the *Project Based Learning* approach. d. Accuracy of concepts and definitions e. Accuracy of image illustrations and learning videos	100%	Very Valid
		4.	Usability	a. Encourage student curiosity b. Encourage interaction between students and learning resources c. Encourage students to build their own knowledge d. Assist in learning activities e. Help improve knowledge in the implementation of archival management practices f. Assist in making it easier to find learning resources g. Assist in the learning process.	88,5%	Very Valid
Average					94,1 %	Very Valid

Source: Akbar (2013) and data processed by researchers (2023)

Based on Table 1, the product has been validated by e-book experts and material experts. The assessment by e-book experts states that the product is very feasible because it has fulfilled two aspects, namely convenience and presentation, so that an average percentage of 98% is obtained. Meanwhile, the assessment by material experts states that the product is very feasible because it has fulfilled four aspects including completeness, relevance, accuracy, and usefulness, with an average percentage of 94.1%.

Table 2. Product Trial Results

No.	User	Aspects	Indicators	Percentage	Criteria
1	Small Group Trial	1. Ease	a. Ease of understanding the content of the material b. Ease of accessing learning videos c. Ease of accessing e-modules	99,3%	Very Valid
		2. Usability	a. Increase interest in learning b. Ease of finding information on the material c. Ease of finding answers d. Ease of finding an overview of archival management practices	98,2%	Very Valid
		3. Graphics	a. Images in accordance with the material b. The learning video is in accordance with the material c. Easy to read writing format	100%	Very Valid
Average				99,1%	Very Valid

Source: Akbar (2013) and data processed by researchers (2023)

Based on table 2, the product trial by small groups obtained a percentage of 99.1% with very feasible results because it fulfilled three aspects, namely convenience, usefulness, and graphics.

Based on the results of trials by E-book experts, material experts, and small group trials, it proves that interactive e-books with a *project-based learning* approach with the Genially application in office management subjects on archiving management material are declared very feasible to be used as digital-based teaching materials at SMK Negeri 1 Malang in class XI MP. Previous research also stated that the results of validation of e-book experts, material experts, and small group trials were used as the basis for the feasibility of e-books when utilised during the learning process. [29], [40], dan [42].

Furthermore, the results of student self regulated learning in the experimental and control classes were calculated using descriptive analysis techniques with aspects of self regulated learning including metacognition, motivation and behaviour. The results of student self regulated learning are presented in table 3 as follows:

Table 3. Percentage of Each Aspect of Self regulated learning

Aspects	Percentage	
	Experiment Class	Control Class
1. Metacognition 1.1 Students' ability to plan their learning 1.2 Setting goals in learning 1.3 Self-regulation in learning 1.4 Self-monitoring in learning 1.5 Self-evaluation in learning	88,7%	69,6%
2. Motivation 2.1 Self-efficacy 2.2 Self-motivation 2.3 Interested in completing the task	92,4%	72,2%
3. Behaviour 3.1 Choose an environment that optimises learning 3.2 Structure environments that optimise learning 3.3 Create an environment that optimises learning	88,4%	66,7%

Average	89,8 %	69,5 %

Table 3 shows the results of self regulated learning in the experimental class obtained 89.8% with high criteria while the control class obtained 69.5% with low criteria, so the self regulated learning of the experimental class was superior to the control class. So that the interactive e-book with a *project-based learning* approach with the Genially application in office management subjects on archival management material developed can increase student self regulated learning. Previous research also states that interactive e-books are able to increase student self regulated learning [22].

Table 4. Normality Test

Psychomotor Learning Outcomes		
Shapiro Wilk		
	Experiment Class	Control Class
Statistic	.950	.964
df	35	34
Sig.	.115	.312

The Shapiro-Wilk normality test results show that the experimental class gets a Sig value of 0.115 and the control class gets a Sig value of 0.312. Table 4 shows that the experimental class and control class got a Sig> 0.05 so it can be concluded that the students' post-test learning outcomes are normally distributed.

Table 5. *Independent Sample T-test*

Independent Samples Test										
		Levene's Test for Equality of Variances		*t-test for Equality of Means*						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. *(2-tailed)*	*Mean Difference*	*Std. Error Difference*	*Lower*	*Upper*
Psychomotor Learning Outcomes	*Equal variances assumed*	4.120	.046	-12.362	67	.000	-12.992	1.051	-15.089	-10.894
	Equal variances not assumed			-12.277	53.729	.000	-12.992	1.058	-15.113	-10.870

Table 5 in the Equal variances assumed section produces a Sig (*2-tailed*) value of 0.000 ≤ 0.05, these results indicate a significant difference in the psychomotor learning outcomes of the control class and experimental class. (Irianti & Arief, 2021). The significant psychomotor learning outcomes in the *Independent Sample T-test* test prove that the interactive e-book developed by researchers is effective for increasing student self regulated learning. This question is in line with previous research [4], [11], [45].

The level of effectiveness of interactive e-books with a *project-based learning* approach can be measured by the average student learning outcomes. The average student psychomotor learning outcomes between experimental and control classes are presented in table 6 as follows:

Table 6. Average Psychomotor Learning Outcomes

	Experiment Class		Control Class	
Gender	*N*	Average Score	*N*	Average Score
Male	1	93	-	-
Women	34	90,2	34	77,2
Overall	35	91,6	34	77,2

Based on table 6 psychomotor learning outcomes. The experimental class consists of 35 students consisting of 1 male student and 34 female students. Male students get a score of 93 and female students get an average score of 90.2 Overall, the experimental class gets a high average of 91.6 so that the average acquisition of psychomotor learning outcomes is above the school's maximum completeness criteria of 80. Meanwhile, the control class consists of 34 female students who get an average score of 72.2.

The scores of the experimental and control class psychomotor learning outcomes became a measure of the effectiveness of the interactive e-book developed. In Table 6, the experimental class score is 91.6 and the control class is 77.2, so it can be stated that the interactive e-book of *project-based learning* approach with Genially application is able to improve psychomotor learning outcomes by 14.4 points.

4. DISCUSSION

The resulting interactive e-book is designed to be attractive and visual in order to encourage interest in self-learning of archive management material, one of which is by presenting menus and practice facilities in interactive e-books. These menus include the e-book identity menu which contains module identity, learning outcomes, and learning objectives, material menu which contains information on 7 learning outcomes, learning video menu which is intended for additional audio-visual understanding of archive storage system material. [28], [45] and the video tutorial menu contains a real picture of practicum activities [8]. [8] The assessment menu presents a *project-based learning* syntax which includes a digital archive management project, an archival quiz menu to add new knowledge and concentration on archive management [1]. [1], [10], [36], dan [43]. The quiz menu in this e-book is an activity for interaction with students [7], [42]. The advantages of the resulting interactive e-book are flexible [37], [2] or can be accessed online via a *link,* e-book design that contains audio-visual elements, and becomes a means of integration between teachers and students so that the use of interactive teaching materials with multimedia technology can increase effectiveness in the learning process [20]. [20], [28] (In addition, the interactive e-book contains the incoming and outgoing mail archive system website (SIAMAR) as a practicum media for digital archive management. Interactive e-books with a *project-based learning* approach are very suitable for vocational education because they prioritise practice [42]. [42], [5]. PjBL is able to increase academic knowledge, improve student work and student skills in the learning process. [14], [16], [31].

Before the developed product is used by students, researchers conduct validation first to ensure the interactive e-book is suitable for the learning process. The validation test was carried out to e-book experts, material experts, and small group trials. E-book expert validation is carried out by e-book experts, namely lecturers who are experts in the field of teaching material development to obtain validity and feasibility when used. [4], [40] The aspects assessed include convenience and presentation. Based on this validation, the product is declared very feasible by e-book experts because overall it has an attractive *user interface* and components that can be functioned properly so that it is easily understood by users. Material expert validation was carried out by office management subject teachers to obtain the feasibility and suitability of the material. The aspects assessed include completeness, relevance, accuracy, and usefulness. Based on this validation, the product was declared very feasible by the material expert because the e-book covers all subject matter from one unit of competency or learning outcome.).. [19], [28] Small group trials to determine the ease with which students can access e-books. The aspects assessed include convenience, usefulness, and graphical. Based on this validation, the product is declared very feasible because users get a new experience with an attractive and informative e-book display that attracts students to study the e-book. The validation results from e-book experts, material experts, and small group trials stated that the e-book is valid and very feasible to be used for the learning process. [4], [19], [22].

Students' self regulated learning and learning outcomes that increased significantly were influenced by the platform used to develop interactive e-book products, namely Genially. [23], [32] The self regulated learning of experimental and control class students in the behavioural aspect obtained the lowest

percentage because students found obstacles in creating an optimal learning environment so that the relationship between thought patterns and action was not optimal [9], [36]. The metacognition aspect obtained a medium percentage because students were able to use strategies but lacked in planning, setting goals, and evaluating their tasks so that the learning process and results were not optimal [46], [9]. Meanwhile, the motivation aspect obtained the highest percentage because students have high self regulated learning and motivation so that they consider themselves competent and believe in their abilities [25], [27]. Interactive e-books also improve student learning outcomes in archival management material as measured by changes in students' psychomotor learning outcomes which increase due to students' interest in project learning which during digital archive practice activities is supported by practicum media that are aligned with learning materials [10]. [10], [29] In addition, practicum activities implemented with the *project-based learning* model are very appropriate so that they have an impact on students learning independently, training students to adapt to modern principles which are implemented by honing skills through practicum and applying them. [5], [13].

5. CONCLUSION

This research and development produces interactive e-book teaching materials with a *project-based learning* approach with the Genially application for office management subjects on archiving management material to increase student self regulated learning and learning outcomes. This e-book is said to be interactive because it is able to create a reciprocal relationship between teachers and students. The statement is in accordance with the results of validation by e-book experts, material experts, and small group trials, namely the e-book has been declared very feasible to use for the learning process. In the large group trial, it was stated that there were differences in psychomotor *learning* outcomes in the experimental class and control class so that it could be concluded that the interactive e-book of the *project-based learning* approach with the Genially application in office management subjects on archiving management material could improve student learning outcomes.

In accordance with the results of the study, it is hoped that for teachers, every practicum learning process should be integrated with information technology so that the student learning process is more varied so that student learning outcomes will increase. Students should be able to choose, structure, and create an optimal learning environment so that they are independent and not dependent on others. It is hoped that future researchers will develop interactive e-books that can be accessed offline by users and add more diverse learning materials and digital practicum activities.

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