Wekiddo as M-Learning to Improve Critical Thinking Ability and Student Achievement

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Abstract. Technologycal changes have a major impact on education which requires educators to be creative and selective in determining learning media. This research and development develop Wekiddo-based m-learning content to improve students' learning outcomes and critical thinking, determine product feasibility through media and material validation. M-learning makes it easier for educators to provide distance learning. The developed media product includes planning, implementation, and assessment. Through the development of the Borg and Gall model, Wekiddo-based m-learning content was declared feasible and valid by media experts, and m-learning users. Wekiddo-based m-learning content is proven to be effective in improving students' learning outcomes and critical thinking in the 21st-century learning era. This study found differences in critical thinking abilities and student learning outcomes before and after using Wekiddo. Improvement and feasibility of this learning media can be used for learning in other subjects.

Keywords: Learning Outcomes · Critical Thinking Ability · Learning Media · M-Learning · Wekiddo

1 Introduction

The existence of the digital world marks an increasingly rapid industrial and technological revolution. This development is seen in the media used to communicate in the world of business, economy, and education as well as the forms of cooperation and collaboration between individuals and companies. The emergence of e-commerce, e-wallet and digital transactions in the economic and business fields, e-learning and digital learning media in the education sector increasingly shows the expansion of business and education economic opportunities. Technological developments in the industrial revolution era brought many influences in various fields. Education is a field that is developing and is the impact of progress and increased use of communication and information technology. The era of the industrial revolution also influenced millennials to understand technological changes. The development of science and technology needs to be balanced with an understanding of the choice of technology to support critical thinking. Therefore, the world of education must be able to adapt technological changes to learning. This is done to seek educational progress and support the application of 21st-century learning

P. Susanto et al. (Eds.): PICEEBA 2022, AEBMR 250, pp. 209–223, 2023.
https://doi.org/10.2991/978-94-6463-158-6_19

[1]. 21st-century learning requires students to study material such as the application of concepts, analysis of problem solving solutions, and experiences in school [2]. Learning activities must be able to elaborate on the analytical skills and participation of students.

Learning activities aim to acquire 21st century skills that prioritize insight and skills in applying technology. The process of designing learning activities needs to use strategies that can develop skills in the 21st-century. To support 21st-century learning, teachers are expected to encourage the learning motivation and creativity of students by using ways (1) assisting discovery and creative and innovative thinking, (2) using digital learning facilities to solve real problems by involving the role of students, (3) support student reflection to demonstrate and elaborate on student understanding with colleagues and others, and (4) take advantage of collaborative knowledge building by engaging in learning in either face-to-face or virtual environments [1]. The application of 21st-century learning is supported by changes to the SMK Pusat Keunggulan curriculum that prioritizes the use of technology and its implementation in the real environment. Blended learning leads to limited practice and analysis, as well as decreased student activity in the learning process [3].

This condition will be further exacerbated by learning media that are less varied and do not utilize technology. Less learning media also hampers the delivery of material from the teacher to students. The incorporation of technology in learning media aims to foster student learning skills [4]. Mobile learning is one example of the use of technology in learning. M-learning can overcome the limitations of face-to-face learning and is equipped with materials that can be accessed without limits [5]. Mobile learning is a practical learning alternative because it utilizes smartphones that are easily accessible by students [6]. Several m-learning development studies have been developed in the fields of general administration [7], physics [8], simulation and digital communication [9], mathematics [5]; [10], basic programming [11], technology [12], informatics [13], electronics [14], geography [15]. This study focuses on the use of m-learning to measure the level of effectiveness, feasibility, and improvement of learning outcomes, learning independence, critical thinking skills and visual literacy skills.

M-learning is applied to support independent learning while still paying attention to the development of student competencies. M-learning makes it easy for students to access learning widely and not limitedly [16]. Students can also listen to learning, implementation, and evaluation independently. However, some m-learning still conducts learning by remaining teacher-centred [17]. The material provided is less diverse, only in the form of text, and there is no direct interaction with students [18]. This research develop m-learning that can provide complex materials and visualizations to trigger interactions between teachers and students. The existence of a feature to provide announcements related to school activities and the integration of student accounts with parents can trigger more focused supervision and learning. Classroom chat feature that makes it easy for teachers and students to have discussions that trigger learning activities and higher-order thinking analysis. M-learning is presented complete with problem-based learning modules and evaluations. The presentation of m-learning is done so that students have the ability to analyze, conclude, and plan solutions to a problem presented.

One of the schools included in the Center of Excellence SMK program is SMKN 1 Ngawi. This study was conducted based on preliminary research by the author which

showed a decrease in learning outcomes and ability to analyze questions in the category of high order thinking skills. This survey was filled out by 36 students (55.6% class X, 36.1% class XI, and 8.3% class XII). 69.4% of students said that the element of managing documents digitally is quite difficult and 30.6% said easy. Then the survey results stated, that 8.3% of students got a less than 70, 47.2% of students scored in the range of 70–80, 36.1 students scored in the range of 81–90, and 8.3% get a score of more than 90. 69.4% of students said they were bored with the teaching methods applied in the classroom. This is exacerbated by the Covid-19 pandemic which causes blended learning and less use of learning technology. The subject teacher said that learning through WhatsApp and Google Classroom. Various learning obstacles include the internet network and the absence and inactivity of students in learning. Students have not been able to analyze or think critically in response to a particular problem. This is evidenced by 3 out of 34 students can answer the analytical questions well and correctly, while 31 students cannot answer the analytical questions correctly. Existence blended learning results in limited material delivery time. This resulted in low understanding and decreased learning outcomes.

Based on this, this study uses the Wekiddo application in developing m-learning media content centered on digital-based document subjects. This development was carried out to see the feasibility of m-learning based on the Wekiddo application to improving students' critical thinking skills and learning outcomes. The development of Wekiddo makes it easy for students, teachers, schools, and parents to be involved during the learning process. Teachers and students can also do more varied learning with an Android-based platform that is easily accessible and flexible in use. The existence of a variety of materials and practical support materials can encourage students to study and explore material that is abstract. The creation of a more interactive learning process can be implemented to improve critical thinking analysis and learning outcomes. Wekiddo for schools can be a learning platform, where schools can monitor overall learning and the government or education office can monitor the course of learning. Besides aiming to develop and determine the feasibility of Wekiddo-based m-learning, it is also to find out the differences in learning outcomes and students' critical thinking skills before and after using Wekiddo.

2 Literature Review

Mobile learning is alternative learning in conducting distance learning activities. M-learning makes it easier for students to receive material packaged using smartphone media, not bound by distance and time [19]. M-learning can be used in distance learning and facilitates the delivery of material, both theory and practice. The ease of m-learning by using only smartphones increases interest and enthusiasm for learning so that learning outcomes and students' analytical skills increase. The use of smartphones during the learning process as a learning medium equipped with varied material content is expected to trigger the creation of learning objectives and student activities in the classroom [11]. M-learning is increasingly being used to facilitate learning by utilizing technology [7].

Sadikin & Hamidah explained that Wekiddo supports the convenience of teachers in carrying out online and offline learning with quite complete features [20]. Wekiddo

has various features to help parents contribute and supervise learning. In addition to facilitating services for teachers, students, and parents, Wekiddo also makes it easy for schools to facilitate and communicate with administration and learning. The government or the education office can also monitor the course of learning to make it more effective [21]. The development of m-learning based on the Wekiddo application is focused on digital-based document elements for class X Office Management and Business Services (MPLB) at SMK N 1 Ngawi. The digital-based document subject is a new subject in accordance with the SMK Pusat Keunggulan curriculum structure [22]. This subject contains learning outcomes (1) the basics of office document handling procedures, (2) types of office document management equipment, and (3) office document storage procedures. These subjects include the basic skills program for the Office Management and Business Services skills program.

Some researchers reveal that m-learning is effectively to improve understanding of learning [12]. M-learning is getting easier to use with changes in content or material according to the needs of the teacher. The use of smartphones greatly facilitates increased student involvement in learning. M-learning can be used to facilitate learning materials, to interact directly with teachers and to improve the competence of students [23]. M-learning creates new experiences in learning that trigger activeness and build critical analytical skills. Completeness of content or materials, ease of access to the learning menu, and use of m-learning for students have an influence on student acceptance [24].

3 Method

This study uses the Research and Development Borg and Gall model consisting of 10 stages. However, the whole production stage was not carried out due to time constraints and consisted of various strategic guidelines so that a new group was required to be prepared [25]. The first step is collecting information related to problems and potentials in schools through interviews and preliminary studies in the second step, collecting data is obtained by researchers. Next, the third step is designing product design and content. The fourth step, test the feasibility of the design with media and materials experts. Next is the fifth step, there is a product revision based on the input written in the media and material feasibility questionnaire. The sixth step is product trials for 6 students of class X MPLB 1 using the revised product. The end of semester assessment determines the selection of the experiment and the control class. The class with the lower average score will be the experiment class. In the seventh step, if there are suggestions for improvement in the trial questionnaire, then revisions are made. In the eighth step, the trial of the final product in the experiment class X MPLB 2 involved 34 students, while the control class X MPLB 1 involved 36 students. In the ninth step, if there are still criticisms and suggestions, a product revision will be carried out (Fig. 1).

This research produces qualitative and quantitative data. The quantitative data in question are the results of media and material validation questionnaires as well as the results of product trials and usage. The qualitative data of this study, criticisms and comments, conclusions will be drawn on the products developed. All data generated will be processed with descriptive percentage analysis to measure the level of feasibility and suitability of m-learning. Then, the data on students' learning outcomes and critical

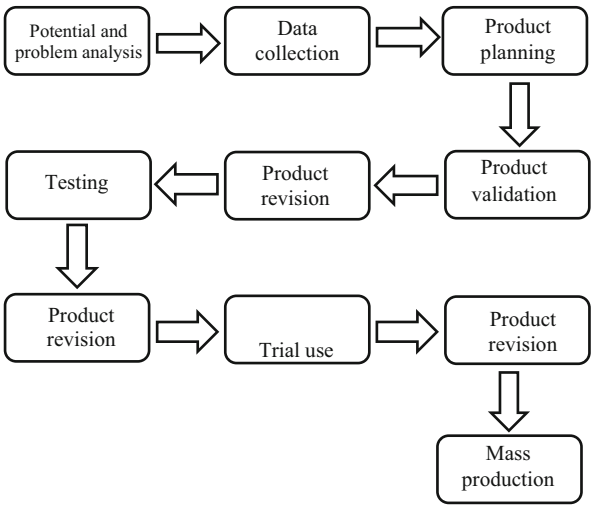

Fig. 1. Stages of Research and Development

thinking were processed through an independent sample t-test to measure improvement in learning outcomes and analysis of critical thinking between students before and after applying Wekiddo.

4 Result and Discussion

4.1 Result

The result of this research and development is Wekiddo-based m-learning containing digital-based document material. The use of m-learning has been proven effective in recent years and even in global education. M-learning is assessed as learning that is more focused and focused on improving student learning outcomes. M-learning has become the most effective learning resource, especially in the European education system [26]. Researchers conducted a preliminary study to find out and explain the deviation between what was expected and what happened [27]. The results of the preliminary study prove that learning at SMK N 1 Ngawi which includes the SMK Pusat Keunggulan still does not apply technology as a learning medium, even though there are good learning facilities such as computers, laboratories, and other supporting facilities. Learning media and limited face-to-face meetings in schools also make practical and analytical learning difficult. Students also revealed that internet network constraints make learning difficult to understand so that skills and learning outcomes decrease. The product display and Wekiddo application menu are described in Figs. 2, 3, and 4.

The features in the Wekiddo application can certainly support distance learning. Presentation of material that includes text, video, link sources, and audio can provide easy understanding of the material to students. The product developed is tested for feasibility through validation carried out by media experts with criteria for lecturers who have relevant experience with m-learning and expertise in the media field as well

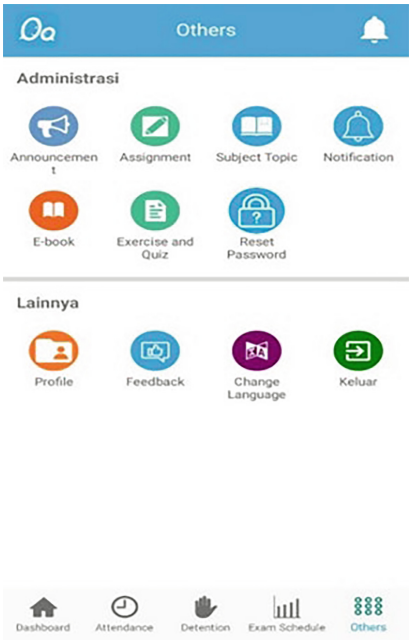

Fig. 2. Wekiddo Menu Display

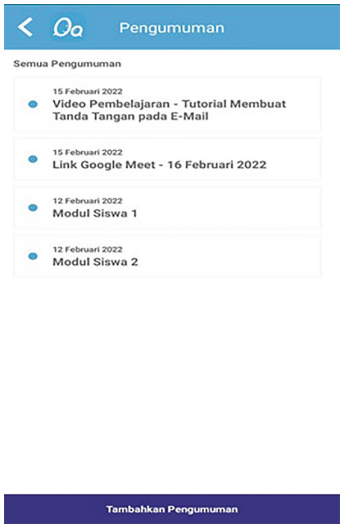

Fig. 3. Announcement Feature to Send Teaching Materials or Information

as material experts with criteria for teachers who understand the school curriculum well and insights relevant to m-learning products. The following table presents the results of media validation (Table 1).

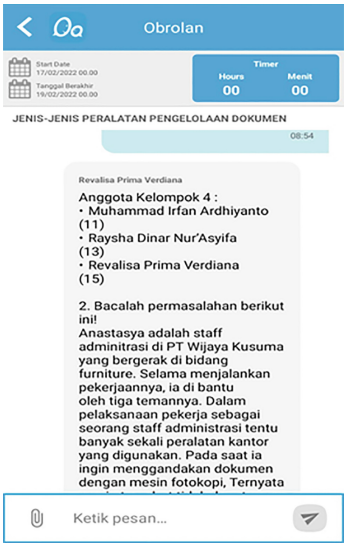

Fig. 4. Classroom Features for Discussion and Assignments

Table 1. Media Validation Questionnaire Result Data

No	Measurement Aspect	Number of Questions	Earned Score	Maximum Score
10.	Ease of Operation	4	20	20
2.	Presentation of M-learning	8	37	40
Total		12	56	60
Average (%)				95%

Table 1 shows that the media validation is 95% with a valid and feasible category according to the criteria for the validity and feasibility of the media [28]. Learning materials or content were also validated by material experts with the following results.

Table 2 explains the results of material validation, which obtained 92% valid and feasible categories according to the criteria for the validity and feasibility of the material [28]. The material presented to students is a learning videos and problem-based learning modules (Fig. 5).

After getting the validation of the feasibility of the media and materials, this product was tested on 6 students before the use trial [29]. The final results of testing in this small group will be input for improving the Wekiddo application-based m-learning product for digital-based document subjects. The data from the test results for 6 students are presented in Table 3.

Table 3 describes the results of the Wekiddo user response questionnaire obtained by 93% which indicates that the Wekiddo application and the content developed are categorized as valid and worthy. This category matches the product eligibility and product

Table 2. Material Validation Questionnaire Results Data

No	Measurement Aspect	Number of Questions	Earned Score	Maximum Score
1.	Usability Aspect	5	23	25
20..	Presentation of M-learning	5	23	25
Total		10	46	50
Average (%)				92%

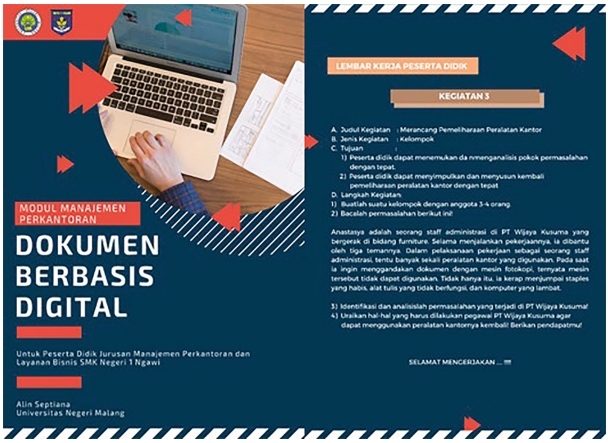

Fig. 5. Electronic Problem-based Learning Module

Table 3. Wekiddo User Response Questionnaire Results Data

No	Measurement Aspect	Number of Questions	Earned Score	Maximum Score
1.	Ease of Access	6	166	180
2.	Benefits of M-learning	4	112	144
Total		12	278	324
Average (%)				93%

validity criteria [28]. The next stage is the use trial conducted on the experimental class, namely class X MPLB 2 and the control class, namely X MPLB 1. The use trial is carried out by giving practical questions and critical thinking analysis questions to see comparisons of learning outcomes and critical thinking analysis of students. Before and after the use of m-learning. Data on learning outcomes of usage trials are described in Table 4.

Table 4 shows the differences in learning outcomes of the usage trials through the pre-test and the post-test. This difference can be seen in the average pre-test of the experiment class and the control class [29]. The results of the analysis prove that the

Table 4. Data on Average Learning Outcomes of Usage Trial

No.	Learning Outcomes	Experiment Class		Control Class	
		Pre-test	Post-test	Pre-test	Post-test
1	Document Management Basics	72,0	84,5	76,0	79,8
2	Types of Document Management Tools	73,1	85,4	79,6	80,9

average learning outcomes of the experiment class have increased after implementing Wekiddo-based m-learning. Critical thinking analysis also shows a visible difference from the average percentage. Critical thinking assessment is based on (1) elementary clarification; (2) basic support; (3) inference; (4) advanced clarification; (5) strategy and tactics.

Table 5 illustrates the comparison of the average critical thinking ability of the usage trial. The average critical thinking ability of the experimental class is 71% and the control class is 66.5%. The improvement of critical thinking skills is not only assessed from critical thinking indicators but also by giving questions using Bloom's Taxonomy Theory verbs on the use of assessment verbs including analyzing, evaluating, and creating. The next stage is data analysis to present data findings in the field and conclude the data presentation [30]. Data analysis was carried out using SPSS through normality test and independent sample t-test. The results of the normality test are presented in Table 6.

Table 6 explains that the normality test using the Shapiro Wilk test results that the significant value of the experimental class and control class in both learning outcomes (pre-test and post-test) and critical thinking analysis is >0.05. The normality test states that the research data is normally distributed. While the results of the independent sample t test are described in Table 7.

Table 5. Average Data of Students' Critical Thinking Ability

No.	Rating Indicator	Experiment Class		Control Class	
		Earned Score	Maximum Score	Earned Score	Maximum Score
1	Elementary Clarification	136	170	134	170
2	Basic Support	118	170	117	170
3	Inference	125	170	107	170
4	Advanced Clarification	110	170	103	170
5	Strategi dan Taktik	114	170	106	170
	Total	602	850	566	850
Average (%)			71%		66,5%

Table 6. Normality Test (Shapiro Wilk Test)

	Significant (Sig.)
Pre-test Experiment Class	0,378
Pre-test Control Class	0,521
Post-test Experiment Class	0,173
Post-test Control Class	0,147
Critical Thinking Experiment Class	0,545
Critical Thinking Control Class	0,145

Table 7. Independent Sample T-Test

	Significant (Sig.)
Pre-test Experiment Class	0.014
Pre-test Control Class	0.016
Post-test Experiment Class	0.003
Post-test Control Class	0.003
Critical Thinking Experiment Class	0.000
Critical Thinking Control Class	0.000

Table 7 the independent sample t-test obtained an overall significance result of 0.05. This data processing proves the comparison of learning outcomes and students' critical thinking skills in the experimental class and control class. Judging from the feasibility level, improving learning outcomes and critical thinking skills, the development of m-learning content is the final product that can be applied to classroom learning.

4.2 Discussion

The existence of the SMK Pusat Keunggulan program has also changed the curriculum at 1 Ngawi vocational high school, especially the use of learning technology. This adjustment to technology supports innovation and creativity in learning by using interest learning media [31]. Based on this, the research develop m-learning content assisted by the Wekiddo application on digital-based document subject for class X Office Management and Business Services at 1 Ngawi vocational high school. M-learning can be used as a learning medium that contains material on the basics of document management and types of document management tools. Previous research that developed Android-based m-learning assisted by Ispring Suite 9 proved that the experimental class learning outcomes had increased compared to the control class [7]. The integration of technological materials can facilitate access to wider, more appropriate and effective materials in the learning process [9, 12].

Sadikin & Hamidah suggested that Wekiddo can support complete and easy-to-access online and offline learning [20]. The use of Wekiddo is made easy by the features that make it easy to do online learning in the classroom. Wekiddo features that can be used by teachers are (1) an announcement feature that makes it easy to notify students of important announcements; (2) the attachment or assignment feature that contains learning assignments and provides classroom chat as a discussion forum; (3) e-books to add learning modules and videos, in this case, the learning content is more complex. Integration of student accounts with parents as well as supervision from the school can guarantee real learning during the blended-learning system. The use of m-learning can make it easy for teachers to control the activities of students during learning and to focus learning on students (student-centred learning) [32].

M-learning based on the Wekiddo application that was developed was categorized as valid, following the criteria and validity [28]. Eligibility by media experts is measured by various ease of access and presentation of content. Material experts also categorize the material or content presented as valid and feasible based on an assessment of the usefulness and technique of presenting the material. Users or students state that the Wekiddo application-based m-learning content is feasible and valid to measure from the aspect of convenience and usefulness. The results of the escalation explained that the learning outcomes and critical thinking skills in the experiment class were proven to increase compared to the control class. Learning outcomes are supported by the provision of more varied and complex materials, the provision of learning media that are easily accessible by smartphones and evaluation of learning starting from preparation, process, results, and work attitudes [11]. Assessment of learning outcomes can measure the effectiveness of learners and test the practice of learning [33].

The level of achievement of critical thinking and learning outcomes is also supported by easy access, low cost, connection to technology, interactive, school support, and attractiveness based on ACTION theory [34]. Teachers must be able to choose and create varied and complete learning media [35]. Learning media are selected to apply critical thinking skills or high-level analysis in problem-solving so that new experiences arise in learning. The level of critical thinking ability can be measured by fluency in understanding questions, formulating solutions, providing conclusions, explaining reasons for drawing conclusions, and re-explaining answers in their own language [36]. Critical analysis is trained in students through the provision of case studies and high-order thinking skills questions that trigger appropriate analysis and conclusion [37].

Students also prefer learning that does not only contain text but also images and audio [38]. Therefore, Wekiddo is designed as a complete learning medium with complex material in the form of text, visuals and audiovisuals as well as a direct interaction between teachers and students during learning if there are difficulties during learning. Students can also communicate personally with their peers for discussion. M-learning can be used in the learning process, effective to be applied, and developed further [39]. In addition, m-learning also makes learning more interesting and provides new experiences for students.

5 Conclusion

This research and development develop m-learning content using the Wekiddo application to improve learning outcomes and students' critical thinking skills centred on digital-based document elements. This M-learning contains digital-based document learning materials with learning outcomes, namely the basics of document management and types of document management tools. M-learning based on the Wekiddo application has proven to be valid and feasible to be applied during learning through media, material, and user experts. M-learning is also proven to be effective in improving learning outcomes and students' critical thinking skills based on the use trial with the results of the independent sample t-test. The Wekiddo application allows learning with broad access and is connected to the internet network.

The Wekiddo application can be accessed independently, so teachers can use Wekiddo as an accessible and attractive choice of learning media to improve learning outcomes and students' critical thinking skills. Further researchers can develop IOS-based learning media and present other subject matter. In addition, further researchers can also measure the effect of using Wekiddo on other variables and the competence of other students.

Acknowledgments. Thank you to the the Universitas Negeri Malang and SMK Negeri 1 Ngawi who have given permission and facilities to researchers to carry out research and development activities.

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