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Appropriate Technology E-book on Mobile Learning For Mathematics Teachers

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Abstract

Technological developments in the industrial era 4.0, which coincided with the Covid-19 Pandemic, required teachers to teach students from home. The use of technology is the right solution during the current Pandemic. This research and development aim to produce an Appropriate Technology (AT) e-book on mobile learning during a Pandemic for mathematics teachers that is valid and practical. The subjects of this study were 17 high school mathematics teachers in Lingga and Bintan districts. The research design used is the ADDIE development model, which specifically includes (1) analysis, (2) design, and (3) development. The instruments of data collection used a validation questionnaire sheet and a practicality questionnaire sheet. The data were analyzed by qualitative descriptive statistics to see the validity and practicality of the AT e-book developed. The results showed that the AT e-book was valid, as seen from the validation results of the validators, the score showed an average of 92.5% with very valid criteria. Based on the results of the practicality questionnaire, the AT e-book obtained an average score of 84.9% in the very practical criteria. This result was also confirmed by the teachers directly that the book helped them understand mobile learning easily. Therefore, it can be concluded that the AT e-book on mobile learning during the Pandemic for mathematics teachers has been categorized as valid and practical.

Keywords: appropriate technology; e-book; mobile learning; covid-19 pandemic; math teacher

I. Introduction

Education is an essential aspect. Undang-Undang No. 20 of year 2003 concerning the National Education System states that education is a conscious and planned effort to create a learning atmosphere and learning process. Through that effort, students can actively develop their potential to have religious and spiritual strength, self-control, personality, intelligence, noble character, and skills needed by themselves, society, nation, and state. Through education, student's potential can be developed under technological developments in the era of the industrial revolution 4.0 at this time, which has brought changes in the field of education.

Amid technological developments in the era of the industrial revolution 4.0, the government announced the first case of *Coronavirus Disease 2019* (Covid-19) in March 2020. Indonesia then faced a pandemic. In addition, Tasdik & Amelia (2021); Sa'id (2021); Cahyani, Listiana, & Larasati (2020) stated that

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the pandemic period carrying out online learning resulted in a decrease in learning enthusiasm, students had difficulty understanding the material, and students were easily bored in the learning process. In this case, Asmuni (2020) revealed that the government, through the Ministry of Education and Culture (Kemdikbud) has implemented a policy of learning from home or Learning From Home, which is implemented as the Distance Learning system.

According to Parlindungan, Mahardika, & Yulinar, (2020); Yuangga & Sunarsi (2020) Distance learning is a learning system carried out online using the internet network. Distance learning that is carried out certainly has its impact. Salsabila et al. (2020) explain that learning that was initially conducted conventionally now has to be done at a distance and utilizes technology. According to Syahroni, Dianastiti, & Firmadani, (2020); Miftah, (2013), mastery of information technology-based learning media will benefit the learning process. Therefore, it is necessary to use technology in the distance learning process, one of which is mobile learning.

Mobile learning began to be designed to make it easier to do learning anytime and anywhere. Mobile learning is learning that utilizes mobile technology that can provide availability of teaching materials that can be accessed at any time and visualize exciting material (Khairunnisa et al., 2019; Amirullah & Hardinata, 2017; Martha, Adi, & Soepriyanto, 2018). It is also stated that mobile learning can trigger attraction and encourage students' motivation to focus on every subject matter, including mathematics. (Yuliani, 2010; Prasetyo et al., 2015; Yanti, Diarini, & Suryanto, 2021). In addition to adding to the attractiveness of students, Chusni et al. (2017) explained that teachers who could design learning using mobile learning could improve teacher pedagogy. Therefore, during distance learning, educators should facilitate students by utilizing technology, one of which is mobile learning in learning mathematics.

Changes in learning and teaching patterns are never separated from the role of educators. Wahyono et al. (2020) revealed that educators must be ready for various learning conditions and students. Mastery of learning tools, learning materials, and good communication is required in delivering distance learning. Sudrajat (2020) said that educators need to have specific competencies that can support the success of student learning during the pandemic, following the teacher competency standards that have been set by Kepmendiknas No. 16 of 2007. This is done by developing an e-book on Appropriate Technology (AT).

Research conducted by Utomo et al. (2018); Wilyanti, Larlen, & Suryani (2021) showed that the development of e-books gets a positive response, can be accepted in the learning process and can be used as a complement to learning. Research by Martha et al. (2018) also mentions that mobile learning-based e-books can help visualize abstract material that can help students understand. However, based on the relevant research above, previous research has produced a product in the form of a mobile learning application. Therefore, the researcher formulated the problem in this study, how is the development of an Appropriate Technology (AT) e-book on mobile learning for mathematics teachers during the pandemic era? The goal is the development of an AT e-book on mobile learning for mathematics teachers during the pandemic era.

II. Research Method

This study is a research and development (R&D), which refers to the ADDIE model developed by Dick & Carey (1996). However, this research is limited to the development stage. The analysis phase of the researcher identifies and determines the content of the primary material and the selection of applications needed in constructing mobile learning-based learning media. In the design phase, the researcher designed the specifications for the AT e-book and determined the components that make up the AT e-book. Then in the development stage, researchers used *Microsoft Office Word 2013* in the process of making the AT e-book and

developed instruments that are questionnaires given to validators to see the validity and teachers to see the practicality of the product developed.

A validity test was conducted using a validation sheet delivered at *Google Form* by two experts according to the qualifications of their respective fields. Meanwhile, subjects to test the practicality of this study were 17 high school mathematics teachers who joined the *Musyawarah Guru Mata Pelajaran* (MGMP) in Lingga and Bintan districts. Implementation of the AT e-book use is the fourth week of July 2021. Data was collected through an electronic questionnaire using the *Google Form* Platform.

The data analysis used in this study was qualitative descriptive statistics analyzed the score results of validity and practicality questionnaires. The data analysis technique in this study was the analysis of the validation of the AT e-book by two experts and the analysis of practicality by 17 MGMP teachers in Lingga and Bintan districts. Aspects of validity include (1) Appropriateness of the AT e-book format; (2) Content design of AT e-book; (3) Feasibility of language presentation; and (4) Components of AT e-book. And, the practical aspects include (1) attractiveness of the book, (2) usefulness, and (3) user satisfaction. The percentage in the validation questionnaire was searched using a formula based on Riduwan & Akdon (2013) as follows:

$$Percentage\ (N) = \frac{The\ sum\ of\ validation\ scores}{Highest\ Score} \times 100\%$$

From the results of these calculations, the valid interpretation criteria adapted from Sugiyono (2019) can be seen in Table 1 below.

Table 1.
Interval of valid category

Calc (%)	Category
80 < N ≤ 100	Very Valid
60 < N ≤ 80	Valid
40 < N ≤ 60	Less Valid
20 < N ≤ 40	Invalid
0 < N ≤ 20	Very Invalid

Meanwhile, the practical interpretation criteria can be seen in Table 2.

Table 2.
Interval of practical category

Calc (%)	Category
80 < N ≤ 100	Very Practical
60 < N ≤ 80	Practical
40 < N ≤ 60	Less Practical
20 < N ≤ 40	Impractical
0 < N ≤ 20	Very Impractical

III. Results and Discussion

This research was conducted on 17 high school mathematics teachers who are members of the MGMP in Lingga and Bintan districts. The main result of this study is an AT e-book on mobile learning for mathematics teachers during a pandemic. The description of the product development stages is as follows:

1. Analysis

The analysis phase carried out by the researcher includes the material topic analysis. The material topic analysis is carried out by identifying the primary relevant material as a guide for teachers in the mobile learning training process, collecting and sorting material relevant to the primary material, and closing with the construction of the material systematically. After being analyzed, the appropriate technology in the development was mobile learning because, on this topic, teachers or educators often have difficulty delivering learning during the implementation of distance learning. This AT e-book on mobile learning can help teachers find solutions to tackling distance learning. The results of the material analysis as a guide to equip teachers in constructing mobile learning include (1) understanding of mobile learning; (2) mobile learning components; (3) the benefits of mobile learning; (4) software to create mobile learning; (5) specifications of the software used; (6) construct two application features; and (7) making mobile learning with construct two on one of the mathematics materials.

2. Design

The next stage is the AT e-book

specification design. This product is an electronic book in pdf form. Specifications of AT e-book consist of three main parts: the front, the content, and the closing.

The components that make up the front of the e-book are the cover page, the introduction, the table of contents, the list of pictures, and the introduction. The content section contains materials related to appropriate mobile learning technology for learning during a pandemic for mathematics teachers. Each material presented includes text, figures, and website links that e-book users can study. Then, the closing section consists of a bibliography and author biodata which are presented based on the level of education the researcher has taken.

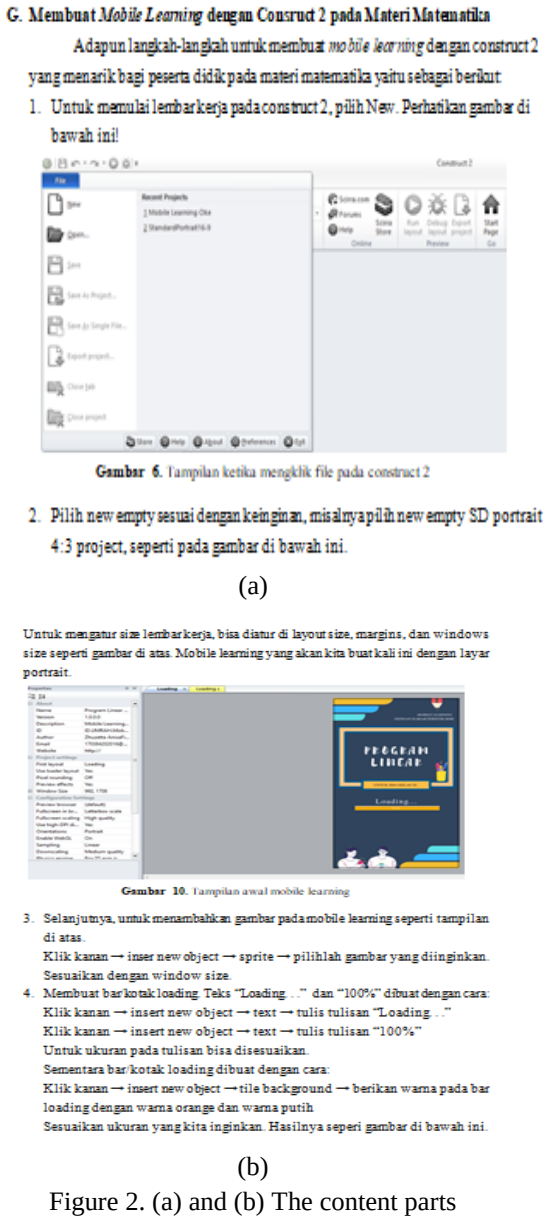
3. Development

After designing the components of the e-book, the next activity carried out by researchers at the development stage was making mobile learning AT e-book. This book is in electronic form created using *Microsoft Office Word 2013*, which was then converted into *pdf*. The following shows some substantive parts of the initial product design made.

a) The front contains the cover of the e-book, table of contents, list of pictures, and introduction.

Figure 1. The front cover

b) The contents section contains AT e-book on mobile learning material for mathematics teachers during the pandemic, which contains discussion material related to mobile learning: the use of software construct 2 to develop mobile learning and its components and learning components that must exist in mobile learning; and processing mathematical materials that have been developed with the Construct 2 application into mobile learning with the 2apk website application; then running the mobile learning in Android.



G. Membuat *Mobile Learning* dengan Consruct 2 pada Materi Matematika

Adapun langkah-langkah untuk membuat *mobile learning* dengan construct 2 yang menarik bagi peserta didik pada materi matematika yaitu sebagai berikut:

1. Untuk memulai lembar kerja pada construct 2, pilih New. Perhatikan gambar di bawah ini!

Gambar 6. Tampilan ketika mengklik file pada construct 2

2. Pilih new empty sesuai dengan keinginan, misalnya pilih new empty SD portrait 4:3 project, seperti pada gambar di bawah ini.

(a)

Untuk mengatur size lembar kerja, bisa diatur di layout size, margins, dan windows size seperti gambar di atas. Mobile learning yang akan kita buat kali ini dengan layar portrait.

Gambar 10. Tampilan awal mobile learning

3. Selanjutnya, untuk menambahkan gambar pada mobile learning seperti tampilan di atas.
   Klik kanan → inser new object → sprite → pilihlah gambar yang diinginkan.
   Sesuaikan dengan window size.
4. Membuat bar/kotak loading. Teks "Loading . . ." dan "100%" dibuat dengan cara:
   Klik kanan → insert new object → text → tulis tulisan "Loading . . ."
   Klik kanan → insert new object → text → tulis tulisan "100%"
   Untuk ukuran pada tulisan bisa disesuaikan.
   Sementara bar/kotak loading dibuat dengan cara:
   Klik kanan → insert new object → tile background → berikan warna pada bar loading dengan warna orange dan warna putih
   Sesuaikan ukuran yang kita inginkan. Hasilnya seperti gambar di bawah ini.

(b)

Figure 2. (a) and (b) The content parts

c) The closing section contains writers' biography

Figure 3. The closing parts

Furthermore, at the development stage, an expert assessment was carried out. Expert validation sheets were given to validate 4 aspects, namely (1) Appropriateness of the AT e-book format, 4 questions to validate content format; (2) Content design of the AT e-book, 4 questions to validate material accuracy; (3) Feasibility of language presentation, 3 questions to validate whether the language used is straightforward and follows Bahasa Indonesia rules; and (4) Components of the AT e-book, 1 question to validate comprehensiveness of all components of the AT e-book. In addition, the practical aspects include (1) attractiveness of the book, 5 questions to evaluate appearance, figure presentation, letters presentation, increase of teachers' interest and attractiveness; (2) usefulness, 4 questions to evaluate whether the AT e-book provides ease of use, ease of understanding the AT e-book contents, and presented concisely; and (3) user satisfaction, 3 questions to evaluate teachers' satisfaction in using the e-book.

After completing the validation, the researcher made a revision based on the comments and suggestions given by the validators. Data processing in this validation used a scoring on the questionnaire (validation sheets) in the form of a description of the percentage of the validity of the AT e-book based on the experts' assessment (see table 3).

Table 3.
Validity test result

Validity Aspects	Percentage (%)	Criteria
Appropriateness of the AT e-book format	97.5	Very Valid
Content design of AT e-books	92.5	Very Valid
Feasibility of language presentation	80	Very Valid
Components of AT e-book	100	Very Valid

Based on the results of the validity test in table 3, the e-book feasibility assessment by experts obtained an average of 92.5% with the Very Valid criteria, according to Sugiyono (2019) a product is declared valid and feasible to be tested if the average value is more than or equal to 60%. The validation results also contain input from the validator to ensure the feasibility of the topics presented in accordance with the teacher's needs during distance learning. This is in line with what was stated by Widiasworo (2017) that the provision of material must be adjusted to the needs so that it is easier to receive the material. The same thing was stated that a product is valid if the product can show a condition by its contents and constructs. (Yerimadesi et al., 2018; Bachtiar, Yidianto, & Sugiarti, 2021).

Hereinafter, the AT e-book draft was used at training by researchers for 17 high school mathematics teachers who are members of the MGMP in Lingga Regency and Bintan Regency to develop mobile learning for online mathematics learning. The AT e-book was provided through Whatsapp Group before the training activity. Along the training, the teachers were guided to develop mobile learning by following the instructions in the AT e-book.

A questionnaire then was given at the end of the activity to measure practicality with 3 aspects of attractiveness, use, and satisfaction of the AT e-book used during the training. The result of the practicality test is presented in table 4.

Table 4.
Practicality test results

No	Aspect	Average (%)	Criteria
1	Attractivenes	88.5	Very Practical
2	Use	82.9	Very Practical
3	Satisfaction	83.5	Very Practical
Overall Practicality Result		84.9	Very Practical

From Table 4, 17 respondents gave a good impression of the AT e-book, with very practical criteria in all aspects of the practicality test at an average 84.9%. This result is also supported by teachers' statements in another questionnaire used in the training that the AT e-book can be studied clearly and easily understood. Besides, the teachers stated directly at the training that they were helped to understand how mobile learning from reading the AT e-book provided and can learn more independently other features of mobile learning from the book.

In line with the opinion Rachmadyanti & Gunansyah (2020); Elvisa & Hamdi (2021), practicality in use can be seen in how respondents find it easy to receive information using the AT e-book on mobile learning. The convenience and interest are contained in the list of questionnaire questions; from the results of filling out the questionnaire, data is obtained, which concludes that the e-book is practical and feasible to use.

Based on the results of the validity and practicality of the AT e-book on mobile learning, it meets the valid and practical categories. Thus, it is hoped that this AT e-book can help mathematics teachers to use technology such as mobile learning in their classroom.

IV. Conclusion

Based on the research that has been done, it can be concluded that the AT e-book on mobile learning during the pandemic for mathematics teachers has been categorized as valid and practical. The AT e-book created by the researcher is an electronic book containing procedures for making mobile learning, tutorials for operating the Construct 2 application, and running mobile learning applications on Android. This AT e-book aims to make it easier for teachers to prepare materials to support distance learning with the output of an application that can be used on smartphones for students and teachers at school.

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