

Development of Digital Worksheets About Integral as Teaching Materials in the COVID Era

Ade Andriani^{1,*}, Izwati Dewi¹, N Siregar¹

¹Mathematic Department of Faculty of Mathematics and Natural Sciences, Universitas Negeri Medan, Indonesia

*Corresponding author. Email: adeandriani@unimed.ac.id

ABSTRACT

Learning is carried out online during the COVID-19 pandemic for every level of education including tertiary education, so learning tools are needed to support the learning model, such as Digital Worksheets because they are easily accessible. This study aims to describe the process of developing digital worksheets about Integral materials, describing their validity, practicality as Materials in the COVID 19 Era. This research is development research because the process is used to develop and validate educational product materials. The type of development method is the Thiagarajan development model which has 4 stages in the research, namely Define, Design, Develop, and Disseminate. The results showed that the worksheet validity value was 4.5 in the good category, it had a practicality value is 84.43 from the lecturer, 85.45 from a student, and readability value is 4.37 in the good category as well.

Keywords: Digital worksheets, Teaching Materials, COVID Era.

1. INTRODUCTION

Coronavirus disease 2019 (COVID 19) first occurred in the city of Wuhan, China in 2019, previously this virus was never identified in humans, initially thought to have originated from bats jumping to humans [1] [2]. This virus causes illnesses ranging from mild to severe symptoms. Common symptoms of COVID-19 infection are acute respiratory problems such as fever, cough, and shortness of breath. The incubation period for this virus is 5-6 days with a maximum incubation period of 14 days. The spread of this virus is so fast, in a short time it has attacked many people. The following is the latest WHO data regarding victims of this virus which was accessed on October 1, 2020. [3]

On January 30, 2020, WHO has declared it a public health emergency that is troubling the world [4]. Therefore, many countries limit the activities of their citizens by imposing lockdowns, All activities must be done at home, such as work from home, schools from home, and several public facilities are also closed. On March 2, 2020, Indonesia reported two cases confirmed of COVID-19. Until March 16, 2020, 10 people have tested positive for corona. The following is the latest data on victims of the coronavirus which was updated on October 1, 2020 [5].

COVID-19 in Indonesia currently impacts the entire activity community. government letter issued by the government on March 18 2020 saw all indoor and outdoor activities in all sectors temporarily postponed, it's to reduce the spread of corona, especially in the education sector. On March 24, 2020, the Minister of Education and Culture of the Republic Indonesia issued decree letter number 4 of 2020 concerning the Implementation Policies Education in Emergencies for the Spread of COVID 19, in the letter Circular explained that the learning process is carried out at home through online learning/ distance. [6]

Although this learning model has changed, the learning objectives must be achieved properly. Therefore the parties involved in the education upgrade their knowledge and skills about distance learning. Distance learning workshops are carried out by the education office at various school levels. Many online seminars about distance learning are carried out by parties who care about education.

Not only at the school level, but this learning model change also occurs at the university level too. This change also requires lecturers to improve their competence in online learning. This competency improvement by participating in training from internal universities and from outside the university such as attending workshops about online learning, Various

platforms are studied to facilitate the learning process, most universities in Indonesia have developed their platforms for online learning. because that, learning tools to based online too such as e-book, digital worksheet, and multimedia teaching materials. This teaching material is very important in supporting this online model of learning [7][8].

However, based on observations made by several lecturers and students, of the 8 lecturers who teach Integral calculus courses, none of them have used digital worksheets. From the results of interviews conducted with several lecturers, it was stated that it required special skills in developing these digital products. Meanwhile, based on interviews with 10 students, it can be concluded that they enjoy learning online using digital worksheets. In addition, many facilities supported the campus. This university has an online learning platform and is very supportive of online learning, namely a MOODLE-based platform that has been maximally developed under the name SIPDA UNIMED. Therefore, researchers are interested in researching to produce a learning device product entitled " Development of Digital Worksheets about Integral as teaching materials in the COVID Era" The purpose of this research is to describe how the value of validity worksheet, then to describe the practicality of the worksheet, and to describe the value of worksheet readability and to describe the effectiveness of the worksheet.

2. METHOD

This research is development research, the development of a worksheet about Integral Material. The target of this research is to produce worksheets that are suitable as online learning tools. This research refers to the 4D model proposed by Thiagarajan. The 4D model consists of four stages, define, design, develop, and disseminate. [9].

The research instrument was a validation questionnaire sheet, a legibility questionnaire sheet, a practicality questionnaire sheet, and a learning observation sheet [10]. The validation questionnaire sheet was given to 4 experts (education experts and media experts), this validation sheet was about the e-Book format and e-Book quality. Readability questionnaire sheets were given to 15 students in the integral calculus course. This questionnaire aims to see the worksheet is easy to understand or not. Practicality sheets were given to 45 students to see based on the indicators whether this book was practical to use or not. To analyze the validation sheet using a Likert scale 1-5, then calculate the average score with the following formula, and to see the validity criteria seen based on the range of values found in Table 3 [11].

$$Avarage = \frac{Score}{Total\ of\ Aspect}$$

(1)

Table 1. Validity criteria

Interval	Criteria
$1 \leq Va < 2$	Not Valid
$2 \leq Va < 3$	Less Valid
$3 \leq Va < 4$	Enough Valid
$4 \leq Va < 5$	Valid
$Va = 5$	Very Valid

Va is the value for the level of validity. To analyze the practicality questionnaire sheet, the score will be calculated the average such as validity, then practicality criteria from the range of values in Table 4 below. [11].

Table 2. Practical criteria

Interval	Criteria
$K \geq 90$	Very Practical
$80 \leq k < 90$	Practical
$70 \leq k < 80$	enough Practical
$60 \leq k < 70$	Less Practical
$K < 60$	Not Practical

Furthermore, to see the value of the readability the worksheet, students and Lecture get readability questionnaire which had 20 questions, where the questions were to see 5 aspects of readability, the questionnaire used a Likert scale of 1-5 too, the convert of readability value can see at Table 5 below [11].

Table 3. Readability criteria

Interval	Criteria
$1 \leq Va < 2$	Not Good
$2 \leq Va < 3$	Less Good
$3 \leq Va < 4$	Enough Good
$4 \leq Va < 5$	Good
$Va = 5$	Very Good

3. RESULT AND DISCUSSION

In July 2021, 5 validators consisting of 3 material expert validators, one development expert validator, and one media expert validator validated the worksheet. After the researchers analyzed the validation sheets of the 5 validators, the following is the validity of the digital worksheet.

Table 4. Validation

Validator	Value	Criteria
Development expert	4.6	Valid
Material learning expert	4.4	Valid
Media Learning Expert	4.7	Valid
Media Learning Expert	4.3	Valid
Media Learning Expert	4.5	Valid
Avarage	4.5	Valid

Based on Table 4, the data provided by 5 validators, it can be said that the worksheet is suitable for use. The 5 validators give suggestions in the comments column. the researcher corrects the digital worksheet based on the validator's suggestion. Next the researcher analysis the worksheet readability value from 15 students. The results of the analysis show that the worksheet has a good readability value. The average readability value was 4.37. The following is table 5 of the results of the teaching material legibility test.

Tabel 5. Readability value

Audience	Value	Criteria
Student 1	4.6	Good
Student 2	4.4	Good
Student 3	4.7	Good
Student 4	4.3	Good
Student 5	4.0	Good
Student 6	4.1	Good
Student 7	4.6	Good
Student 8	4.7	Good
Student 9	4.5	Good
Student 10	4.3	Good
Student 11	4.1	Good
Student 12	4.25	Good
Student 13	4.33	Good

Student 14	4.24	Good
Student 15	4.45	Good
Avarage	4.37	Good

Next, Table 6 is the result of the e-book practicality analysis, data number 1 is the practicality test results from students, while data number 2 is the practicality test results from the lecturers. The table value shows that the e-book has practical value.

Tabel 6. Practical value

Audience	N	Average	Criteria
Student	45	85.45	Good
Lecturer`	8	84.43	Good

This research consist of 4 stages, the following is an explanation of each stage. This stage is related to the research results previously described. with a dot following the number and then separated by a single space.

3.1 Define

At this stage, the researcher conducted 3 analyzes, 1) analysis of student abilities and student initial characteristics, 2) analysis of the curriculum, and 3) analysis of university facilities and infrastructure. Based on the results of the student capability analysis, it shows that students who take calculus integral courses are students who were born in an era of digital technology. These students are easy to operate digital devices such as cellphones and laptops [13]. In July, researchers surveyed students who would take calculus integral courses. The survey results show that 98.9 % of students own gadgets and can use them. 87% own a laptop and can also use it.

Most students come from the city so that students are familiar with digital information access systems such as digital worksheets. In addition, at the campus have been learning from home since Covid 19 arrived in Indonesia, to be precise in the 3rd month of 2020, have trained students in the use of digital teaching materials such as digital worksheet and others [12] [13] [14].

The curriculum is divided into 2 at Universitas Negeri Medan, students from class 2020 and below using the Indonesian National Qualifications Framework (KKNI) curriculum, while students of class 2020 use the independent learning curriculum, students who calculus integral courses are students who use the independent learning curriculum, but the task in this curriculum same with KKNI which have 6 KKNI tasks, namely 1) Critical Book Report (CBR), 2) Critical Review-Journal, 3) Engineering Ideas, 4) Mini research, 5) Projects and 6) Routine Tasks. Task 1 aims to

encourage students to read a lot from various sources including books that can be accessed on the internet such as digital books and e-books. To get the objectives of the curriculum, of course, it cannot be separated from the supporting facilities and infrastructure. Currently, the Medan state university has provided a wifi network in every department, so that students can easily find learning information, including supporting teaching materials such as worksheets. Based on the analysis of these three aspects, the researcher determined that the product to be produced was in the form of teaching materials that supported learning online models during the Covid-29 pandemic. The product was a worksheet about calculus integral.

3.2. Design

At this stage, the researcher compiles a semester learning plan for the calculus Integral course. this is the basis for compiling the material in the worksheet. This worksheet consists of 5 subject matter, namely:

- Anti-derivative Indefinite integrals and their applications in science
- Anti-derivative Integral algebraic functions, rational, powers of fractions by substitution method, partial integration
- Integral of trigonometric functions, integrals of exponential functions, and logarithmic functions
- Definite integral, sigma notation, area as the limit of the sum
- The area between the functions, the volume of the rotating object, the arc length, the area of the rotating object blanket, and the area in polar coordinates
- Integral application of course in physics/science
- Unnatural integral

At the end of the material in the worksheet, there are 10 essay questions as an evaluation tool at the teaching. After designing the material, then designing the worksheet display using the CANVA and Geogebra application. By using this application, the worksheet becomes colorful and very nice by taking advantage of the sharing layouts and templates in it. Then choose the appropriate application for its existence. The existence of this worksheet is in the form of an HTML link so that it is easily accessible to students anywhere using the link. To design the link, the researcher uses the Flipbook application. The results of the design at this stage were developed by the researcher to produce the worksheet.

3.3. Development

The 1st draft that was produced during the design stage was given to 5 expert validators. The validity of a

worksheet is very important because it is appropriate and improper for this worksheet to be reviewed based on the value of expert validation. Based on table 4 shows the average value of e-book validation is 4.5. Based on the range of validation values, in general, this worksheet is suitable for use as online learning teaching material during the COVID 19 pandemic. There are several suggestions from the validator, namely:

- There was a typo on some words
- Give The Space at the question area
- Add color to make it more interesting
- Consistent numbering
- Make a more beautiful worksheet cover

The researcher made improvements to the worksheet based on the suggestions of the expert validator. Furthermore, testing the readability of the worksheet to 15 students. A readability test is important in the product development of a worksheet because this test will show whether it is easy to understand or not. Based on table 5 shows that the worksheet has an average readability value of 4.37. The results of this test indicate that worksheets have good readability, meaning that students easily understand them. There are several suggestions from the examiners, namely:

- 10 sentences contain multiple meanings so that they can be corrected.
- There are several sentences with the next sentence not related to the plot.

The results of the improvements based on suggestions from the validator and the suggestions of students on the readability test resulted in draft 2.

Next, look at the practicality of the e-book draft 2 by conducting a practicality test. A practicality test is important for a product, this test shows whether the product has practical value or not when used or utilized. Based on a large dictionary of Indonesian, it has a practical use it. This test was conducted on 45 students and 8 lecturers who taught mathematics teaching and learning strategies. Based on table 6, shows that the average practicality value of students is 85.45, this shows that practical worksheet is used in learning, as well as the practicality test scores of lecturers show an average of 84.43. which also shows that practical digital worksheets are used in learning.

4. CONCLUSION

This study explains that during the covid period, learning carried out in Indonesia uses an online model, so digital learning tools are needed that support the learning process. This development research produces a product in the form of worksheets that are suitable for use in integral calculus learning with valid value 4.5,

readability values 4.37, and practicality values are good learning by using digital worksheets produces an interactive learning process, so that student-centered learning is formed, meaning that students forming the concept of independent learning material. The use of digital worksheets does not reduce the learning objectives achieved, as learning is done face-to-face.

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