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Development booklet 3-dimensional image-based digital as learning media on virus materials for senior high school

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ABSTRACT

Learning media is something that is used to increase student's interest in learning activities. Limited learning media makes biology material difficult for students to understand. Virus material is a type of biological material that has a lot of material and images that are difficult to understand. So, learning media needed that is concise and has attractive images in the form of booklet 3-dimensional image-based digital as a learning medium for viral material for Senior High School. This research aims to test the feasibility and practicality booklet 3-dimensional image-based digital as a learning medium for virus material at Kartika High School 1-5 Padang. This research is a development using Thiagarajan's 4-D development model. Based on the research results obtained as follows: material expert validation results 90.15% in the very good category, media experts 94.69% in the very good category, teacher practicality test results 95.83% in the very good category, student practicality test 89.10% in the very good category. Can be concluded that booklet digital material developed on viral material is feasible and capable of increasing student interest.

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INTRODUCTION

Human needs are currently made easier by the existence of technology, technological advances are developing rapidly, and all information from mass media such as cellphones, radio, television, and others has become completely digital (Setiawan, 2017). Technological advances influence all aspects of human life, especially in the field of education (Maritsa et al., 2021). In the education system, there is knowledge that is important for students to obtain as much as possible so that it can be realized in real life and be useful for society and its surroundings. The implementation of the education system, apart from being for the future, is also prioritized for teenagers who are progressing to the stage of maturity (Ihsan, 2003).

The education system has a learning process that involves educators and students. The learning process is carried out so that there is a change in students' attitudes and behavior, this happens if there is interaction between teachers and students or between other students (Aunurrahman, 2012). During the learning process, media is needed that contains information about the material to be taught. According to Intika (2018) to support learning, media is used as an intermediary containing various learning resources for teachers and students.

Learning media is anything useful for conveying important things from the author so that students' feelings, thoughts, attention, and interests can be stimulated so that the learning process occurs (Sadiman, Arief S et al., 2014). Designing learning media must pay attention to the students' character (Novianti & Syamsurizal, 2021). Learning media can increase students' sense of responsibility and control learning as well as take students' long-term perspective regarding their learning (Hasan et al., 2021).

Learning media that suit students' needs will provide good output, including changes in students' attitudes. Using media appropriately when delivering material will achieve good learning results. Learning media in the digital era means students must have creative ideas. Educators are required to be able to use modern learning media. Several studies have suggested the positive influence of using media as part of overall learning activities or the main way learning takes place in class (Hasan et al., 2020). The use of interesting learning media accompanied by pictures and narratives is what students want. The learning media offered by researchers is in the form of a booklet digital with 3-dimensional images.

A booklet is a small book that has approximately five pages and no more than 48 pages outside the cover (Satmoko & Astuti, 2006). Booklet innovated with technology to be booklet digital which can be accessed as needed with Android or other device. Booklet digital is equipped with images that match the material presented. Design development on Booklet Digital begins with arranging materials and designing designs using the Canva application. Images are designed using web monstermash. zone which will then be merged into the content booklet digital and entered into the Heyzine flipbook website so that the display becomes Flipbook.

Biology is a subject in high school that is often considered difficult to understand because it does not explain theories with clear pictures, such as the excretory system, digestion, respiration, body defense, regulation, and reproduction (Alfiraida, 2018). In studying biology, learning media has not been used for a long time. Sources of information for learning are only obtained from textbooks and the delivery of material from teachers in class. Kartika High School 1-5 Padang currently only applies the independent curriculum in class X. Learning with the independent curriculum refers to the use of technology.

Based on the results of an interview with biology teachers. The learning resources used are only textbooks from the library, which are limited in number and cannot be taken by students to read and study again when they are not at school, while the learning methods used by teachers are lectures and discussions so that students feel bored and lack focus in learning biology.

Based on the results of filling out the preliminary study questionnaire by 28 students in class This causes biology learning activities to not run effectively. Even though in the independent curriculum, students are given the convenience of accessing various information from the internet. However, this does not allow students to get information about biological material clearly and correctly. Therefore, students must be able to choose which sources of information to use as learning references. The lack of clarity in the material on the internet makes students confused and doubtful.

Based on the results of material analysis through student questionnaires, it was found that virus material was the most difficult material to learn in class X E5 by 75%. According to students, the material about viruses is quite difficult to understand because the biology books do not show

many interesting pictures and are only in black and white so they are not clear and do not increase students' motivation to learn biology and understand the material about the virus in a more complex way. Based on the existing problems, the result was that there was no availability of interactive and creative learning media so learning resources on biological material, especially viruses, were limited.

Students find it difficult to understand the material and learning objectives are not achieved. So research was carried out regarding the development of Booklet 3-Dimensional Image-based Digital as a Learning Media on Virus Material for Senior High School. This research aims to test the feasibility and practicality of digital-based 3-dimensional image booklets as a learning medium for viral material at Kartika High School 1-5 Padang. The use of media learning with the latest innovations can act as a means to share and obtain information easily, with ease of access booklet because it was innovated with the development of technology that refers to android makes it easier for students to understand the material through pictures and concise explanations as well as the unique design of booklet digital which creates attraction and fosters students' interest and motivation to study biology.

RESEARCH METHODS

Research Design

This research is development research that uses the 4D development model. This model consists of 4 stages, namely analysis, design, development, and dissemination. The research aims to produce a 3-dimensional digital booklet product based on virus material which is used as a learning medium for students in class X E5 at Kartika High School 1-5 Padang. The design stages for developing a digital booklet based on 3-dimensional images as a learning medium for virus material for high school using the 4-D Models research procedure can be seen in Figure I.

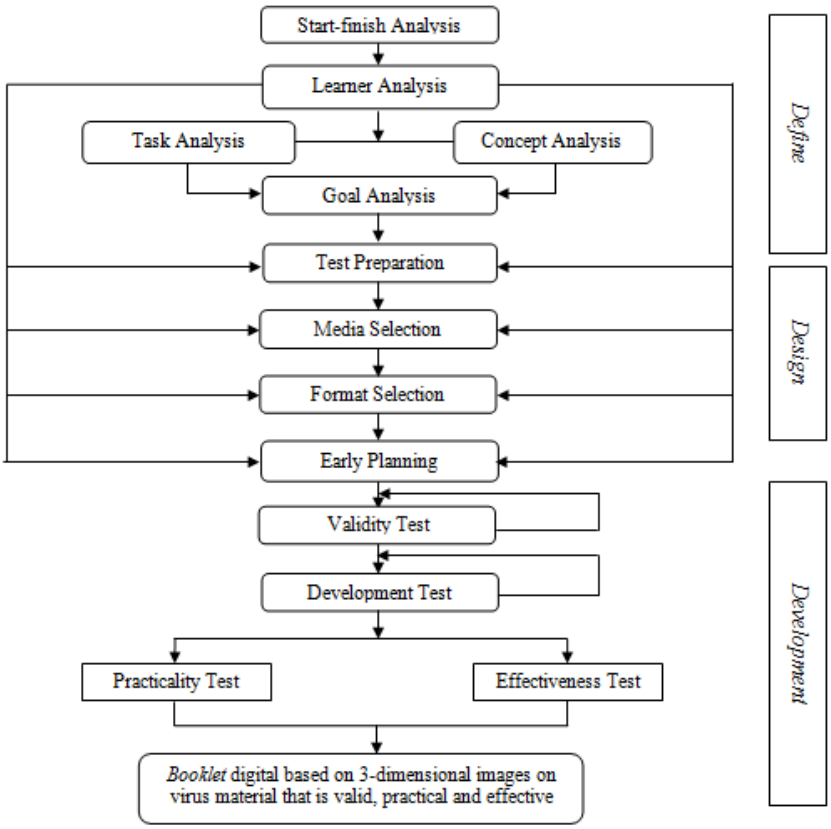


Figure I. Development Research Design Booklet 3-Dimensional Image-Based Digital Using 4D-Models

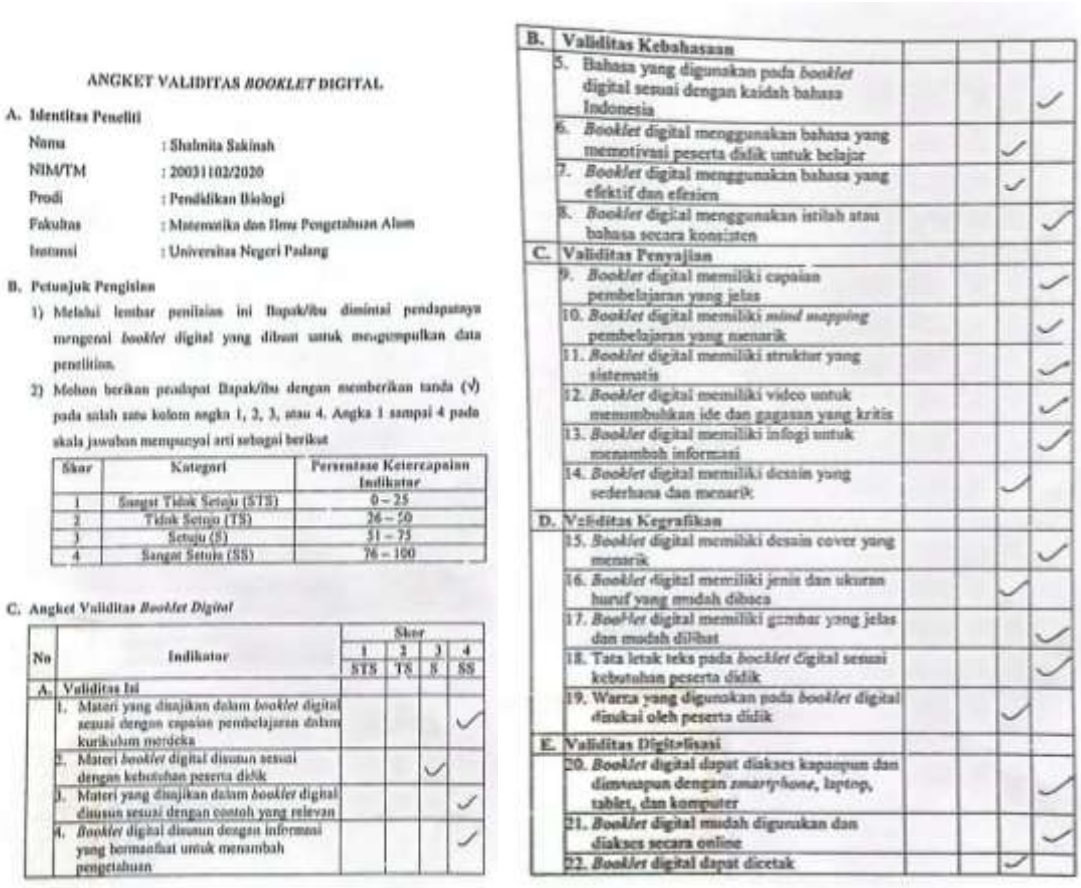
The development model begins with an explanation explaining the learning outcomes, teaching materials and student attitudes that have been analyzed. Next, design by formulating learning objectives as a material design containing the questions contained in booklet digital so that a product is obtained that has been prepared in outline with instruments as a tool to test the validity and practicality of a product. The final step is to develop with an application prepared such as Canva. After that, the product will be validated by material and media expert validators as well as class X high school teachers as users. The next step is to improve the booklet according to criticism or suggestions from validators and users.

Population and Samples

The research subjects were (1) two biology lecturers at the Faculty of Mathematics and Natural Sciences as validators (2) one biology teacher at Kartika High School 1-5 Padang as validator (3) twenty eight class X students at Kartika High School 1-5 Padang as a subject of practicality. The object of the research is a digital booklet based on 3-dimensional images as a learning medium for virus material for class X Senior High School

Instruments

The research instruments used to collect data in research are validation sheets and practicality sheets. The validity test of the digital booklet was carried out by 3 biology lecturers from Universitas Negeri Padang, 1 biology teacher at Senior High School of 2 Sikakap and 2 biology teachers at Pertiwi High School 1 Padang. Practicality instrument booklet digital was tested on biology teachers and students of class X at Kartika High School 1-5 Padang. The validity sheet can be seen in Figure 2.



ANGKET VALIDITAS *BOOKLET* DIGITAL

A. Identitas Peneliti

Nama : Shalmita Sakinah
NIM/TM : 20031102/2020
Prodi : Pendidikan Biologi
Fakultas : Matematika dan Ilmu Pengetahuan Alam
Institusi : Universitas Negeri Padang

B. Petunjuk Pengisian

1) Melalui lembar penilaian ini Bapak/Ibu diminta pendapatnya mengenai *booklet* digital yang dibuat untuk mengumpulkan data penelitian.
2) Mohon berikan pendapat Bapak/Ibu dengan memberikan tanda (√) pada salah satu kolom angka 1, 2, 3, atau 4. Angka 1 sampai 4 pada skala jawaban mempunyai arti sebagai berikut

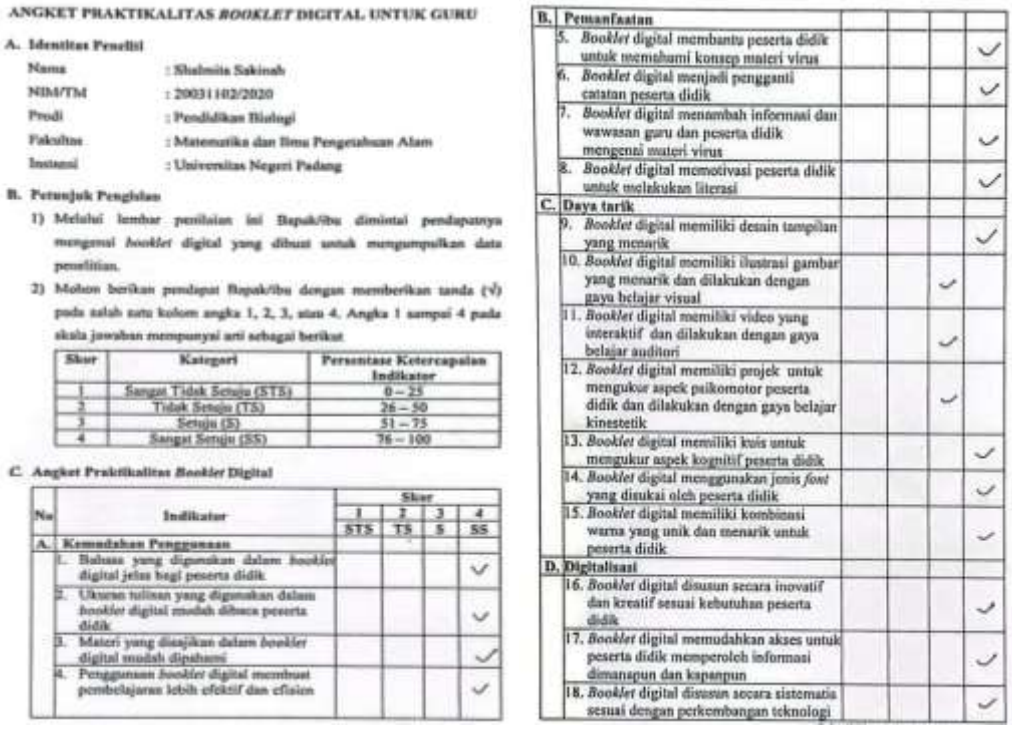
Skor	Kategori	Persentase Ketercapaian Indikator
1	Sangat Tidak Setuju (STS)	0 – 25
2	Tidak Setuju (TS)	26 – 50
3	Setuju (S)	51 – 75
4	Sangat Setuju (SS)	76 – 100

C. Angket Validitas *Booklet Digital*

No	Indikator	Skor 1 STS	2 TS	3 S	4 SS
A.	Validitas Isi				
1.	Materi yang disajikan dalam *booklet* digital sesuai dengan capaian pembelajaran dalam kurikulum merdeka				✓
2.	Materi *booklet* digital disusun sesuai dengan kebutuhan peserta didik			✓	
3.	Materi yang disajikan dalam *booklet* digital disusun sesuai dengan contoh yang relevan				✓
4.	*Booklet* digital disusun dengan informasi yang bermanfaat untuk menambah pengetahuan				✓
B.	Validitas Kebahasaan				
5.	Bahasa yang digunakan pada *booklet* digital sesuai dengan kaidah bahasa Indonesia				✓
6.	*Booklet* digital menggunakan bahasa yang memotivasi peserta didik untuk belajar			✓	
7.	*Booklet* digital menggunakan bahasa yang efektif dan efesien			✓	
8.	*Booklet* digital menggunakan istilah atau bahasa secara konsisten				✓
C.	Validitas Penyajian				
9.	*Booklet* digital memiliki capaian pembelajaran yang jelas				✓
10.	*Booklet* digital memiliki *mind mapping* pembelajaran yang menarik				✓
11.	*Booklet* digital memiliki struktur yang sistematis				✓
12.	*Booklet* digital memiliki video untuk memunculkan ide dan gagasan yang kritis				✓
13.	*Booklet* digital memiliki infogi untuk menambah informasi				✓
14.	*Booklet* digital memiliki desain yang sederhana dan menarik			✓	
D.	Validitas Kegrafikan				
15.	*Booklet* digital memiliki desain cover yang menarik				✓
16.	*Booklet* digital memiliki jenis dan ukuran huruf yang mudah dibaca			✓	
17.	*Booklet* digital memiliki gambar yang jelas dan mudah dilihat				✓
18.	Tata letak teks pada *booklet* digital sesuai kebutuhan peserta didik				✓
19.	Warna yang digunakan pada *booklet* digital disukai oleh peserta didik			✓	
E.	Validitas Digitalisasi				
20.	*Booklet* digital dapat diakses kapanpun dan dimanapun dengan *smartphone*, laptop, tablet, dan komputer				✓
21.	*Booklet* digital mudah digunakan dan diakses secara online				✓
22.	*Booklet* digital dapat dicetak			✓	

Figure 2. The validity sheets

The validity sheet consists of five aspects consisting of content, language, presentation, graphics, and digitalization. each aspect has an indicator with the highest score being 4 and the lowest score being 1. The practicality sheet can be seen in Figure 3.



ANGKET PRAKTIKALITAS *BOOKLET* DIGITAL UNTUK GURU

A. Identitas Peneliti

Nama : Shalmita Sakinah
NIM/TM : 20031102/2020
Prodi : Pendidikan Biologi
Fakultas : Matematika dan Ilmu Pengetahuan Alam
Instansi : Universitas Negeri Padang

B. Petunjuk Pengisian

1) Melalui lembar penilaian ini Bapak/ibu dimintai pendapatnya mengenai *booklet* digital yang dibuat untuk mengumpulkan data penelitian.
2) Mohon berikan pendapat Bapak/ibu dengan memberikan tanda (√) pada salah satu kolom angka 1, 2, 3, atau 4. Angka 1 sampai 4 pada skala jawaban mempunyai arti sebagai berikut

Skor	Kategori	Persentase Ketercapaian Indikator
1	Sangat Tidak Setuju (STS)	0 – 25
2	Tidak Setuju (TS)	26 – 50
3	Setuju (S)	51 – 75
4	Sangat Setuju (SS)	76 – 100

C. Angket Praktikalitas *Booklet* Digital

No	Indikator	Skor 1 STS	2 TS	3 S	4 SS
A.	**Kemudahan Penggunaan**				
1.	Bahasa yang digunakan dalam *booklet* digital jelas bagi peserta didik				√
2.	Ukuran tulisan yang digunakan dalam *booklet* digital mudah dibaca peserta didik				√
3.	Materi yang disajikan dalam *booklet* digital mudah dipahami				√
4.	Penggunaan *booklet* digital membuat pembelajaran lebih efektif dan efisien				√

B.	**Pemanfaatan**				
5.	*Booklet* digital membantu peserta didik untuk memahami konsep materi virus				√
6.	*Booklet* digital menjadi pengganti catatan peserta didik				√
7.	*Booklet* digital menambah informasi dan wawasan guru dan peserta didik mengenai materi virus				√
8.	*Booklet* digital memotivasi peserta didik untuk melakukan literasi				√
C.	**Daya tarik**				
9.	*Booklet* digital memiliki desain tampilan yang menarik				√
10.	*Booklet* digital memiliki ilustrasi gambar yang menarik dan dilakukan dengan gaya belajar visual			√	
11.	*Booklet* digital memiliki video yang interaktif dan dilakukan dengan gaya belajar auditori			√	
12.	*Booklet* digital memiliki projek untuk mengukur aspek psikomotor peserta didik dan dilakukan dengan gaya belajar kinestetik			√	
13.	*Booklet* digital memiliki kuis untuk mengukur aspek kognitif peserta didik				√
14.	*Booklet* digital menggunakan jenis *font* yang disukai oleh peserta didik				√
15.	*Booklet* digital memiliki kombinasi warna yang unik dan menarik untuk peserta didik				√
D.	**Digitalisasi**				
16.	*Booklet* digital disusun secara inovatif dan kreatif sesuai kebutuhan peserta didik				√
17.	*Booklet* digital memudahkan akses untuk peserta didik memperoleh informasi dimanapun dan kapanpun				√
18.	*Booklet* digital disusun secara sistematis sesuai dengan perkembangan teknologi				√

Figure 3. The practicality sheet

The practicality sheet consists of four aspects consisting of ease of use, utilization, attractiveness and digitalization. Each aspect has an indicator with the highest score being 4 and the lowest score being 1.

Procedures

Digital Booklets will be developed using the 4D development model. The 4D development model includes 4 stages, namely define, design, develop, and disseminate. Research was carried out until the development stage due to limited time, energy and costs.

1. Define

At this stage, the activities carried out are determining and defining learning requirements. This stage is called needs analysis. Each product requires different analysis. As for defining learning requirements, it can be done in 5 stages as follows:

a) Start-finish analysis
Start-finish analysis or Front-End Analysis carried out to determine the problems in biology learning at school.

b) Learner Analysis
Learner Analysis this was done to look at cognitive aspects and find out the extent of students' development during biology learning. At the analysis stage, the results of student interviews and questionnaires will be obtained, these results will be used as a reference for development booklet 3-dimensional image-based digital as a learning medium. At this stage the author can find out the attitudes and behavior of students during biology learning, including things that students do as well as students' relationships with peers or teachers during the learning process in class X Kartika High School 1-5 Padang.

c) Task Analysis

Task Analysis aims to determine the content of the material that will be achieved in biology learning. At the task analysis stage, it can be done by analyzing the learning outcomes and learning objectives in the independent curriculum so that you will get clearer and more detailed material so that it can be included in the booklet digital to develop.

d) Concept Analysis
Concept Analysis aims to determine the concepts contained in the booklet digital based on 3-dimensional images which will be developed as a learning medium for students. This stage can be carried out by systematically analyzing the concepts studied in the virus material to make it easier for students to understand the material.

e) Specifiying Instructional analysis
Specifiying Instructional analysis aims to find out the learning objectives that will be achieved during biology learning. The learning objectives are guided by the learning outcomes in the independent curriculum and are included in booklet 3-dimensional image-based digital as a learning medium.

2. Design

The design stage is carried out to prepare or design digital booklet learning media based on 3-dimensional images through several stages as follows:

a) Media Selection
Media selection carried out by referring to the results of student analysis, task analysis, concept analysis, and learning objectives. So it is generated booklet 3-dimensional image-based digital media that will be used as a biology learning medium for class X phase E virus material.

b) Format Selection
Format selection carried out in accordance with the learning media booklet digital. The components contained include the title, study instructions, competencies to be achieved, assignments, supporting information, work stages, and assessment for students.

c) Early Planning
Early planning or initial design done with the Canva application which includes cover, foreword, table of contents, instructions for use, learning outcomes, learning objectives, explanation of material and assignments in the form of projects. The evaluation section includes project evaluation, quiz, infogi (Information about Biology), and glossary.

3. Development

The development stage is carried out to develop the product under study. The development consists of 2 stages including validation and practicality tests.

a) Validity test
The validity test is carried out by validators with a validity questionnaire which aims to determine the level of validity of the media being developed.

b) Practicality Test
The practicality test was carried out by two biology subject teachers in class X E5 and 32 students in class X E5 using a practicality questionnaire. The purpose of conducting a practicality test is to determine the level of practicality of the media being developed.

Data Analysis

The data analysis used is qualitative analysis and quantitative analysis. The use of qualitative analysis is used at the definition stage define and design which will be presented in the form of a description. Quantitative data analysis is used at the development stage through validity tests and practicality tests. The data analysis used is validity and practicality analysis. Determine the validity value with the following formula:

$$\text{Validity} = \frac{\text{Total score}}{\text{Max score}} \text{ x100\%}$$

Table 1. Assessment of the value of validity (Sarinami et al., 2022).

Score range	Category
81% - 100%	Very valid
61% - 80%	Valid
41% - 60%	Fairly valid
≥21% - 40%	Invalid

Booklet The 3-dimensional image-based digital device developed is said to be valid if it has a validity value of ≥61% and is said to be invalid if it only reaches a value of ≤40%, then revisions will be made to the booklet digital and re-tested for validity. Determine the practicality value using the following formula:

$$\text{Practicality} = \frac{\text{Total score}}{\text{Max score}} \text{ x100\%}$$

Table 2. Assessment of the value of practicality (Khairul et al., 2019).

Score range	Category
81% - 100%	Very practical
61% - 80%	Practical
41% - 60%	Quite practical
≥21% - 40%	Not practical

Booklet The 3-dimensional image-based digital device being developed is said to be practical if it has a practicality value of ≥61% and is said to be impractical if it only reaches a value of ≤40%. If the value is in the impractical category then revisions are carried out booklet digital and re-tested for practicality.

RESULTS

Based on the research that has been carried out, qualitative and quantitative data was obtained by material and media experts. The results of validation tests by material experts and media experts can be seen in Table 3.

Table 3. Material expert validation test results for digital booklet quality

Aspect	Validator			Percentage (%)	Criteria
	1	2	3		
Contents	15	13	16	91,66	Very valid
Language	14	12	14	83,33	Very valid
Presentation	23	20	23	91,66	Very valid
Graphics	18	18	20	93,33	Very valid
Digitalization	11	9	12	88,88	Very valid
Total value		238		90,15	Very valid

Based on the assessment of material experts, the percentage score obtained by the three material experts was 90.15%, based on the validation results of the material experts booklet digital is included in the very valid category.

Table 4. Media expert validation test results for digital booklet quality

Aspect	Validator			Percentage (%)	Criteria
	1	2	3		
Contents	14	16	16	95,83	Very valid
Language	14	16	15	93,75	Very valid
Presentation	21	24	22	93,05	Very valid
Graphics	17	20	20	95	Very valid
Digitalization	11	12	12	97,22	Very valid
Total value		250		94,69	Very valid

Based on the assessment of media experts in Table 4, the percentage score obtained by three media experts is 94.69%, based on the validation results of media experts, booklet digital is included in the very valid category. So the conclusion is obtained that the booklet the digital product developed is suitable for use with very valid criteria by comments and suggestions from validators. Based on the research that has been carried out, the results obtained are that the booklet digital has passed the validation stage with minor improvements. Improvements were made according to suggestions and input from material experts and media experts including italicizing foreign words on each page, including learning outcomes and objectives on one page. Next, provide pictures of each type of disease caused by viruses and their sources.

Part quiz more enlarged and includes some information in the infogi and a glossary containing matters related to virus material. This is done so that booklets can be used as learning media or tools that have instructional material in an environment that can stimulate students to learn (Arsyad, 2014). According to research (Adiko, 2019) and (Putra & Milenia, 2021), through effective learning media, students can be stimulated to remember the material and increase motivation. Input from media experts is change cover which includes the name of the author, supervisor and validator from the lecturer, cover slightly changed the image and included a virus image, the image must be clear with a reference, the writing was corrected to be neater, the use of scientific names was italicized, the position of the reference text and the image number were changed, changed mind mapping by including a little explanation and hyperlink to go straight to the page you want to read, include all references to the image in the bibliography and delete the biography page. Several illustrations of revisions according to suggestions and input from material experts and media experts can be seen in Figure 4.

Figure 4. View of the digital booklet cover before revision and after revision

The booklet cover display is created in a creative way that contains a lot of pictures, usage booklet it is considered capable of increasing children's understanding of material regarding inspiring and interesting learning (Putri, 2020). Booklet making online access easier and use in learning more creative and innovative (Gustaning, 2014). Expected with deep 3 dimensional images booklet digital will be a characteristic of digital booklets that attract students' interest in reading difficult material (Irmanto, 2018).

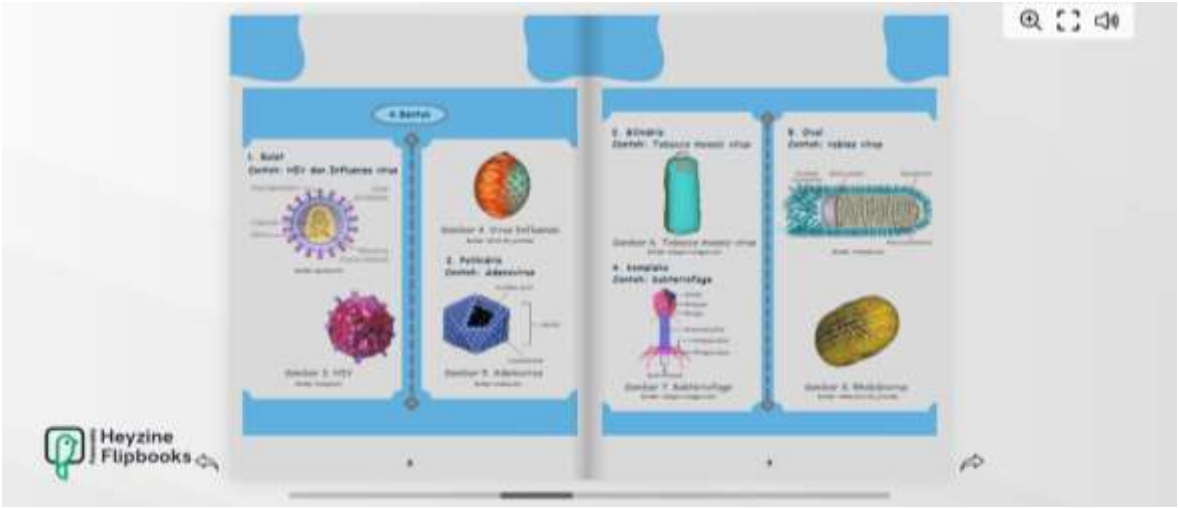


Figure 5. Display 3-dimensional images on digital booklets

Several images of virus in 3-dimensional form on Figure 5 namely HIV, Influenza virus, Adenovirus, Tobacco mosaic virus, Bacteriophage and Rabies virus. 3 dimensional images. Three-dimensional media is a work of fine art that has width, length and height or volume and occupies space (Rondhi & Anton, 2002). Three-dimensional media is a visual aid that has length, width and height and can be seen from various points of view (Sudjana, 2014).

Several characteristics of three-dimensional media are that it is practical to use and does not require much processing, the presentation of material is integrated or easy for students to understand, its use involves students, the process of delivering material is carried out simultaneously and overcomes space, time and the senses (Asrotun, 2014). So it is hoped that 3-dimensional images can become a characteristic of digital booklets to attract students' interest in studying the biology of virus material.

Based on the validity value booklet this digital test can then be tested on class X E5 students at SMA Kartika 1-5 Padang. Trials Booklet Digital aims to determine the response of teachers and students to a booklet developed digitally. The trial was carried out by two biology subject teachers and class X E5 students at Kartika High School 1-5 Padang.

The trial was carried out on two biology subject teachers by giving a booklet digitally via a link that has been sent to each teacher's number, after the teacher has read the content booklet digitally, the teacher fills in the practicality assessment sheet that has been given.

Table 5. Teacher practicality test results on digital booklets

Aspect	Teacher		Percentage (%)	Criteria
	1	2		
Ease of Use	16	16	100	Very practical
Utilization	16	14	93,75	Very practical
Attractiveness	25	27	92,85	Very practical
Digitalization	12	12	100	Very practical
Total value	138		95,83	Very practical

Based on the teacher's practicality assessment on Table 5, the percentage score obtained by two teachers is 95.83%, then booklet digital is included in the very practical category so booklet the digital technology developed can be used for class X phase E students on virus material at Kartika High School 1-5 Padang.

Next, a trial phase was carried out on 32 students in class X E5 at Kartika High School 1-5 Padang. During the trial, respondents were asked to look at the content booklet through the link which was sent via the class X E5 biology WhatsApp group. Respondents were given 15 minutes to look at the display and read the booklet digitally. Then respondents can open the video inside the booklet digitally. After 15 minutes respondents were asked to answer the quiz. Then the respondents filled out an assessment sheet in the form of a practicality questionnaire for the students that had been given.

The resulting data is quantitative, namely, the value of students' responses regarding the booklet digitally, and qualitative data is in the form of student comments on the booklet developed digitally. Several aspects assessed in the student practicality questionnaire include ease of use, utilization, attractiveness, and digitalization. Test results data can be seen in Table 6.

Table 6. Results of student responses to aspects of digital booklets

Aspect	Value	Max value	Percentage (%)	Category
Ease of Use	460	512	89,84	Very good
Utilization	450	512	87,89	Very good
Attractiveness	803	896	89,62	Very good
Digitalization	340	384	88,54	Very good
Total value	2053	2304	89,10	Very good

Based on the data above, it can be seen that students' responses in every aspect are in the very good category. The ease of use aspect was 89.84%, the utilization aspect was 87.89%, the attractiveness aspect was 89.62%, and the digitalization aspect was 88.54%. This indicates that every aspect has met the requirements to become booklet practical digital. So it can be concluded that the product booklet the digital technology developed is very practical for students to use as a learning medium.

The final stage is to revise the product, through the results of product trials to obtain assessments and responses from teachers and students that the product developed is good and suitable for use in learning activities. Suggestions from teachers to be able to upload products to social media can be concluded that a booklet digital has been developed to produce the final product.

DISCUSSION

This research is a type of research and development that aims to determine the feasibility of Booklet Digital as a learning medium for viruses material in Senior High School. The results of this research are a booklet digital which is used as a learning medium. This research was carried out using the 4D development model. The 4D model is a development model used to develop various types of learning media (Arkadiantika et al., 2020). Research only reaches the development stage to determine the feasibility booklet developed digitally. Steps for developing a learning media booklet digital begins with the beginning-to-end analysis stage. The learning media development process begins with a preliminary study stage, namely by conducting a needs analysis. Needs analysis has a role in connecting teachers, students, teaching materials, and teaching procedures well (Aflah & Rahmani, 2018). Needs analysis includes observations and interviews at Kartika High School 1-5 Padang to obtain the information needed by researchers. Then an analysis is carried out on the

students so that students' problems in understanding biology material can be identified. Therefore, learning media are needed that can increase students' interest and interest in learning.

Booklet digital as a learning medium is expected to increase students' interest in the material presented because it has a simple and attractive appearance. Interesting and informative learning media can arouse students' interest in learning (Hanifah et al., 2020). Booklet Digital is equipped with images and videos that can provide explanations that are easier to understand for students. There are many pictures included in the learning media so that the presentation of the material is more concise (Darlen et al., 2015). Through the observations that have been made, a literature study is needed to find solutions to existing problems booklet digital can be used as a learning medium as expected through relevant references. Based on interviews conducted with one of the biology subject teachers, it is known that students are still less interested in reading, and there is a lack of learning media at school. Therefore it is necessary to explain about booklet digital to students and teachers, that booklet digital as a learning medium can be the right solution to increase students' reading interest.

The next stage is to collect information through references that are relevant to the material that will be developed in the media booklet digital, namely class X phase E virus material. Booklet digital contains material sourced from previously used educational printed books and various articles from journals via Google Scholar, as well as several other supporting books. The next stage is to design the product, at this stage, an initial design is carried out to prepare digital booklet material that is appropriate to the virus material. Things must be done at the design stage, namely choosing learning media sources, choosing the format, and initial design (Hanifah et al., 2020). Next is making the design booklet digital, The booklet digital was created using the Canva application after which it was entered into Heyzine flipbook which is found in Canva until the display is shaped flipbook and accessed online at the link provided. A flipbook is a collection of sheets of paper such as an album or calendar that measures 21 x 28 cm (Rahmawati, 2018). Booklet digital will automatically open each page according to the user's wishes.

Booklet digital has the advantage of being more practical and easy to access and can be used anywhere. This agrees with Riyan (2021) one of the advantages of Android-based learning media is that it can be accessed anywhere and at any time. Making the process booklet digital is adjusted with suggestions and input from material experts and media experts. Therefore after the booklet digital, then the next stage is carried out, namely validation. Expert validation data uses validation sheets from various aspects such as appropriateness of content or material, language, and presentation (Hanifah et al., 2020). Based on the results of this research, the booklet digital has met the validity criteria of 94.69% in the very valid category. So the results obtained were that the learning media in the form of digital booklets was in the very good category for students to use during learning.

The next stage is design revision, based on the results of product validation, it still requires improvements according to the validator's suggestions. Suggestions given by material experts include: booklet It's good, only some of the writing needs to be corrected, the pictures made clearer, and some examples need to be added. Suggestions given by media experts are: cover the Independent Curriculum logo and supervisor's name included, the writing is tidier, the writing is improved, the use of colors brighter and the numbering is clear. Next, product trials are carried out, and products that have been revised by lecturers and teachers are then tested in the learning process. This trial aims to determine various shortcomings, weaknesses, or errors in the product (Mahyuddin et al., 2018). The trial was carried out by two biology teachers and class X E5 students at Kartika High School 1-5 Padang. The trial by two biology teachers obtained a percentage result of 95.83%, while the trial by 32 students obtained a percentage result of 89.10%.

CONCLUSION

Based on the results of research and development of digital booklets based on 3-dimensional images as learning media on virus material for Senior High School, it was concluded that this research produced digital booklets that were suitable and meet the criteria based on material and media expert assessments. The material expert test results were 90.15% and media expert test results were 94.69% with the category very valid and worthy of development. Practicality booklet digital based on an assessment by two biology subject teachers which had a percentage of 95.83% in the very practical category. The students' responses to booklet digital in the X E5 class is very good with a percentage of 89.10%. Every aspect is in the very good category. Therefore, it is hoped that it can be followed up and tested in learning to find out the expected positive impact and influence of the digital booklets on students' motivation and interest when studying.

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