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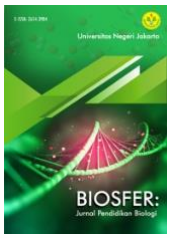

Learning media of digital booklets for class VIII junior high school

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ABSTRACT

The learning system that has changed to online causes teachers to be creative in delivering material through digital learning media. Thus, research on the development of booklets into digital learning media needs to be carried out to assist teachers in facilitating learning and assisting students in understanding the material. This study aims to determine the quality and appropriateness of the content and its presentation as a medium for learning science in class VIII SMP material on the structure and function of plant tissue. This research method is a Research and Development (R & D) study, adapted from Thiagarajan's 4D (Define, Design, Development, and Disseminate) model. The data taken is the result of product assessment with a data collection instrument in the form of a questionnaire analyzed using descriptive-quantitative data. The resulting assessment from four media experts, four material experts, and a teacher showed the digital booklet in the very good category, with an average of 78.13% (media), 88.28% (material), and 96.88% (teacher). Besides, students gave very good responses., indicated by the acquisition of an average assessment of 94.89%. The digital booklet could be used as an alternative learning media on the structure and function of plant tissue.

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INTRODUCTION

SARS-Cov-2 (Covid-19) became a global pandemic, with major implications for the world of education (Bourgault et al., 2022; Owusu-Fordjour et al., 2020), the impact felt was a shift in the learning system to online (Herawati et al., 2022; Schrenk et al., 2021). This is a big challenge for teachers to carry out the learning process without meeting face-to-face (Frei-Landau & Avidov-Ungar, 2022; Sumira et al., 2021) so the emergence of innovation in the form of learning media (Küsel et al., 2020) is needed by teachers and educational institutions, one of the relevant innovations used in the online learning process is the application of digital learning media (Chick et al., 2020). The use of digital learning media is an obligation for every teacher responding to the challenges of the times. This is what underlies the importance of developing digital learning media that hopes to assist teachers in delivering material content (Mulenga & Marbán, 2020), encourage student curiosity (Algiani et al., 2023; Kurniawan et al., 2019), and help understand the information/material (Sukenda et al., 2019), as well as student skills for technological progress (Falloon, 2020) amid the limitations of the learning process.

These limited conditions encourage the emergence of digital learning media that use the internet network (Ma & Li, 2021; Wardono et al., 2016) so students can use them easily. Digital learning media must also follow students' characteristics and generate interest in learning from students so that they are up to date to use. The use of new media, such as computer-based technologies, can enhance engagement, increase participation in learning activities, and improve learning motivation (Lin et al., 2017; Umarova, 2020).

The use of appropriate media in science learning is one solution to various problems related to students' interests and motivation. Sirakaya and Cakmak (2018) state that using appropriate media will increase students' attention to the topics studied, interests, and motivation so that students will concentrate more. The learning process can to improve and affect student learning outcomes (Degner et al., 2022).

Based on the results of an interview with one of the science teachers at MTs Muhammadiyah Gedongtengen, it is admitted that some materials students still find difficult. One of the materials that is considered difficult for students to understand is the material on the structure and function of plant tissue. This is because the material on the structure of plant organs (roots, stems, leaves, flowers) and the structure of plant tissue requires more visualization because the object being studied cannot be seen directly by the eye, and the technology sub-material inspired by the structure of plant tissue becomes one of the materials that is considered new for students, so teachers need media as a tool in visualizing the object being studied.

The use of learning media that can be seen and heard is a combination that is expected to support the ability of students' memory of the material because students will be encouraged to optimize their senses. Thus, profound understanding will be enacted by students through engaging their senses (at least listening and watching) in comprehending the phenomenon occurs (Mellisa & Yanda, 2019). The use of visual materials in learning greatly influences the understanding of abstract concepts; explaining facts to mental perception is clearer than through words (Sarif et al., 2022).

There are many types of learning media, including print media, visual media, audio-visual media, digital media, and other media. However, the media chosen in this study is audio-visual-based digital media, which were developed as digital booklets to help teachers visualize learning materials for their students. Audio-visual media can increase the motivation and focus of the student (Mellisa & Yanda, 2019; Tumbel, 2018; Wurarah & Semuel, 2019).

Digital learning media is an alternative for teachers to package learning materials to make them more attractive to children (Falloon, 2020). Digital learning media are engaging and can help increase students' reading interest and understanding has been needs. One of the ideas that can be applied in the learning process is to use digital media, which are varied into booklets for the science learning process in schools. Digital booklet contributes to improving the teaching-learning process (Abreu et al., 2017). This developing product has a characteristic based on hypertext multi-language (HTML) such as website and presentation of material using text, images, and audio-visual; so, it can be easy to access and does not need more storage.

This characteristic is relevant to the shift in the learning system to online, causes teachers to be creative in delivering material through online learning media (Basar, 2021), and strengthens the potential for the development of digital books to be applied in learning (Prasetya et al., 2018). Thus, research on the development of booklets into digital learning media needs to be carried out to assist

teachers in facilitating learning and assisting students in understanding the material. Therefore, this research aims to develop alternative digital learning media in the form of digital booklets.

METHODS

Research Design

The research used is research and development (R&D) modifying the 4-D development model (four D model) recommended by Thiagarajan. The development procedure in this study was designed to refer to the 4D development model, which includes four stages: define, design, development, and dissemination. The defined stage carried out five activities as the basis for development, including front-end analysis, learner analysis, task analysis, concept analysis, and specifying instructional objectives.

In the design stage, the design of the product developed, and the preparation of the instrument used to assess the product are carried out. In the development stage, product assessment is carried out by material experts, media experts, and science teachers (Biology), and product improvements are based on expert assessments. In the dissemination stage, the product was tested on a small scale (7 students) and a large scale (21 students) from MTs Muhammadiyah Gedongtengen.

Population and Samples

This study involved eighth-grade students of MTs Muhammadiyah Gedongtengen, Yogyakarta City, Indonesia as the research population. The total of class VIII in this school is 2 classes that have the same level of ability, therefore, simple random sampling technique is used in the sample determination process for testing small-scale and large-scale digital booklet products, where the small scale consists of 7 students and the large scale consisted of 21 students from a total of 40 students in class VIII.

Instrument

The research data collection instrument is a product assessment instrument developed with reference to the BSNP (National Education Standards Agency) indicators. The product assessment instrument consists of a grid, a rubric and an assessment using a rating scale for the assessment of media experts, materials, teachers, and the Guttman scale for the assessment of trials to students, which were then validated by the validator. The following is a description of the instruments used:

1. Validation of digital booklets by material experts using assessment instruments with assessment indicators in the form of material content, material presentation, the material's accuracy, material updates, and language use.
2. Validation of digital booklets by media experts using assessment instruments with assessment indicators in the form of media design, media color combination, text and image layout, font size and type, clarity of writing, and media attractiveness.
3. Validation of digital booklets by science teachers using assessment instruments with assessment indicators in the form of display, presentation of material, benefit to students, and overall appearance.
4. Students' digital booklet assessment survey consists of several indicators, namely appearance, material, language, and media benefits.

Procedure

1. Defining Stage
   At this stage, the researcher analyzes various things that will be used as the basis for designing and developing products, including analyzing school needs in the curriculum and materials that will be used in learning media.
2. Design Stage
   At this stage the researcher designs the form of product presentation from the results of the definition in the previous stage, then arranges the research data collection instrument in the form of a questionnaire and is validated by the validator.
3. Development Stage
   The development stage begins with conducting a product assessment carried out by reviewers, namely expert lecturers consisting of material experts and media experts, and science (biology) teachers, then the results of product assessments is revised based on input from expert lecturers and teachers. Product trials are carried out to determine whether the developed product runs as expected.
4. Deployment Stage

The dissemination stage is the stage in realizing and implementing the booklet learning media that has been developed and declared suitable for use to users, namely students.

Data Analysis Techniques

The digital booklet validation questionnaire data from experts, teachers and students were analyzed using the formula (1).

$$P = \frac{Ni}{N} \times 100\ \% \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ (1)$$

Formula description:
P= Percentage of assessment score
Ni= Total score of all answered items
N= Ideal score (Arikunto, 2013; Riduwan, 2006)

The percentage value obtained is then adjusted to the criteria for the ideal percentage assessment in Table 1.

Table 1.
Product Quality Rating Percentage Scale

Interval	Criteria
76 %-100%	very good
51%-75%	good
26%-50%	enough
0%-25%	not enough

(Sugiyono, 2012)

RESULTS AND DISCUSSION

The research results are discussed following the stage of research and development four-D.

1. Define Stage

a. Font-end analysis

The product of a digital booklet on the structure and function of plant tissue for grade VIII junior high school students was developed due to several conditions, including 1) the absence of digital learning media to support online learning, as well as learning using technology; 2) students do not entirely own study guidebooks, and 3) teachers have not been able to develop digital learning media. The trend of online learning needs to be supported by digital learning media (Chick et al., 2020), which can be developed by utilizing scientific and technological developments (Falloon, 2020).

b. Learner analysis

Student analysis is carried out by making observations during the learning process and activities outside of learning, and several confirmations support it through interviews with students. The characteristics observed included reading interest, tendency to use gadgets, and learning style tendencies. The number of students interested in reading is less than 50%, showing that students tend not to read books when learning. Some students stated that the existing books were less interesting because they contained too much text and were challenging to illustrate. Even though students have gadgets, they do not want to find information about the studied material. Students tend to prefer that the material is provided without seeking further information, following the Z-generation characteristics (Shorey et al., 2021). While related to learning styles, most students are more dominant in visuals. This information was revealed by students who prefer to pay attention to visual images with a small amount of text.

c. Task analysis

Students' mastery of science (biology) material related to new terms of the material is one of the obstacles, especially in one of the KD 3.4 of the structure and function of plant tissue delivered by the teacher requiring more visualization because it is closely related to everyday life. Student day, so that it becomes an advantage of the material If it can be visualized properly, it will be able to stimulate students' motivation and interest in the material (Schneider et al., 2023; Tsai & Yen, 2013), and also in the plant tissue sub-material which is material with characteristics that cannot be seen with the naked

eye, so that it requires a big role of visualization, this is due to the limited school facilities for microscoes as a tool for viewing and online learning systems (on the network) that do not allow students to use microscopes at school.

d. Concept Analysis

Based on the material that requires visualization media, namely the structure and function of plant tissue, the researchers analyzed the concept of the material that will be presented in digital learning media, which consists of the structure and function of plant organs, the structure and function of plant tissue, the structure of the tissue in roots, stems and leaves and technology inspired by the structure of plant tissue to present material concepts coherently gradually from simple ones (Azizah & Astuti, 2020).

e. Specifying Instructional Objectives

The specifications of the material presented in the media need to refer to learning objectives and learning achievement indicators, namely students are able to know various plant organs and their structures, know plant tissues and their functions, and know technology inspired by plant tissue structures in facilitating human daily life so that the material presented is accurate, does not cause multiple interpretations and can support the achievement of core competencies (KI) and basic competencies (KD)(Yulinda & Saifuddin, 2022).

2. Design Stage

The digital learning media developed based on the results of the definition stage analysis is an HTML-based digital booklet processed through the flip builder application. The digital booklet media design includes the systematic preparation of writing in the digital booklet and designing the content of the material in the developed digital booklet as well as compiling the assessment instrument.

a. Systematic Preparation of Digital booklet writing

The digital booklet product for the structure and function of plant tissue for class VIII SMP students is designed using the design application which is packaged with a cover, introduction, table of contents, core competencies (KI) and basic competencies (KD), concept maps, materials, images, videos, knowledge information, bibliography, author bios and a glossary which are then exported to pdf and processed in the flipbuilder application to turn digital booklets into html. Digital booklets are concisely designed like leaflets and provide a lot of visualization in the form of full color images, the size of this digital booklet is A5 or 10.5 cm x 15 cm, using Times New Roman typeface with font size 16 for chapter titles, 12 for contents. and the space used is 1.5.

b. Designing Material Content in Digital Booklets

The material used in the digital booklet is material on the structure and function of plant tissue, which is designed based on the objectives and achievements of competence. The material design is not only in the form of an explanation but also contains related learning videos that can be directly accessed by clicking on the video in the booklet and contains some knowledge information that adds insight and sharpens knowledge, the material in the booklet opens with an introduction to the general characteristics of plants first, then continues with the main content, namely the structure and function of plant organs, the structure and function of plant tissues, the structure of tissues in roots, stems and leaves and technology inspired by the structure of plant tissues.

c. Develop Digital Booklet Assessment Instruments

The preparation of the digital booklet assessment instrument is carried out at the end after the digital booklet product has been created so that the assessment aspects and indicators compiled in the instrument are truly in accordance with the state of the digital booklet to be assessed so that the instrument will be valid if it is validated. The instrument consists of 4 instruments: instruments for media experts, material experts, science teachers (biology), and instruments for students. The scale used in compiling the instrument is a rating scale for media experts, material experts and teachers, while the Guttman scale for students, the selection of the rating scale is intended to get more detailed results because it is related to validation so that it is expected to be more accurate while the selection of the Guttman scale for students is intended to get a firm assessment result regarding the feasibility of a digital booklet product that is developed and strengthened with the psychology of students who will find it easier to choose answers with not many choices.

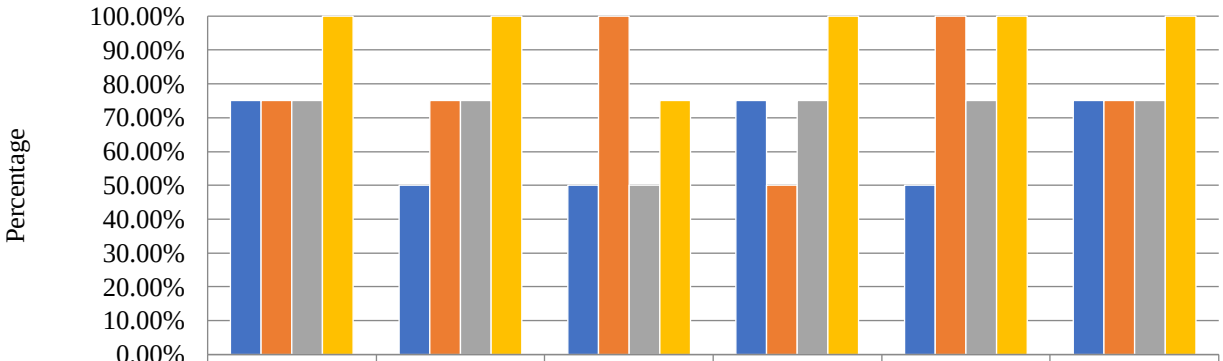
3. Development Stage

Digital booklet products and product assessment instruments that have been made are then validated so that the products developed can be improved based on the assessments and suggestions

from several material experts, media experts and science (Biology) teachers before being tested on class VIII SMP students. The following is an analysis of the data obtained from the validation process:

a. Data analysis of product assessment results by material experts, media experts and teachers in the field of science (Biology) studies

Based on the data that has been obtained from all aspects of the assessment by material expert lecturers, namely 88.28%, media experts 78.13% and teachers 97.92%. The data of this research are presented in Figures 1, 2, and 3 as follows.



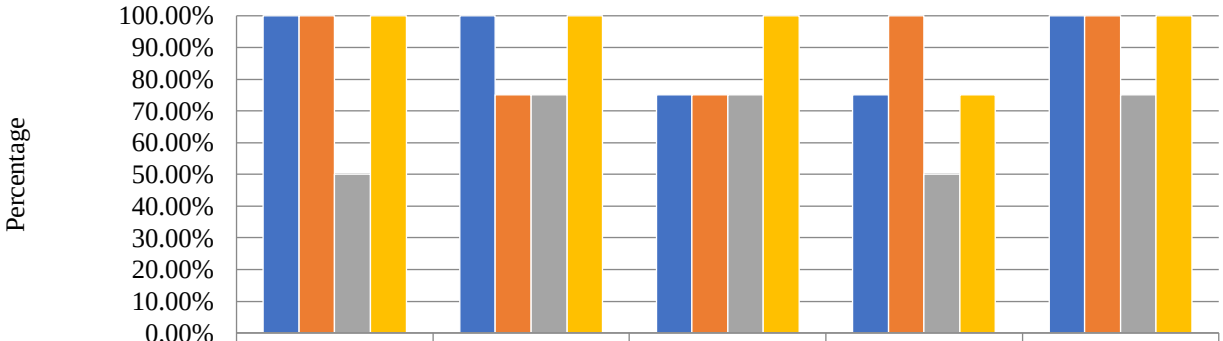
	Media design	Media color combination	Text and image layouts	Font size and type	Writing clarity	Media appeal
Media expert 1	75.00%	50.00%	50.00%	75.00%	50.00%	75.00%
Media expert 2	75.00%	75.00%	100.00%	50.00%	100.00%	75.00%
Media expert 3	75.00%	75.00%	50.00%	75.00%	75.00%	75.00%
Media expert 4	100.00%	100.00%	75.00%	100.00%	100.00%	100.00%

Figure 1. Percentage diagram of media expert assessment 1, 2, 3, and 4

Based on the data from the assessment results by media experts 1, 2, 3, and 4 in Figure 1 on digital booklet products, it can be seen that the aspect of the appearance and the content of the media has an average rating that is in the good category according to three media experts and is in the very good category. According to one media expert, on average, they get an assessment of the appearance and content of the media in the good category, which is 75%. This aspect is important because it is hoped that a good display will be able to attract students' attention so that learning can be effective and fun. The presentation of clear image displays on booklet media can make learning messages conveyed effectively, the images presented in booklet media are adjusted to their original colors in the field, this aims to make it easier for students to understand and attract more students' attention (Paramita et al., 2019; Prameswati & Saifuddin, 2022). The combination of colors in e-books can increase students' interest and keep them comfortable in reading so it is not saturated in learning (de Oliveira et al., 2014; Prameswati & Saifuddin, 2022). Then another important thing is that typography can be said to be good if it has a size that is not too big nor too small and is systematically arranged. The design and selection of layouts are an important thing to design, this aims to make the reader comfortable with readability and clarity in a book, the application of the layout of the text made in the form of points can also support the absorption of information easily (Abreu et al., 2017). Harmonious, coherent, and clear layouts can make the information conveyed and understanding easier (Bergström et al., 2022).

In addition to the aspect of the appearance and content of the media, there are also aspects of media assessment in terms of media presentation with assessment indicators in terms of writing clarity and media attractiveness which are included in the good category according to 2 media experts and included in the very good category according to two other media experts, this shows that digital booklet media is feasible to be used in the learning process by science (Biology) teachers, as stated by Paramita et al. (2019) which states that the clarity of writing on booklet media is very influential in achieving the delivery of material messages to students. Using the right media will also affect students' attention to the material to be studied, increase student interest and motivation and increase student concentration so that the learning process will be even better (Dyrberg et al., 2016; Lin et al., 2017; Shabiralyani et al., 2015).

Media experts in addition to providing quantitative assessments also provide descriptive assessments in the form of suggestions for the media, among the general suggestions given are related to choosing a soft background color and writing those contrasts with the background color, rearranging the font size to make it more proportional, and making presentations. Videos can be directly displayed in the booklet. Some of these suggestions are then used as a reference for making improvements before testing the students. In addition to being validated by media experts, the digital booklet material on the structure and function of plant tissue is also validated by material experts, the data on the results of the digital booklet product assessment by material experts is presented in Figure 2.



	Content	Material presentation	Material accuracy	Material updates	Language use
Material expert 1	100.00%	100.00%	75.00%	75.00%	100.00%
Material expert 2	100.00%	75.00%	75.00%	100.00%	100.00%
Material expert 3	50.00%	75.00%	75.00%	50.00%	75.00%
Material expert 4	100.00%	100.00%	100.00%	75.00%	100.00%

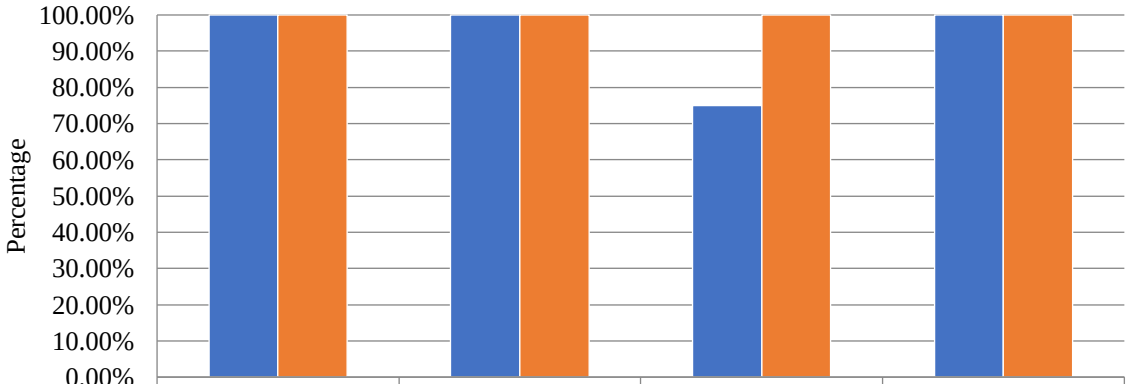
Figure 2. Diagram of the percentage of material expert assessments 1, 2, 3, and 4

Based on the data from the assessment results from material experts 1, 2, 3, and 4 in Figure 2 on digital booklet products, it can be seen that the feasibility of the content of the material is included in the very good category according to three material experts, and is included in the good category according to one material expert so that in the average of getting an assessment of the feasibility aspect of the content of the material in the very good category is 88.28%. This aspect is important because it is hoped that the good material content can improve the quality of learning. The material content can be said to be of high quality if it has appropriate, complete, and coherent material content, supports learning objectives, has clear material content objectives, and uses an image or animation media (Bergström et al., 2022; El Mhouti et al., 2013; Zulfarina et al., 2021). Learning media presented with many pictures can stimulate students' imagination so that students will like what they read and the presentation of material that is not dense can make it easier for students to understand the content of the material so that it can improve student learning outcomes (Alyahya & Nasser, 2019; Küsel et al., 2020). The accuracy of the material is also an important indicator, including the accuracy of concepts and definitions in the material to avoid student misconceptions about the material presented in order to assist teachers in achieving KI and KD, the accuracy of principles in formulating theories needs to be formulated so as not to cause multiple interpretations, accuracy of procedures to be systematic, accuracy in terms of presentation such as facts and illustrations in order to strengthen and enrich students' thinking horizons, and the accuracy of the social aspects of students' understanding of the material presented (Tsai & Yen, 2013), and the material presented can be said to be up-to-date if the material is in accordance with student development and contains current information. , the material also contains pictures, photos and concept maps that are in accordance with the original situation, the material is contextual to the lives of students. The presentation of material using contemporary technology adapts to the times (Abanikannda & Oluwafemi, 2018), as stated by a material expert that The material can be called up-to-date if the material presented, both pictures, illustrations and examples contained in it, is in accordance with the original conditions in the surrounding environment and is commonly found in students' lives. There is a combination of other literature study information sources such as the internet (Ma & Li, 2021).

In addition to the feasibility aspect of the content of the material, there is also an aspect of

assessing the material from the language side with assessment indicators in terms of language use which is included in the very good category according to three material experts and is included in the good category according to one other material expert, this shows that the material in Digital booklet media are suitable for use in the learning process by science teachers (Biology), as stated by Dikmenli (2015); Fuad et al. (2020) which states that media should be arranged using good and correct language by paying attention to the preparation of clear sentences so that they are easy to understand and does not cause multiple interpretations or misunderstandings from students who study it.

Material experts in addition to providing quantitative assessments also provide descriptive assessments in the form of suggestions for the media, among the general suggestions given are related to the addition of Core Competencies (KI) and Basic Competencies (KD), procurement of concept maps and glossaries, detailing the content of the material, prioritizing images used are from personal documentary sources, and the addition of up-to-date references. Some of these suggestions are then used as a reference for making improvements before testing the students. The digital booklet material on the structure and function of plant tissue, apart from being validated by media experts and material experts, was also validated by a junior high school science (Biology) teacher, the data on the results of the digital booklet product assessment by a science (Biology) teacher is presented in Figure 3.



	Appearance	Material presentation	Benefit to students	Full view
Teacher 1	100.00%	100.00%	75.00%	100.00%
Teacher 2	100.00%	100.00%	100.00%	100.00%

Figure 3. Diagram of the assessment percentage of 2 Science (Biology) teachers

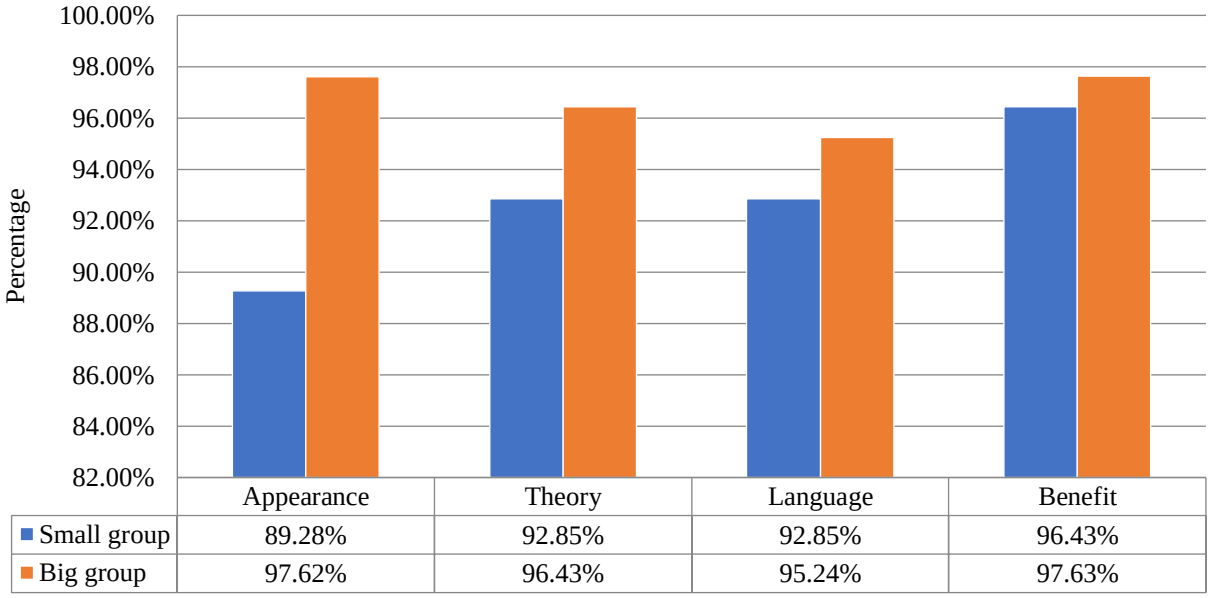
Based on the data from the assessment by 2 Science (Biology) teachers in Figure 3 on digital booklet products, it can be seen that the feasibility of the aspect of the appearance and the content of the media is included in the very good category, namely 95.84% so that it can be said that the digital booklet media developed is suitable for use by teachers in the field of science studies as learning media, this is reinforced by the indicators used in assessing the feasibility of the appearance and content of the media, namely in terms of appearance, presentation of material, and usefulness to students who are used to be among the benchmarks that are expected to be able to make digital booklet products a medium of delivery. According to Abreu et al. (2017) that the display of illustrations in the form of pictures and videos can clarify the information conveyed, and has an attraction to encourage students' interest in reading, studying the material and able to strengthen student memory. Then from the usefulness indicator it can be seen that the teacher assesses the media with different percentages, this can happen because from the usefulness side one of the indicators is to make it easier for students to understand the material so that there are external considerations beyond the teacher's opinion whose results are not yet known, as expressed by Prameswati and Saifuddin (2022) that appropriate and useful learning media are media that can make it easier for students to understand the existing materials. In addition to the aspect of the appearance and content of the media, there is also a format aspect to make it easier for students to understand the material, namely the overall appearance of the media which is considered very good by the teacher with an average of 100%. A coherent and systematic presentation of concepts that are consistent can make it easier for students to understand the concepts being studied and can motivate students to learn (Azizah & Astuti, 2020).

Some suggestions and comments were also part of the assessment of the developed digital

booklet. Suggestions given by science teachers (Biology) include the need to pay attention to the use of color in image descriptions and the addition of learning objectives so that students know the reasons for studying the structure and function of plant tissue. The comments and suggestions given by the teacher are used as a reference for making improvements before testing the students.

b. Data analysis of product assessment results by small group and large group students

The product trial to students consisted of a small group trial consisting of 7 students and a large group of 21 students of class VIII SMP. This research data is presented in Figure 4.



	Appearance	Theory	Language	Benefit
Small group	89.28%	92.85%	92.85%	96.43%
Big group	97.62%	96.43%	95.24%	97.63%

Figure 4. Diagram of the percentage of student assessments in small group trials and large group trials

Based on Figure 4, the average percentage of student responses in small and large group trials to digital booklets is 94.89% with very feasible criteria. In addition, some students also gave positive descriptive responses that were listed in the student assessment questionnaire, including digital booklets that were good for development, facilitated learning, good media, interesting media, became more interested in learning, and were good at explaining. Then there were students who gave suggestions to be more sophisticated and created for the development of digital booklets in the future. The students' suggestions and responses reinforce that digital booklets are very feasible and useful for students in supporting learning. According to Lin et al. (2017) the use of appropriate media will increase students' attention to the topic to be studied, with the help of media students' interest and motivation can be increased, students will be more concentrated and the learning process is expected to be better.

4. Disseminate stage.

The Disseminate stage is carried out after improvements have been made to become a final product. The final product of this booklet learning media has several main characteristics, including 1) the booklet is supported by pictures and videos, 2) pop-ups are available to clarify pictures, and 3) it relates to the application of biological sciences in the field of technology (Figure 5. The final product of the booklet learning media can be used in learning biological material on the structure and function of plant tissues. The final product was given to the biology teacher at MTs Muhammadiyah Gedongtengen, Indonesia.

Figure 5. Main characteristics of the booklet product (https://mhusein.github.io/)

CONCLUSION

Based on the results of the research, the development of digital booklets of the structure and function of plant tissue for class VIII SMP students is declared very feasible to be applied in learning, it is hoped that digital booklets can be created, enhanced, and further developed to help teachers and make it easier for students to understand the material for the realization of goals. learning and mastery of science material concepts, especially biology.

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